Arlington Zoning Board of Appeals

Date: Tuesday, January 26, 2021
Time: 7:30 PM
Location: Conducted by remote participation
Additional Details:

Agenda Items

Administrative Items

1. **Remote Participation Details**

   In accordance with the Governor's Order Suspending Certain Provisions of the Open Meeting Law, G. L. c. 30A, § 20 relating to the COVID-19 emergency, the Arlington Zoning Board of Appeals meetings shall be physically closed to the public to avoid group congregation until further notice. The meeting shall instead be held virtually using Zoom.

   Please read Governor Baker's Executive Order Suspending Certain Provision of Open Meeting Law for more information regarding virtual public hearings and meetings: https://www.mass.gov/doc/open-meeting-law-order-march-12-2020/download

   The Legal Department is inviting you to a scheduled Zoom meeting.
   Topic: Zoning Board of Appeals, Meeting/Hearing
   Time: January 26, 2021, 7:30 PM Eastern Time (US and Canada)

   You are invited to a Zoom meeting.
   When: Jan 26, 2021 07:30 PM Eastern Time (US and Canada)
   Register in advance for this meeting:
   https://town-arlington-ma-us.zoom.us/meeting/register/tJMtfu2pqTkrHdw9ydc4ayyr3dmVf7igUPAZ
   After registering, you will receive a confirmation email containing information about joining the meeting.

   Meeting ID: 970 9417 2178

   Find your local number: https://town-arlington-ma-us.zoom.us/u/adNWeNXzLr

   Dial by Location: 1-646-876-9923 US (New York)

2. **Members Vote: Approval of Meeting Minutes from January 12, 2021**

3. **Members Vote: Approval of Decision for Docket #3641, 69 Epping Street.**

Comprehensive Permits

4. **Thorndike Place: Discussion of Architectural and Urban Design Aspects of Project Submission.**
5. **Thorndike Place - Updated Documents from Applicant**
6. **Thorndike Place - Public Comments**
7. **Thorndike Place - Previous Correspondence Received**
8. **Thorndike Place - New Documents**

Meeting Adjourn

Town of Arlington, Massachusetts

Remote Participation Details

Summary:
In accordance with the Governor's Order Suspending Certain Provisions of the Open Meeting Law, G. L. c. 30A, § 20 relating to the COVID-19 emergency, the Arlington Zoning Board of Appeals meetings shall be physically closed to the public to avoid group congregation until further notice. The meeting shall instead be held virtually using Zoom.

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Town of Arlington, Massachusetts

Thorndike Place - Updated Documents from Applicant

ATTACHMENTS:

	Type	File Name	Description
🗋	Reference Material	2021-01-18_Stormwater_Report.pdf	2021-01-18 Stormwater Report
🗋	Reference Material	2021-01-22_Response_to_Stormwater_Peer_Review-Throndike_Place.pdf	2021-01-22 Response to Stormwater Peer Review-Throndike Place
🗋	Reference Material	FIA_Thorndike_Place_(00186746xBC4F6).pdf	FIA_Thorndike Place (00186746xBC4F6)
🗋	Reference Material	2021-01-21_Revised_Plan_Sheets.pdf	2021-01-21 Revised Plan Sheets
🗋	Reference Material	2021-01-25_Response_to_BETA_Traffic-Throndike_Place_with_Attachment.pdf	2021-01-25 Response to BETA Traffic-Throndike Place with Attachment
🗋	Reference Material	Thorndike_Place_Revised_Wetland_Delineation_Memo_2021-01-18_with_Field_Data_Forms.pdf	Thorndike Place Revised Wetland Delineation Memo_2021-01-18 with Field Data Forms

STORMWATER REPORT

THORNDIKE PLACE
DOROTHY ROAD
ARLINGTON, MA

NOVEMBER 2020
REVISED: JANUARY 2021

Owner/Applicant:

ARLINGTON LAND REALTY LLC
84 Sherman Street, 2nd Floor
Cambridge, MA 02140

BSC Job Number: 23407.00

Prepared by:

BSC GROUP

803 Summer Street
Boston, MA 02127

TABLE OF CONTENTS

SECTION 1.0

PROJECT INFORMATION

1.01 PROJECT DESCRIPTION

Arlington Realty, LLC (The Applicant) is seeking to construct a new multi-family housing development in Arlington, Massachusetts, hereinafter referred to as "the Project." The total property area is approximately 17.66 acres and is located off Dorothy Road near the intersection with Littlejohn Street. The project is bounded on the north by Dorothy Road, on the east by residential properties and Thorndike Field, and bounded on the south and west by Concord Turnpike (Route 2).

The Project consists of clearing and grubbing of the northwest section of the property and construction of one 3-4 story multi-family apartment building with a lower level parking garage, as well as surface parking, walkways, courtyards, a playground, utility services, and a stormwater management system. The building has a footprint of approximately 51,555 square feet.

The Project is designed to comply with the Massachusetts General Laws (M.G.L.) Chapter 40B, which allows developers to override certain aspects of municipal zoning bylaws by providing a certain percentage of affordable housing, as well as the Department of Environmental Protection's Stormwater Management Standards. There are wetland resource areas in the south, west and east portions of the property. The Project is concentrated in the northwest area of the property and minimizes impacts to the 100-foot wetland buffer zones, which are regulated by the Arlington Wetlands Bylaw as Adjacent Upland Resource Areas (AURA's). Part of the site is located within the 1% Chance Annual Flood as defined by FEMA which is regulated under the Wetlands Protection Act and the Arlington Wetlands Bylaw as Bordering Land Subject to Flooding (BLSF). Compensatory flood storage is proved at a 2:1 ratio as described in section 2.12 below.

1.02 PRE-DEVELOPMENT CONDITIONS

The existing site topography generally slopes southeast across the property towards the wetlands located on the property with slopes ranging from 0-15%. The current site is comprised of forest and the primary soil classification identified by the NRCS Web Soil Survey is udorthents (655), which accounts for the majority of the property and all of the project area. On November 25, 2020, BSC Group conducted three test pits on the site, the locations of which are noted on the Grading and Drainage plan, and the test pit logs are attached in Appendix D. The test pits consisted primarily of fill material to a depth of 9-11 feet generally conforming with the soils mapping. Even though the material was fill, all samples textured as sandy loam in test pits TP-1 and TP-2, closest to the proposed stormwater management systems. At the bottom of test pit TP-3, a layer of clay material was found. Based on the fill materials found, runoff calculations have been performed using curve numbers corresponding to Hydrologic Soil Group (HSG) C.

The existing site being largely undeveloped has no existing drainage facilities and the majority of the stormwater runoff is directed to the wetlands on the property. A small portion of the site discharges to the north to Dorothy Road.

1.03 POST-DEVELOPMENT CONDITIONS

The proposed stormwater management system has been designed in a manner that will meet or exceed the provisions of the Department of Environmental Protection (DEP) Stormwater Management Standards for a new construction project. The design is also in conformance the with Town of Arlington Zoning Bylaws.

Stormwater runoff from the majority of the building will be detained on the roof of the building. This collected runoff will be released at controlled rates through roof drains to an underground infiltration system in the adjacent surface parking lot. A portion of the roof in the southeast corner of the building (approximately 9,000-square feet) will discharge at grade directly to the surface and flow overland towards the wetlands to the south.

Stormwater runoff from the small parking/drop-off area at the main entrance to the building will be collected via a trench drain, and runoff from the other surface parking area will be collected in a deep sump catch basin, both of which are conveyed through a water quality unit before being directed to the underground infiltration system. This underground infiltration system will overflow via a flared end section to the northwest. Despite all soils sampled in TP-

1 and TP-2 nearest the stormwater management systems textured as sandy loam (see above), the infiltration rate for loam (0.52-inches per hour) has been used in the infiltration system design to account for the materials found being primarily fill. Based upon the test pit data performed in November 2020 (see above), the estimated seasonal high groundwater elevation ranges between elevations 0 and 2. As such the infiltration system has been set with a bottom elevation of 5.0 to provide the minimum 2-feet of clearance above groundwater.

Stormwater runoff from the driveway into the garage below the building will be collected via a trench drain and conveyed through a water quality unit before being directed to a second underground system located directly south of this area. No credit has been taken for recharge from this infiltration system as, due to grades of the driveway, insufficient clearance from estimated seasonal high groundwater exists. This system has been designed to hold the runoff from the full 100-year, 24-hour storm event without any overflow. Despite it being sized to hold the 100-year event, this system has been provided with an overflow pipe to a flared end section to the area directly south of the proposed building.

To provide emergency access to the sides and rear of the building, a reinforced grass access lane will be installed. A portion of this access lane will include a 6-foot wide, porous asphalt walkway to allow residents to have ADA/AAB accessible access the rear of the site including the play area. Both the reinforced grass and porous asphalt will allow stormwater runoff to freely infiltrate back to the ground and will result in negligible runoff.

Specifics of the project's compliance with the Stormwater Standards are discussed in detail in the following sections.

SECTION 2.0

DRAINAGE SUMMARY

2.01 Stormwater Standard 1 – New Stormwater Conveyances

Per Massachusetts Stormwater Management Standard #1, no new outfalls may discharge untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth. No new untreated stormwater discharges are proposed. Rip-rap outlet protection sizing calculations are included in Section 6.0 of this Report.

2.02 Stormwater Standard 2 – Stormwater Runoff Rates

Watershed modeling was performed using HydroCAD Stormwater Modeling Software version 10.00, a computer aided design program that combines SCS runoff methodology with standard hydraulic calculations. A model of the site's hydrology was developed for both pre-and post-development conditions to assess the effects of the proposed development on the project site and surrounding areas.

In accordance with the requirements of the Town of Arlington Regulations for Wetlands Protection, all runoff modeling was performed using rainfall data from the Northeast Regional Climate Center's Extreme Precipitation Tables (commonly called the Cornell method). Rainfall data used is provided in the Appendix E.

The stormwater management system for the project has been designed such that the post-development conditions result in no increase to peak runoff rates to the adjacent wetlands or the adjacent public street for the 2, 10, 25, 50, and 100-year, 24-hour storm events, as detailed in the table below.

Peak Flow Discharge Rates

Node 1S/1L – Flow to Wetlands

Storm Event	Pre-Development Peak Discharge Rate (cfs)	Post-Development Peak Discharge Rate (cfs)	Change in Peak Discharge Rate (cfs)
2-Year	2.1	2.1	0.0
10-Year	5.4	4.5	-0.9
25-Year	8.3	6.5	-1.8
50-Year	11.3	8.5	-2.8
100-Year	14.9	11.4	-3.5

Node 2S/2L – Flow to Street

Storm Event	Pre-Development Peak Discharge Rate (cfs)	Post-Development Peak Discharge Rate (cfs)	Change in Peak Discharge Rate (cfs)
2-Year	0.2	0.2	0.0
10-Year	0.4	0.4	0.0
25-Year	0.6	0.6	0.0
50-Year	0.8	0.8	0.0
100-Year	1.1	1.1	0.0

2.03 Stormwater Standard 3 – Groundwater Recharge

Groundwater recharge is provided on site via an underground structural infiltration system beneath the surface parking area to the west of the building. Overall, the project will result in no loss of annual recharge to groundwater as required by Standard 3. Refer to Section 6.0 of this Report for groundwater recharge information.

As the infiltration system has more than 2-feet but less than 4-feet separation to estimated seasonal high groundwater, a mounding analysis has been performed in accordance with the Hantoush Method to ensure that a groundwater mound does not extend into the bottom of the infiltration system preventing infiltration of the required recharge volume. This analysis is included in Section 6.0 of this Report.

2.04 Stormwater Standard 4 – TSS Removal

As a new development, the Project stormwater management system will achieve a TSS removal greater than 80%. The proposed stormwater management system has been designed to provide treatment of runoff in order to reduce suspended solids prior to discharge off-site through the implementation of the following best management practices:

- Deep Sump Hooded Catch Basins
- Proprietary Hydrodynamic Separator
- Underground Stormwater Infiltration System

The water quality volume is defined as the runoff volume requiring TSS Removal for the site, and is equal to 0.5-inches of runoff over the total impervious area of the post-development site. The required water quality volume for the project is provided in Section 6.0 of this Report

The underground infiltration system has been sized to treat the required water quality volume and calculations are included in Section 6.0 of this Report.

A long-term pollution prevention plan complying with the requirements of Standard 4 is included in Section 4.0 of this Report.

2.05 Stormwater Standard 5 – Land Uses with Higher Potential Pollutant Loads

This standard is not applicable as the project site is not a land use with higher potential pollutant loads (LUHPPL).

2.06 Stormwater Standard 6 – Stormwater Discharges to a Critical Area

This standard is not applicable as runoff from the project site does not discharge to a critical area.

2.07 Stormwater Standard 7 – Redevelopment Projects

This project is a new development and therefore has been designed to fully comply with the Stormwater Management Standards.

2.08 Stormwater Standard 8 – Sedimentation and Erosion Control Plan

Erosion and sedimentation controls are shown on the Project Plans. Additionally, a Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan is included in Section 3.0 of this Report.

2.09 Stormwater Standard 9 – Long Term Operation and Maintenance Plan

A Long-Term Operation and Maintenance Plan is included in Section 4.0 of this Report.

2.10 Stormwater Standard 10 – Illicit Discharges

There are no known illicit discharges on the project site and none are proposed. An illicit discharge compliance statement is included in Section 6.0 and will be signed by the Applicant prior to issuance of any permits.

2.11 Conclusion

The project has been designed in accordance with DEP Stormwater Management Standards and the Town of Arlington Wetlands Protection Bylaw and Regulations. Through the construction of the aforementioned stormwater systems, the project will provide peak rate attenuation, TSS removal and groundwater recharge.

2.12 Compensatory Flood Storage

A portion of the project site is located within the 1% Chance Annual Flood as defined by FEMA, which is regulated under the Wetlands Protection Act and Arlington Wetlands Bylaw as Bordering Land Subject to Flooding (BLSF). In order to protect the values provided by BLSF and prevent downstream flooding impacts, the project is required to provide compensatory flood storage on a 1-foot incremental basis to match whatever is lost due to the project's development. Further, Arlington requires compensatory flood storage to be provided at a 2 to 1 ratio for any flood storage lost. In order to provide this compensatory flood storage, the project will minimize the area of BLSF impacted and regrade a portion of the project property southeast of the proposed building as shown on the Plans. A breakdown of the flood storage impacts and compensatory storage provided is shown below:

Elevations	Existing Incremental Available Flood Storage (CU.FT.)	Incremental Available Flood Storage with No Compensatory Storage (CU.FT.)	Incremental Flood Storage Change w/No Compensatory Storage (CU.FT.)	Proposed Incremental Compensatory Storage (CU.FT.)	Ratio of Compensatory Storage to Storage Lost
5.0 - 6.0	**67.0**	**0.0**	**-67.0**	**144.5**	**2.2**
6.0 - 6.8	**7,454.0**	**4,806.8**	**-2,647.2**	**5,990.0**	**2.3**

As shown above, the project will exceed the 2 to 1 ratio of compensatory flood storage for all flood storage lost due to the project development. In addition, as shown on the Plans, the proposed compensatory storage is hydrologically connected to the flood plain impacted by the project. Therefore, the project as proposed meets the applicable requirements for BLSF in both the Wetlands Protection Act and the Arlington Wetlands Bylaw and Regulations.

SECTION 3.0

CONSTRUCTION PERIOD POLLUTION PREVENTION AND EROSION AND SEDIMENTATION CONTROL PLAN

3.0 CONSTRUCTION PERIOD POLLUTION PREVENTION AND EROSION AND SEDIMENTATION CONTROL PLAN

This Section specifies requirements and suggestions for implementation of a Stormwater Pollution Prevention Plan (SWPPP) for **Thorndike Place, in Arlington, Massachusetts**. The SWPPP shall be provided and maintained on-site by the Contractor(s) during all construction activities. The SWPPP shall be updated as required to reflect changes to construction activity.

The stormwater pollution prevention measures contained in the SWPPP shall be at least the minimum required by Local Regulations. The Contractor shall provide additional measures to prevent pollution from stormwater discharges in compliance with the National Pollution Discharge Elimination System (NPDES) Phase II permit requirements and all other local, state and federal requirements.

The SWPPP shall include provisions for, but not be limited to, the following:

1. Construction Trailers
2. Lay-down Areas
3. Equipment Storage Areas
4. Stockpile Areas
5. Disturbed Areas

The Contractor shall NOT begin construction without submitting evidence that a NPDES Notice of Intent (NOI) governing the discharge of stormwater from the construction site for the entire construction period has been filed **at least fourteen (14) days prior to construction**. It is the Contractor's responsibility to complete and file the NOI, unless otherwise determined by the project team.

The cost of any fines, construction delays and remedial actions resulting from the Contractor's failure to comply with all provisions of local regulations and Federal NPDES permit requirements shall be paid for by the Contractor at no additional cost to the Owner.

As a requirement of the EPA's NPDES permitting program, each Contractor and Subcontractor responsible for implementing and maintaining stormwater Best Management Practices shall execute a Contractor's Certification form.

Erosion and Sedimentation Control

The Contractor shall be solely responsible for erosion and sedimentation control at the site. The Contractor shall utilize a system of operations and all necessary erosion and sedimentation control measures, even if not specified herein or elsewhere, to minimize erosion damage at the site to prevent the migration of sediment into environmentally sensitive areas. Environmentally sensitive areas include all wetland resource areas within, and downstream of, the site, and those areas of the site that are not being altered.

Erosion and sedimentation control shall be in accordance with this Section, the design drawings, and the following:

- "National Pollutant Discharge Elimination System General Permit for Discharges from Construction Activities (EPA Construction General Permit February 16, 2017).
- Massachusetts Stormwater Management Policy Handbook issued by the Massachusetts Department of Environmental Protection, January 2008.
- Massachusetts Erosion and Sediment Control Guidelines for Urban and Suburban Areas, A Guide for Planners, Designers and Municipal Officials, March 1997.

The BMP's presented herein should be used as a guide for erosion and sedimentation control and are <u>not</u> intended to be considered specifications for construction. The most important BMP is maintaining a rapid construction process, resulting in prompt stabilization of surfaces, thereby reducing erosion potential. Given the primacy of rapid construction, these guidelines have been designed to allow construction to progress with essentially no hindrance by the erosion control methods prescribed. These guidelines have also been designed with sufficient flexibility to allow the Contractor to modify the suggested methods as required to suit seasonal, atmospheric, and site-specific physical constraints.

Another important BMP is the prevention of concentrated water flow. Sheet flow does not have the erosive potential of a concentrated rivulet. These guidelines recommend construction methods that allow localized erosion control and a system of construction, which inhibits the development of shallow concentrated flow. These BMP's shall be maintained throughout the construction process.

CONTACT INFORMATION AND RESPONSIBLE PARTIES

The following is a list of all project-associated parties:

Owner
Arlington Land Realty, LLC
84 Sherman Street, 2nd Floor
Cambridge, MA 02140

Contractor
To be determined

Environmental Consultant
BSC Group, Inc.
803 Summer Street
Boston, MA 02127

Contact: John Hession, P.E.
Phone: (617) 896–4300
Email: jhession@bscgroup.com

Qualified SWPPP Inspectors
To Be Determined

3.1 Procedural Conditions of the Construction General Permit (CGP)

The following list outlines the Stormwater Responsibilities for all construction operators working on the Project. The operators below agree through a cooperative agreement to abide by the following conditions throughout the duration of the construction project, effective the date of signature of the required SWPPP. These conditions apply to all operators on the project site.

The project is subject to EPA's NPDES General Permit through the CGP. The goal of this permit is to prevent the discharge of pollutants associated with construction activity from entering the existing and proposed storm drain system or surface waters.

All contractors/operators involved in clearing, grading and excavation construction activities must sign the appropriate certification statement required, which will remain with the SWPPP. The owner must also sign a certification, which is to remain with the SWPPP in accordance with the signatory requirements of the SWPPP.

Once the SWPPP is finalized, a signed copy, plus supporting documents, must be held at the project site during construction. A copy must remain available to EPA, State and Local agencies, and other interested parties during normal business hours.

The following items associated with this SWPPP must be posted in a prominent place at the construction site until final stabilization has been achieved:

- The completed/submitted NOI form
- Location where the public can view the SWPPP during normal business hours
- A copy of the signed/submitted NOI, permit number issued by the EPA and a copy of the current CGP.

Project specific SWPPP documents are not submitted to the US EPA unless the agency specifically requests a copy for review. SWPPP documents requested by a permitting authority, the permitee(s) will submit it in a timely manner.

EPA inspectors will be allowed free and unrestricted access to the project site and all related documentation and records kept under the conditions of the permit.

The permitee is expected to keep all BMP's and Stormwater controls operating correctly and maintained regularly.

Any additions to the project which will significantly change the anticipated discharges of pollutants, must be reported to the EPA. The EPA should also be notified in advance of any anticipated events of noncompliance. The permitee must also orally inform the EPA of any discharge, which may endanger health or the environment within 24 hours, with a written report following within 5 days.

In maintaining the SWPPP, all records and supporting documents will be compiled together in an orderly fashion. Inspection reports and amendments to the SWPPP must remain with the document. Federal regulations require permitee(s) to keep their Project Specific SWPPP and all reports and documents for at least three (3) years after the project is complete.

3.2 Existing Site and Soil Conditions

The total project area is approximately 17.66 acres and is located off Dorothy Road. The project is bounded on the north by Dorothy Road, bounded on the east by residential properties, and bounded on the south and west by Concord Turnpike (Route 2).

The current site is comprised of forest and the primary soil classification identified by the NRCS Web Soil Survey is udorthents (655), which accounts for the majority of the property and all of the project area. On November 25, 2020, BSC Group conducted three test pits on the site, the locations of which are noted on the Grading and Drainage plan, and the test pit logs are attached in Appendix D. The test pits consisted of primarily fill material to a depth of 9-11 feet generally conforming with the soils mapping. Even though the material was fill, it all samples textured as sandy loam in test pits TP-1 and TP-2, closest to the proposed stormwater management systems. At the bottom of test pit TP-3, a layer of clay material was found. Based on the fill materials found, runoff calculations have been performed using curve numbers corresponding to Hydrologic Soil Group (HSG) C.

3.3 Project Description and Intended Construction Sequence

The site is currently comprised of woods. The proposed activities will include the following major components:

- The construction of one (1) multi-family housing building with associated parking, driveways, and walkways,

- The construction of stormwater management systems, and
- Site grading, and utility installation.

The proposed project will disturb a total of approximately 138,233± S.F. (3.17± acres).

Soil disturbing activities will include site demolition, installing stabilized construction exits, installation of erosion and sedimentation controls, grading, storm drain inlets, stormwater management systems, utilities, building foundation, construction of site driveways and preparation for final landscaping. Please refer to Table 1 for the projects anticipated construction timetable. A description of BMP's associated with project timetable and construction-phasing elements is provided in this Erosion and Sediment Control Plan.

Table 1 – Anticipated Construction Timetable

Construction Phasing Activity	Anticipated Timetable
Grubbing and Stripping of Limits of Construction Phase	To be determined
Rough Site Grading and Site Utilities	To be determined
Utility Plan Construction	To be determined
Landscaping	To be determined

3.4 Potential Sources of Pollution

Any project site activities that have the potential to add pollutants to runoff are subject to the requirements of the SWPPP. Listed below are a description of potential sources of pollution from both sedimentation to Stormwater runoff, and pollutants from sources other than sedimentation.

Table 2 – Potential Sources of Sediment to Stormwater Runoff

Potential Source	**Activities/Comments**
Construction Site Entrance and Site Vehicles	Vehicles leaving the site can track soils onto public roadways. Site Vehicles can readily transport exposed soils throughout the site and off-site areas.
Grading Operations	Exposed soils have the potential for erosion and discharge of sediment to off-site areas.
Material Excavation, Relocation, and Stockpiling	Stockpiling of materials during excavation and relocation of soils can contribute to erosion and sedimentation. In addition, fugitive dust from stockpiled material, vehicle transport and site grading can be deposited in wetlands and waterway.
Landscaping Operations	Landscaping operations specifically associated with exposed soils can contribute to erosion and sedimentation. Hydroseeding, if not properly applied, can runoff to adjacent wetlands and waterways.

Table 3 – Potential Pollutants and Sources, other than Sediment to Stormwater Runoff

Potential Source	**Activities/Comments**
Staging Areas and Construction Vehicles	Vehicle refueling, minor equipment maintenance, sanitary facilities and hazardous waste storage
Materials Storage Area	General building materials, solvents, adhesives, paving materials, paints, aggregates, trash, etc.
Construction Activities	Construction, paving, curb/gutter installation, concrete pouring/mortar/stucco

3.5 Erosion and Sedimentation Control Best Management Practices

All construction activities will implement Best Management Practices (BMP's) in order to minimize overall site disturbance and impacts to the sites natural features. Please refer to the following sections for a detailed description of site specific BMP's. In addition, an Erosion and Sedimentation Control Plan is provided in the Site Plans.

3.6 Timetable and Construction Phasing

This section provides the Owner and Contractor with a suggested order of construction that shall minimize erosion and the transport of sediments. The individual objectives of the construction techniques described herein shall be considered an integral component of the project design intent of each project phase. The construction sequence is not intended to prescribe definitive construction methods and should not be interpreted as a construction specification document. However, the Contractor shall follow the general construction phase principles provided below:

- Protect and maintain existing vegetation wherever possible.
- Minimize the area of disturbance.
- To the extent possible, route unpolluted flows around disturbed areas.
- Install mitigation devices as early as possible.
- Minimize the time disturbed areas are left unstabilized.
- Maintain siltation control devices in proper condition.
- The contractor should use the suggested sequence and techniques as a general guide and modify the suggested methods and procedures as required to best suit seasonal, atmospheric, and site specific physical constraints for the purpose of minimizing the environmental impact of construction.

Demolition, Grubbing and Stripping of Limits of Construction Phase

- Install Temporary Erosion Control (TEC) devices as required to prevent sediment transport into resource areas.
- Place a ring of silt socks and/or haybales around stockpiles.
- Stabilize all exposed surfaces that will not be under immediate construction.
- Store and/or dispose all pavement and building demolition debris as indicated in accordance with all applicable local, state, and federal regulations.

Driveway Area Sub-Base Construction

- Install temporary culverts and diversion ditches and additional TEC devices as required by individual construction area constraints to direct potential runoff toward detention areas designated for the current construction phase.
- Compact gravel as work progresses to control erosion potential.
- Apply water to control air suspension of dust.
- Avoid creating an erosive condition due to over-watering.
- Install piped utility systems as required as work progresses, keeping all inlets sealed until all downstream drainage system components are functional.

Binder Construction

- Fine grade gravel base and install processed gravel to the design grades.
- Compact pavement base as work progresses.
- Install pavement binder coat starting from the downhill end of the site and work toward the top.

Finish Paving

- Repair and stabilize damaged side slopes.
- Clean inverts of drainage structures.
- Install final top coat of pavement.

Final Clean-up

- Clean inverts of culverts and catch basins.
- Remove sediment and debris from rip-rap outlet areas.
- Remove TEC devices only after permanent vegetation and erosion control has been fully established.

3.7 Site Stabilization

Grubbing Stripping and Grading

- Erosion control devices shall be in place as shown on the design plans before grading commences.
- Stripping shall be done in a manner, which will not concentrate runoff. If precipitation is expected, earthen berms shall be constructed around the area being stripped, with a silt sock, silt fence or haybale dike situated in an arc at the low point of the berm.
- If intense precipitation is anticipated, silt socks, haybales, dikes and /or silt fences shall be used as required to prevent erosion and sediment transport. The materials required shall be stored on site at all time.
- If water is required for soil compaction, it shall be added in a uniform manner that does not allow excess water to flow off the area being compacted.
- Dust shall be held at a minimum by sprinkling exposed soil with an appropriate amount of water.

Maintenance of Disturbed Surfaces

- Runoff shall be diverted from disturbed side slopes in both cut and fill.
- Mulching may be used for temporary stabilization.
- Silt sock, haybale or silt fences shall be set where required to trap products of erosion and shall be maintained on a continuing basis during the construction process.

Loaming and Seeding

- Loam shall not be placed unless it is to be seeded directly thereafter.
- All disturbed areas shall have a minimum of 4" of loam placed before seeded and mulched.
- Consideration shall be given to hydro-mulching, especially on slopes in excess of 3 to 1.
- Loamed and seeded slopes shall be protected from washout by mulching or other acceptable slope protection until vegetation begins to grow.

Stormwater Collection System Installation

- The Stormwater drainage system shall be installed from the downstream end up and in a manner which will not allow runoff from disturbed areas to enter pipes.
- Excavation for the drainage system shall not be left open when rainfall is expected overnight. If left open under other circumstances, pipe ends shall be closed by a staked board or by an equivalent method.
- All catch basin openings shall be covered by a silt bag between the grate and the frame or protected from sediment by silt fence surrounding the catch basin grate.

Completion of Paved Areas

- During the placement of sub-base and pavement, the entrance to the Stormwater drainage systems shall be sealed when rain is expected. When these entrances are closed, consideration must be given to the direction of run-off and measures shall be undertaken to minimize erosion and to provide for the collection of sediment.
- In some situations, it may be necessary to keep catch basins open.
- Appropriate arrangements shall be made downstream to remove all sediment deposition.

Stabilization of Surfaces

- Stabilization of surfaces includes the placement of pavement, rip-rap, wood bark mulch and the establishment of vegetated surfaces.
- Upon completion of construction, all surfaces shall be stabilized even though it is apparent that future construction efforts will cause their disturbance.
- Vegetated cover shall be established during the proper growing season and shall be enhanced by soil adjustment for proper pH, nutrients and moisture content.
- Surfaces that are disturbed by erosion processes or vandalism shall be stabilized as soon as possible.
- Areas where construction activities have permanently or temporarily ceased shall be stabilized within 14 days from the last construction activity, except when construction activity will resume within 21 days (e.g., the total time period that construction activity is temporarily ceased is less than 21 days).
- Hydro-mulching of grass surfaces is recommended, especially if seeding of the surfaces is required outside the normal growing season.
- Hay mulch is an effective method of temporarily stabilizing surfaces, but only if it is properly secured by branches, weighted snow fences or weighted chicken wire.

3.8 Temporary Structural Erosion Control Measures

Temporary erosion control measures serve to minimize construction-associated impacts to wetland resource and undisturbed areas. Please refer to the following sections for a description of temporary erosion control measures implemented as part of the project and this sample SWPPP.

3.8.1 Silt Socks, Haybales, and Silt Fencing

The siltation barriers will demarcate the limit of work, form a work envelope and provide additional assurance that construction equipment will not enter the adjacent wetlands or undisturbed portions of the site. All barriers will remain in place until disturbed areas are stabilized.

3.8.2 Temporary Stormwater Diversion Swale

A temporary diversion swale is an effective practice for temporarily diverting stormwater flows and to reduce stormwater runoff velocities during storm events. The swale channel can be installed before infrastructure construction begins at the site, or as needed throughout the construction process. The diversion swale should be routinely compacted or seeded to minimize the amount of exposed soil.

3.8.3 Dewatering Basins

Dewatering may be required during stormwater system, foundation construction and utility installation. Should the need for dewatering arise, groundwater will be pumped directly into a temporary settling basin, which will act as a sediment trap during construction. All temporary settling basins will be located within close proximity of daily work activities. Prior to discharge, all groundwater will be treated by means of the settling basin or acceptable substitute. Discharges from sediment basins will be free of visible floating, suspended and settleable solids that would impair the functions of a wetland or degrade the chemical composition of the wetland resource area receiving ground or surface water flows and will be to the combined system.

3.8.4 Material Stockpiling Locations

Piping and trench excavate associated with the subsurface utility work will be contained with a single row of silt socks and/or haybales.

3.9 Permanent Structural Erosion Control Measures

Permanent erosion control measures serve to minimize post-construction impacts to wetland resource areas and undisturbed areas. Please refer to the Site Plans and Long-Term Operations and Maintenance Plan for a description of permanent erosion control measures implemented as part of the project and this SWPPP.

3.10 Good Housekeeping Best Management Practices

3.10.1 Street Sweeping

Dorothy Road in front of the project property shall be swept clean on a daily basis of any soils tracked onto it from the project site. All sweepings shall be disposed of off-site in accordance with all applicable laws and regulations.

3.10.2 Material Handling and Waste Management

Solid waste generation during the construction period will be primarily construction debris. The debris will include scrap lumber (used forming and shoring pallets and other shipping containers), waste packaging materials (plastic sheeting and cardboard), scrap cable and wire, roll-off containers (or dumpsters) and will be removed by a contract hauler to a properly licensed landfill. The roll-off containers will be covered with a properly secured tarp before the hauler exits the site. In addition to construction debris, the construction work force will generate some amount of household-type wastes (food packing, soft drink containers, and other paper). Trash containers for these wastes will be located around the site and will be emptied regularly so as to prevent wind-blown litter. This waste will also be removed by a contract hauler.

All hazardous waste material such as oil filters, petroleum products, paint and equipment maintenance fluids will be stored in structurally sound and sealed shipping containers in the hazardous-materials storage area and segregated from other non-waste materials. Secondary containment will be provided for all materials in the hazardous materials storage area and will consist of commercially available spill pallets. Additionally, all hazardous materials will be disposed of in accordance with federal, state and municipal regulations.

Two temporary sanitary facilities (portable toilets) will be provided at the site in the combined staging area. The toilets will be away from a concentrated flow path and traffic flow and will have collection pans underneath as secondary treatment. All sanitary waste will be collected from an approved party at a minimum of three times per week.

3.10.3 Building Material Staging Areas

Construction equipment and maintenance materials will be stored at the combined staging area and materials storage areas. Silt fence will be installed around the perimeter to designate the staging and materials storage area. A watertight shipping container will be used to store hand tools, small parts and other construction materials.

Non-hazardous building materials such as packaging material (wood, plastic and glass) and construction scrap material (brick, wood, steel, metal scraps, and pine cuttings) will be stored in a separate covered storage facility adjacent to other stored materials. All hazardous-waste materials such as oil filters, petroleum products, paint and equipment maintenance fluids will be stored in structurally sound and sealed containers under cover within the hazardous materials storage area.

Large items such as framing materials and stockpiled lumber will be stored in the open storage area. Such materials will be elevated on wood blocks to minimize contact with runoff.

The combined storage areas are expected to remain clean, well-organized and equipped with ample cleaning supplies as appropriate for the materials being stored. Perimeter controls such as containment structures, covers and liners will be repaired or replaced as necessary to maintain proper function.

3.10.4 Designated Washout Areas

Designated temporary, below-ground concrete washout areas will be constructed, as required, to minimize the pollution potential associated with concrete, paint, stucco, mixers etc. Signs will, if required, be posted marking the location of the washout area to ensure that concrete equipment operators use the proper facility. Concrete pours will not be conducted during or before an anticipated precipitation event. All excess concrete and concrete washout slurries from the concrete mixer trucks and chutes will be discharged to the washout area or hauled off-site for disposal.

3.10.5 Equipment/Vehicle Maintenance and Fueling Areas

Several types of vehicles and equipment will be used on-site throughout the project including graders, scrapers, excavators, loaders, paving equipment, rollers, trucks and trailers, backhoes and forklifts. All major equipment/vehicle fueling and maintenance will be performed off-site. A small, 20-gallon pickup bed fuel tank will be kept on-site in the combined staging area. When vehicle fueling must occur on-site, the fueling activity will occur in the staging area. Only minor equipment maintenance will occur on-site. Vehicular refueling or maintenance shall not be allowed within the Adjacent Upland Resource Area (AURA) or in any protected wetland resource areas as defined by the Town of Arlington Regulations for Wetland Protection. All equipment fluids generated from maintenance activities will be disposed of into designated drums stored on spill pallets. Absorbent, spill-cleanup materials and spill kits will be available at the combined staging and materials storage area. Drip pans will be placed under all equipment receiving maintenance and vehicles and equipment parked overnight.

3.10.6 Equipment/Vehicle Wash down Area

All equipment and vehicle washing will be performed off-site.

3.10.7 Spill Prevention Plan

A spill containment kit will be kept on-site in the Contractor's trailer and/or the designated staging area throughout the duration of construction. Should there be an accidental release of petroleum product into a resource area, the appropriate agencies will be immediately notified.

3.10.8 Inspections

Maintenance of existing and proposed BMP's to address stormwater management facilities during construction is an on-going process. The purpose of the inspections is to observe all sources of stormwater or non-stormwater discharge as identified in the SWPPP as well as the status of the receiving waters and fulfill the requirements of the Order of Conditions. The following sections describe the appropriate inspection measures to adequately implement the project's SWPPP. A blank inspection form is provided at the end of this section. Completed inspection forms are to be maintained on site.

Inspection Personnel

The owner's appointed representative will be responsible for performing regular inspections of erosion controls and ordering repairs as necessary.

Inspection Frequency

Inspections will be performed by qualified personnel once every 7 days and within 24-hours after a storm event of greater than one-quarter inch, in accordance with the CGP. The inspections must be documented on the inspection form provided at the end of this section, and completed forms will be provided to the on-site supervisor and maintained at the Owner's office throughout the entire duration of construction.

Inspection Reporting

Each inspection report will summarize the scope of the inspection, name(s) and qualifications of personnel making the inspection, and major observations relating to the implementation of the SWPPP, including compliance and non-compliance items. Completed inspection reports will remain with the completed SWPPP on site.

3.10.9 Amendment Requirements

The final SWPPP is intended to be a working document that is utilized regularly on the construction site, and provides guidance to the Contractor. It must reflect changes made to the originally proposed plan and will be updated to include project specific activities and ensure that they are in compliance with the NPDES General Permit and state and local laws and regulations. It should be amended whenever there is a change in design, construction, operation or maintenance that affects discharge of pollutants. The following items should be addressed should an amendment to the SWPPP occur:

- Dates of certain construction activities such as major grading activities, clearing and initiation of and completion of stabilization measures should be recorded.
- Future amendments to the SWPPP will be recorded as required. As this SWPPP is amended, all amendments will be kept on site and made part of the SWPPP.
- Upon completion of site stabilization (completed as designed and/or 70% background vegetative cover), it can be documented and marked on the plans. Inspections are no longer required at this time.
- Inspections often identify areas not included in the original SWPPP, which will require the SWPPP to be amended. These updates should be made within seven days of being recognized by the inspector.

3.11 SWPPP Inspection and Maintenance Report

The following form is an example to be used for SWPPP Inspection Reporting.

Stormwater Construction Site Inspection and Maintenance Report

TO BE COMPLETED AT LEAST EVERY 7 DAYS AND WITHIN 24 HOURS OF A STORM EVENT OF AT LEAST 0.25 INCHES. AFTER SITE STABILIZATION, TO BE COMPLETED AT LEAST ONCE PER MONTH FOR THREE YEARS OR UNTIL A NOTICE OF TERMINATION IS FILED (IF APPLICABLE).

General Information			
Project Name	Thorndike Place		
NPDES Tracking No. (if applicable)		**Location**	Dorothy Road Arlington, MA
Date of Inspection		**Start/End Time**	
Inspector's Name(s)			
Inspector's Title(s)			
Inspector's Contact Information			
Inspector's Qualifications			
Describe present phase of construction			
Type of Inspection: ❑ Regular ❑ Pre-storm event ❑ During storm event ❑ Post-storm event			
Weather Information			
Has there been a storm event since the last inspection? ❑Yes ❑No **If yes, provide:** Storm Start Date & Time: Storm Duration (hrs): Approximate Amount of Precipitation (in):			
Weather at time of this inspection? ❑ Clear ❑Cloudy ❑ Rain ❑ Sleet ❑ Fog ❑ Snowing ❑ High Winds ❑ Other: Temperature:			
Have any discharges occurred since the last inspection? ❑Yes ❑No **If yes, describe:**			
Are there any discharges at the time of inspection? ❑Yes ❑No **If yes, describe:**			

Site-specific BMPs

- *Number the structural and non-structural BMPs identified in your SWPPP on your site map and list them below (add as many BMPs as necessary). Carry a copy of the numbered site map with you during your inspections. This list will ensure that you are inspecting all required BMPs at your site.*
- *Describe corrective actions initiated, date completed, and note the person that completed the work in the Corrective Action Log.*

	BMP	**BMP Installed?**	**BMP Maintenance Required?**	**Corrective Action Needed and Notes Action required by whom and when**
1	Catch Basin Protection	❑Yes ❑No	❑Yes ❑No	
2	Haybale & Silt Fencing	❑Yes ❑No	❑Yes ❑No	
3	Straw Wattles	❑Yes ❑No	❑Yes ❑No	
4	Construction Entrance	❑Yes ❑No	❑Yes ❑No	
5	Sediment Basins	❑Yes ❑No	❑Yes ❑No	
6	Dewatering Pit	❑Yes ❑No	❑Yes ❑No	
7		❑Yes ❑No	❑Yes ❑No	

Overall Site Issues

Below are some general site issues that should be assessed during inspections. Customize this list as needed for conditions at your site.

	BMP/activity	Implemented?	Maintenance Required?	Corrective Action Needed and Notes Action required by whom and when
1	Are all slopes and disturbed areas not actively being worked properly stabilized?	❑Yes ❑No	❑Yes ❑No	
2	Are natural resource areas (e.g., streams, wetlands, mature trees, etc.) protected with barriers or similar BMPs?	❑Yes ❑No	❑Yes ❑No	
3	Are perimeter controls and sediment barriers adequately installed (keyed into substrate) and maintained?	❑Yes ❑No	❑Yes ❑No	
4	Are discharge points and receiving waters free of any sediment deposits?	❑Yes ❑No	❑Yes ❑No	
5	Are storm drain inlets properly protected?	❑Yes ❑No	❑Yes ❑No	
6	Is the construction exit preventing sediment from being tracked into the street?	❑Yes ❑No	❑Yes ❑No	
7	Is trash/litter from work areas collected and placed in covered dumpsters?	❑Yes ❑No	❑Yes ❑No	
8	Are washout facilities (e.g., paint, stucco, concrete) available, clearly marked, and maintained?	❑Yes ❑No	❑Yes ❑No	
9	Are vehicle and equipment fueling, cleaning, and maintenance areas free of spills, leaks, or any other deleterious material?	❑Yes ❑No	❑Yes ❑No	Vehicle Maintenance not allowed on site
10	Are materials that are potential stormwater	❑Yes ❑No	❑Yes ❑No	

	BMP/activity	Implemented?	Maintenance Required?	Corrective Action Needed and Notes Action required by whom and when
	contaminants stored inside or under cover?			
11	Are non-stormwater discharges (e.g., wash water, dewatering) properly controlled?	❑Yes ❑No	❑Yes ❑No	
12	(Other)	❑Yes ❑No	❑Yes ❑No	

Non-Compliance

Describe any incidents of non-compliance not described above:

CERTIFICATION STATEMENT

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

Print name and title: ____
(Qualified Person Performing the Inspection)

Signature:_________________________________ **Date:** ______________

Print name and title: ____
(Contractor/Operator)

Signature:_________________________________ **Date:**______________

SECTION 4.0

LONG-TERM POLLUTION PREVENTION & OPERATION AND MAINTENANCE PLAN

4.0 LONG-TERM POLLUTION PREVENTION & OPERATION AND MAINTENANCE PLAN

As required by Standard #4 of the Stormwater Management Policy, this Long-Term Pollution Prevention Plan has been developed for source control and pollution prevention at the site after construction.

MAINTENANCE RESPONSIBILITY

Ensuring that the provisions of the Long-Term Pollution Prevention Plan are followed will be the responsibility of The Applicant, Arlington Land Realty, LLC.

GOOD HOUSEKEEPING PRACTICES

The site to be kept clean of trash and debris at all times. Trash, junk, etc. is not to be left outside.

VEHICLE WASHING CONTROLS

The following BMP's, or equivalent measures, methods or practices are required if you are engaged in vehicle washing and/or steam cleaning:

> It is allowable to rinse down the body or a vehicle, including the bed of a truck, with just water without doing any wash water control BMP's.
>
> If you wash (with mild detergents) on an area that infiltrates water, such as gravel, grass, or loose soil, it is acceptable to let the wash water infiltrate as long as you only wash the body of vehicles.
>
> However, if you wash on a paved area and use detergents or other cleansers, or if you wash/rinse the engine compartment or the underside of vehicles, you must take the vehicles to a commercial vehicle wash.

REQUIREMENTS FOR ROUTINE INSPECTIONS AND MAINTENANCE OF STORMWATER BMPS

All stormwater BMPs are to be inspected and maintain as follows;

Haybales, Silt Fence, and other temporary measures

The temporary erosion control measures will be installed up gradient of any wetland resource area where any disturbance or alteration might otherwise allow for erosion or sedimentation. They will be regularly inspected to ensure that they are functioning adequately. Additional supplies of these temporary measures will be stockpiled on site for any immediate needs or routine replacement.

Deep Sump Hooded Catch Basins

Regular maintenance is essential. Catch basins remain effective at removing pollutants only if they are cleaned out frequently. Inspect or clean basins at least four times per year and at the end of the foliage and snow removal seasons. Sediments must also be removed four times per year or whenever the depth of the deposits in the catch basin sump is greater than or equal to one half the depth from the bottom of the invert of the lowest pipe in the basin.

Water Quality Treatment Units

The water quality treatment structures require periodic inspection and cleaning to maintain operation and function. Owners should have these units inspected on a semi-annual basis and after periods of intense precipitation. Inspections can be done by using a clear Plexiglas tube ("sludge judge") to extract a water column sample. When sediment accumulation reaches 15% of storage capacity, cleaning of the unit is required.

These water quality structures must and will be checked and cleaned immediately after petroleum spills; contact appropriate regulatory agencies.

Maintenance of these units should be done by a vacuum truck that will remove the water, sediment, debris, floating hydrocarbons and other materials in unit. Proper cleaning and disposal of the removed materials and liquid must be followed.

Underground Infiltration System

Maintenance is required for the proper operation of the underground infiltration system. Infiltration systems are prone to failure due to clogging if the upstream water quality units are not maintained. The use of pretreatment BMPs will minimize failure and maintenance requirements.

After construction, the infiltration system shall be inspected after every major storm for the first few months to ensure proper stabilization and function. Water levels in the access ports shall be recorded over several days to check the drainage of the systems. It is recommended that a log book be maintained showing the depth of water in the detention/infiltration systems at each observation in order to determine the rate at which the system dewaters after runoff producing storm events. Once the performance characteristics of the detention/infiltration have been verified, the monitoring schedule can be reduced to an annual basis, unless the performance data suggests that a more frequent schedule is required.

Preventive maintenance on the infiltration system shall be performed at least twice a year, and sediment shall be removed from any and all pretreatment and collection structures. Sediment shall be removed when deposits approach within six inches of the invert heights of connecting pipes between unit rows, or in sumped inlet structures. Ponded water inside the systems (as visible from the access ports) that remains after several days most likely indicates that the bottom of the system is clogged and will require cleaning or replacement.

The system is designed with a defined top portal area at the “down-flow” end of the chamber that can be cut out to accept up to a 10-inch diameter riser pipe. The 10-inch riser can be used as an observation well and as access for a vacuum truck tube for use in removing sediment. The “down flow” ends of the units have end walls that are closed on the bottom. The closed bottom functions like a coffer dam, with most of the sediment depositing prior to flowing into the next chamber, facilitating its removal through the riser pipe, which is positioned directly above this area.

Pipe Outlet Protection

The outlet protection should be checked at least annually and after every major storm. If the rip-rap has been displaced, undermined or damaged, it should be repaired immediately. The channel immediately below the outlet should be checked to see that erosion is not occurring. The downstream channel should be kept clear of obstructions such as fallen trees, debris, and sediment that could change flow patterns and/or tailwater depths on the pipes. Repairs must be carried out immediately to avoid additional damage to the outlet protection apron.

PROVISIONS FOR MAINTENANCE OF LAWNS, GARDENS AND OTHER LANDSCAPE AREAS

Suggested Maintenance Operations

A. Trees and Shrubs

Disease and Pest Management - Prevention of disease or infestation is the first step of Pest Management. A plant that is in overall good health is far less susceptible to disease. Good general landscape maintenance can reduce problems from disease.

Inspections of plant materials for signs of disease or infestation are to be performed monthly by the Landscape Maintenance Contractor’s Certified Arborist. This is a critical step for early diagnosis. Trees and Shrubs that have been diagnosed to have a plant disease or an infestation of insect pests are to be treated promptly with an appropriate material by a licensed applicator.

Fertilization - Trees and shrubs live outside their natural environment and should be given proper care to maintain health and vigor. Fertilizing trees and shrubs provides the plants with nutrients needed to resist insect attack, to resist drought and to grow thicker foliage. Fertilizing of new and old trees may be done in one of three ways, in either the early spring or the late fall.

- Systemic Injection of new and existing trees on trees 2 inches or greater in diameter. You must be licensed to apply this method.

- Soil Injection – a liquid fertilizer with a product such as Arbor Green or Rapid Grow injected into the soil under the drip zone of a tree or shrub. Material must be used according to manufacturers' specifications to be effective. Outside contracting is recommended.
- Punch Bar Method – a dry fertilizer such as 10-10-10, may be used by punched holes in the drip zone of the tree 12-18" deep, two feet apart around the circumference, to the edge of the drip line. Three pounds of fertilizer should be used per diameter inch for trees with trunks six inches or more in diameter.
- Fertilizer of shrubs – use a fertilizer such as 10-10-10, broadcast over the planting area according to the manufacturers' rate and water in.
- All fertilization must be noted on daily maintenance log.

Watering - Trees and Shrubs will need supplemental watering to remain in vigorous health. All new plants need to be watered once a week in cool weather, twice a week during warm weather, and up to three times in a week during periods of extreme heat and drought. Trees and shrubs should be watered in such a manner as to totally saturate the soil in the root zone area. Over-watering or constant saturation of the soil must be avoided as this could lead to root rot and other disease problems. The use of a soil moisture meter can help you monitor the soil's water intake.

Plant Replacement - Unhealthy plants that may cause widespread infestation of other nearby plants shall be immediately removed from the site. Any vegetation removed from the site must be recorded and submitted with the daily maintenance log. The area shall be treated to prevent further infestation. The plant shall then be replaced with a healthy specimen of the same species and size. This work shall have a pre-established budget allowance for the year.

A spring inspection of all plant materials shall be performed to identify those plant materials that are not in vigorously healthy condition. Unhealthy plant materials shall be evaluated. If the problem is determined to be minor the plant material shall be given appropriate restorative care in accordance with this maintenance guideline until it is restored to a vigorously healthy condition. Unhealthy plant materials that do not respond to restorative care or are determined to be beyond saving shall be replaced with a healthy specimen of the same species and size. In the case of the necessity of replacing extremely large plant materials the Landscape Architect shall determine the size of the replacement plant.

Pruning - Proper pruning is the selective removal of branches without changing the plant's natural appearance, or habit of growth. All tree pruning is to be performed by a licensed Arborist. All branches that are dead, broken, scared or crossing should be removed. All cuts should be made at the collar and not cut flush with the base.

Pruning on the site shall be done for the following purposes;

- To maintain or reduce the size of a tree or shrub
- To remove dead, diseased or damaged branches
- To rejuvenate old shrubs and encourage new growth
- To stimulate future flower and fruit development
- To maximize the visibility of twig color
- To prevent damage and reduce hazards to people and properties

All shrubs are recommended to be pruned on an annual basis to prevent the shrub from becoming overgrown and eliminate the need for drastic pruning. There are several types of pruning for deciduous shrubs. Hand snips should be used to maintain a more natural look or hand shears can be used for a more formal appearance.

Winter Protection - All trees and shrubs are to be watered, fertilized, and mulched before the first frost. All stakes should be checked and ties adjusted. Damaged branches should be pruned.

Broadleaf and Coniferous Evergreen plant materials are to be sprayed with an anti-desiccant product to prevent winter burn. The application shall be repeated during a suitable mid-winter thaw.

Shrubs located in areas likely to be piled with snow during snow removal (but not designated as Snow Storage Areas) shall be marked by six-foot high poles with bright green banner flags. Stockpiles of snow are not to be located in these areas due to potential damage to the plant materials from both the weight of the snow and the snow melting chemicals.

At the fall landscape maintenance conference parameters will be discussed between the Landscape Maintenance Contractor and the snow removal contractor to assure minimal damage and loss of landscape amenities during the winter season.

Seasonal Clean Up - A thorough spring cleanup is to be performed. This includes the removal and replacement of dead or unhealthy plant materials and the cleanup of plant debris and any general debris that has accumulated over the winter season. Mulch is to be lightly raked to clean debris from the surface without removing any mulch. Twigs and debris are to be removed from the planting beds throughout the growing season.

Mulching - Planting beds shall be mulched with a treated shredded hardwood mulch free from dirt, debris, and insects. A sample of this mulch shall be given to the Owner for approval prior to installation.

Maintain a 2-3" maximum depth and keep free of weeds either by hand weeding or by the use of a pre-emergent weed control such as Treflan or Serfian. Seasonal re-mulching shall occur as necessary in the spring and the fall to maintain this minimum depth. When new mulch is added to the planting bed it shall be spread to create a total depth of no more than three inches. Edges should be maintained in a cleanly edged fashion.

Mulch shall not be placed directly against the trunk of any tree or shrub.

B. Groundcover and Perennials

Disease and Pest Management – Pesticides and herbicides should be applied only as problems occur, with the proper chemical applied only by a trained professional or in the case of pesticide, a Certified Pesticide Applicator. Plants should be monitored weekly and treated accordingly.

Fertilizer – The health of the plants can be maintained or improved, and their growth encouraged by an application of complete fertilizer. Apply a fertilizer such as 4-12-4 as growth becomes apparent and before mulching. Apply to all groundcover and perennial planting areas by hand and avoid letting the fertilizer come in contact with the foliage, or use a liquid fertilizer and apply by soaking the soil. Apply according to the manufacturers' specifications.

Fertilization shall stop at the end of July.

Water – Groundcovers and Perennials will need supplemental watering in order to become established, healthy plants. All new plants need to be watered once a week in cool weather, twice a week during warm weather, and up to three times in a week during periods of extreme heat and drought. Until established, groundcovers and perennials should be watered in such a manner as to totally saturate the soil in the root zone area, to a depth of 6 inches. Once established, perennials shall continue to be watered as necessary to maintain them in a vigorous healthy condition. Over-watering or constant saturation of the soil must be avoided as this could lead to root rot and other disease problems. The use of a soil moisture meter can help you monitor the soil's water intake.

On-site water shall be furnished by the Owner. Hose and other watering equipment shall be furnished by the Landscape Maintenance Contractor.

Replacement – Any unhealthy plant/s that may cause widespread infestation of other nearby plants shall be immediately removed from the site. Any vegetation removed from the site must be recorded and submitted with the landscape maintenance log. The area shall be treated to prevent further infestation. The plant/s shall then be replaced with healthy specimen/s of the same species and size. Old Forge shall have a pre-established budget allowance for this type of replacement, each year.

Plant material that is damaged as a result of other landscape maintenance activities, such as mowing, shall be replaced with healthy specimens of the same species and size, at no additional cost to the owner.

Deadheading – Perennials shall be checked on a weekly basis and dead-headed once flowers have faded or as necessary based on plant type and duration of flower. Spent flowers can be pinched off with the thumb and forefinger. Continue to remove all faded flowers until Fall. All associated debris shall be removed from site daily.

Staking – Upright-growing perennials need support especially when in flower. Use of bamboo stakes, galvanized wire hoops or mesh may be necessary for their support. Supports should be put in place before they have become too difficult to handle. The supports should not be taller than the mature height of the perennial plant.

Division of Perennials – Two or three-year-old perennials are easily divided in the spring if more plants are needed. To divide, cut out the entire section of plant to be divided, including roots. The larger divisions (those with three or more shoots), can be set out immediately in their permanent location, where they can be expected to bloom the same season. Smaller divisions are best planted in an out-of-the-way planting bed until the following autumn or spring, when they can be moved to their permanent location.

Weeding – All planting beds should be kept weed-free. Weed either by hand or with a pre-emergent herbicide such as Treflen used according to manufacturers' specifications. Manual weeding is to be used in combination with the use of spot applications of herbicides. Both live and dead weeds are to be pulled and removed from the site.

All herbicide applications shall be documented in the Landscape Maintenance Log. The actual product label or the manufacturer's product specification sheet for the specific product shall also be included in the Log.

Only personnel with appropriate applicator licenses shall supervise and/or perform the application of pesticide products requiring a license.

Winterizing – Perennial gardens should be cleaned-up when growth ceases in the fall. Remove foliage of plants that normally die down to the ground. Divide and replant over-grown clumps.

C. Lawn Areas - Turf Systems

Mowing – Proper mowing is an integral part of any good turf maintenance program. Without it, the finest in fertilization, watering and other vital maintenance practices would be completely ineffective. Proper mowing will help control dicot weeds; help the turf survive during periods of extreme heat, and gain strength and vigor to resist disease and other infestations.

Mowing height – The proper mowing height will vary somewhat according to the type of grass. The most common type of seed & sod lawns contain a mixture of bluegrass, fine fescue and perennial rye, which should be mowed at 2-3 inches.

Mowing frequency – The basic rule of thumb for mowing frequency is to never remove more than 1/3 of the grass blade in one mowing. Example: if you want to mow your turf at 2 inches, you should cut it when it reaches 3 inches. Removing more than ½ of the grass plant at a time can put the plant into shock, thus making it more susceptible to stress disease and weed infestation.

Mowing frequency will vary with the growing season and should be set by the plant height and not a set date. It will often be necessary to mow twice a week during periods of surge growth to help maintain plant health and color. Mowing should be cut back during periods of stress.

Grass clippings should be removed whenever they are thick enough to layer the turf. The return of clippings to the soil actually adds nutrients and helps retain moisture. Heavily clumped grass clippings are a sign of infrequent mowing, calling for an adjustment in the mowing schedule.

When mowing any area, try to alternate mowing patterns. This tends to keep grass blades more erect and assures an even cut. A dull mower will cause color loss due to tearing of the turf plant, and since mowing will ultimately determine the appearance of any turf area there is an absolute necessity for a clean sharp cut.

Weed & Pest Control and Fertilizing- In order to maintain turf grass health, vigor color, and nutrients, fertilizer must be added to the soil. Recommendations for fertilization of lawn areas are as follows; fertilize at the rate of one (1) pound of nitrogen per thousand square feet, per year is optimum. Fertilizer should be a balanced slow release, sulfur coated type fertilizer.

Weed Control - All turf areas will require some weed control, for both weed grasses and dicot weeds. Weeds should be treated at the appropriate time and with a material labeled for the target weed. Please refer to the fertilizer weed and pest schedule for timing.

Pest Control - All turf areas will require some pest control. Pests should be treated at the appropriate time with a material labeled for the target pest. Please refer to the fertilizer, weed and pest schedule for timing.

Lime - A common cause for an unhealthy lawn is acidic soil. When the pH is below the neutral range (between 6-7) vital plant nutrients become fixed in the soil and cannot be absorbed by the grass plant. Lime corrects an acid soil condition, supplies calcium for plant growth and improves air and water circulation. Limestone applied at the rate of 50 lbs. per thousand square feet will adjust the soil pH one point over a period of 6-9 months.

D. Fertilizer, Weed & Pest Control Schedule – Turf Systems

Spring - (April)	Fertilize one (1) pound of nitrogen per 1,000 square feet Pre-emergent weed grass control Broadleaf weed control
Late Spring - (June)	Fertilize one (1) pound of nitrogen per 1,000 square feet Pre-emergent weed grass control Broadleaf weed control Insect Control (if needed)
*Summer - (August)	Fertilize one (1) pound of nitrogen per 1,000 square feet Broadleaf weed control (if needed) Insect Control (if needed)
Fall - (September)	Fertilize one (1) pound of nitrogen per 1,000 square feet

*Omit if area is not to be irrigated

Lawn Maintenance Task Schedule

MARCH (Weather permitting)
- Clean up winter debris, sand, leaves, trash etc.
- Re-edge mulch beds, maintain at 2-3” maximum.
- Fertilize plants
- Aerate and thatch turf (conditions permitting)

APRIL
- Reseed or sod all areas needing attention.
- Fertilize and weed control
- Lime
- Start mowing when grass reaches 2-1/2”, mow to 2”

MAY
- Mow turf to 2-2-1/2”
- Weed as necessary.
- Check for disease and pest problems in both turf and plants.

JUNE

- Mow turf to 2-1/2” – 3”
- Fertilize and weed control.
- Weed
- Check for disease and pest problems in both turf and plants, treat as necessary.

Provisions for Solid Waste Management (Site Trash)

Trash will be placed in on-site dumpsters and the Owner will make provisions for its regular and timely removal.

Snow Disposal and Plowing Plans

The purpose of the snow and snowmelt management plan is to provide guidelines regarding snow disposal site selection, site preparation and maintenance that are acceptable to the Department of Environmental Protection. For the areas that require snow removal, snow storage onsite will largely be accomplished by using pervious areas along the shoulder of the roadway and development as windrowed by plows.

- Avoid dumping of snow into any water body, including rivers, ponds, or wetlands. In addition to water quality impacts and flooding, snow disposed of in open water can cause navigational hazards when it freezes into ice blocks.
- Avoid disposing of snow on top of storm drain catch basins or in stormwater basins. Snow combined with sand and debris may block a storm drainage system, causing localized flooding. A high volume of sand, sediment, and litter released from melting snow also may be quickly transported through the system into surface water.
- In significant storm events, the melting or off-site trucking of snow may be implemented. These activities shall be conducted in accordance with all local, state and federal regulations.

Winter Road Salt and/or Sand Use and Storage Restrictions

The applicant will be responsible for sanding and salting the site. No storage on site.

Street Sweeping Schedules

There are three types of sweepers: Mechanical, Regenerative Air, and Vacuum Filter.

1) Mechanical: Mechanical sweepers use brooms or rotary brushes to scour the pavement.
2) Regenerative Air: These sweepers blow air onto the road or parking lot surface, causing fines to rise where they are vacuumed.
3) Vacuum filter: These sweepers remove fines along roads. Two general types of vacuum filter sweepers are available - wet and dry. The dry type uses a broom in combination with the vacuum. The wet type uses water for dust suppression

Regardless of the type chosen, the efficiency of street sweeping is increased when sweepers are operated in tandem.

This project has not included street sweeping as part of the TSS removal calculations. However, it is recommended that street sweeping of the parking areas occur four times a year, including once after the spring snow melt.

Reuse and Disposal of Street Sweepings

Once removed from paved surfaces, the sweepings must be handled and disposed of properly. Mass DEP’s Bureau of Waste Prevention has issued a written policy regarding the reuse and disposal of street sweepings. These sweepings are regulated as a solid waste, and can be used in three ways:

- In one of the ways already approved by Mass DEP (e.g., daily cover in a landfill, additive to compost, fill in a public way)

- If approved under a Beneficial Use Determination
- Disposed in a landfill

TRAINING OF STAFF OR PERSONNEL INVOLVED WITH IMPLEMENTING LONG-TERM POLLUTION PREVENTION PLAN

The Long-Term Pollution Prevention Plan is to be implemented by property owner of the site. Trained and, if required, licensed Professionals are to be hired by the owner as applicable to implement the Long-Term Pollution Prevention Plan.

LIST OF EMERGENCY CONTACTS FOR IMPLEMENTING LONG-TERM POLLUTION PREVENTION PLAN

The applicant will be required to implement the Long-Term Pollution Prevention Plan and will create and maintain a list of emergency contacts.

POST CONSTRUCTION PHASE INSPECTION SCHEDULE AND EVALUATION CHECKLIST

Inspection Date	Inspector	BMP Inspected	Inspection Frequency Requirements	Comments	Recommendation	Follow-up Inspection Required (yes/no)
		Catch Basin	Four times a year			
		Water Quality Units	Four times a year			
		Infiltration System	Twice a year			
		Pipe Outlet Protection	Once a year			

1. Refer to the Massachusetts Stormwater Handbook Volume Two: Stormwater Technical Handbook (February 2008) for recommendations regarding frequency for inspections and maintenance of specific BMP's

2. Inspections to be conducted by a qualified professional such as an environmental scientist or civil engineer.

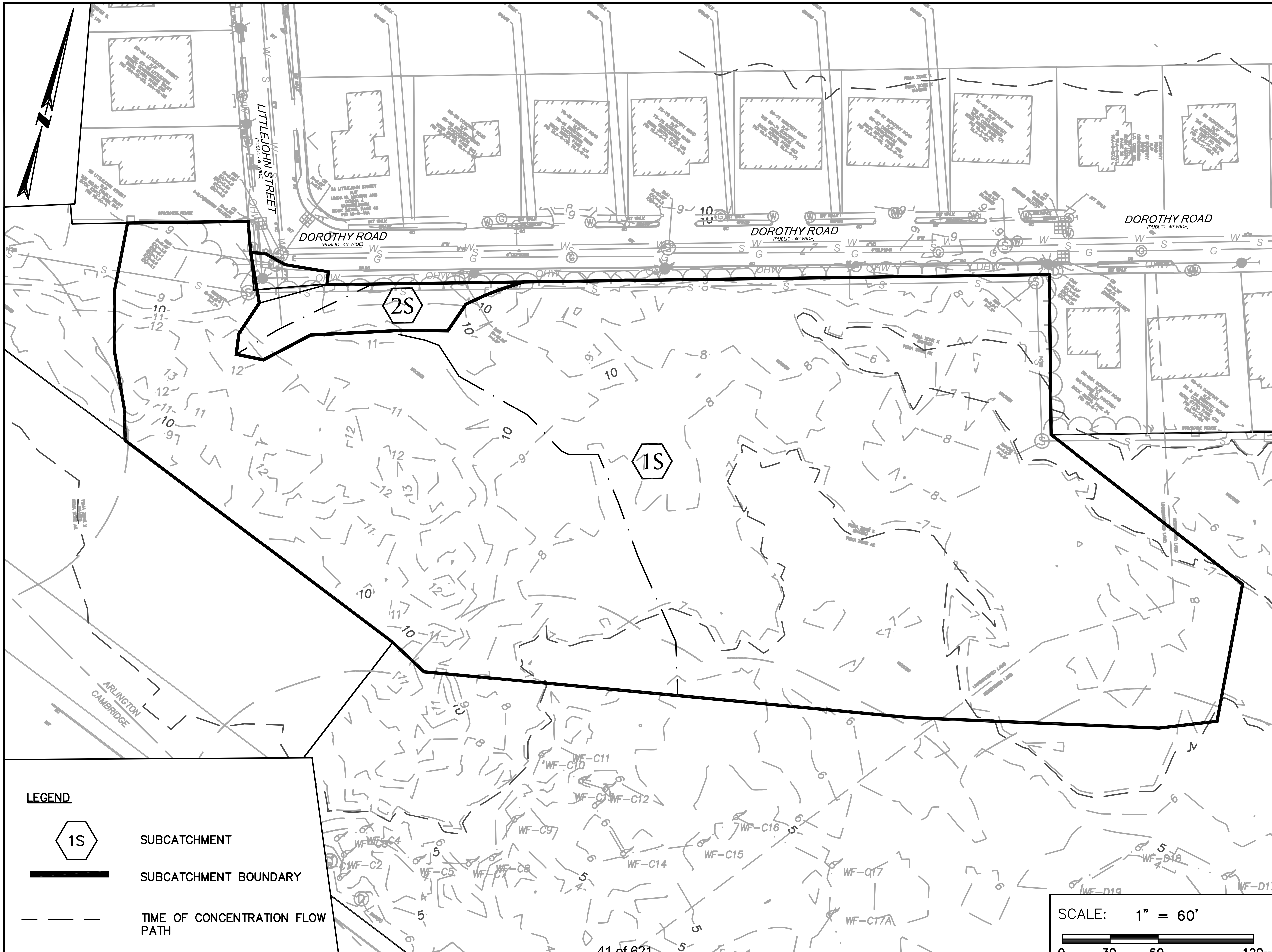
3. Limited or no use of sodium chloride salts, fertilizers or pesticides recommended.

4. Other Notes: (Include deviations from Conservation Commission Approvals, Planning Board Approvals and Approved Plans)

SECTION 5.0

HYDROLOGY CALCULATIONS

5.01 EXISTING WATERSHED PLAN



LEGEND

1S SUBCATCHMENT

SUBCATCHMENT BOUNDARY

TIME OF CONCENTRATION FLOW PATH

THORNDIKE PLACE

DOROTHY ROAD

ARLINGTON
MASSACHUSETTS
(MIDDLESEX COUNTY)

EXISTING WATERSHED PLAN

NOVEMBER 3, 2020

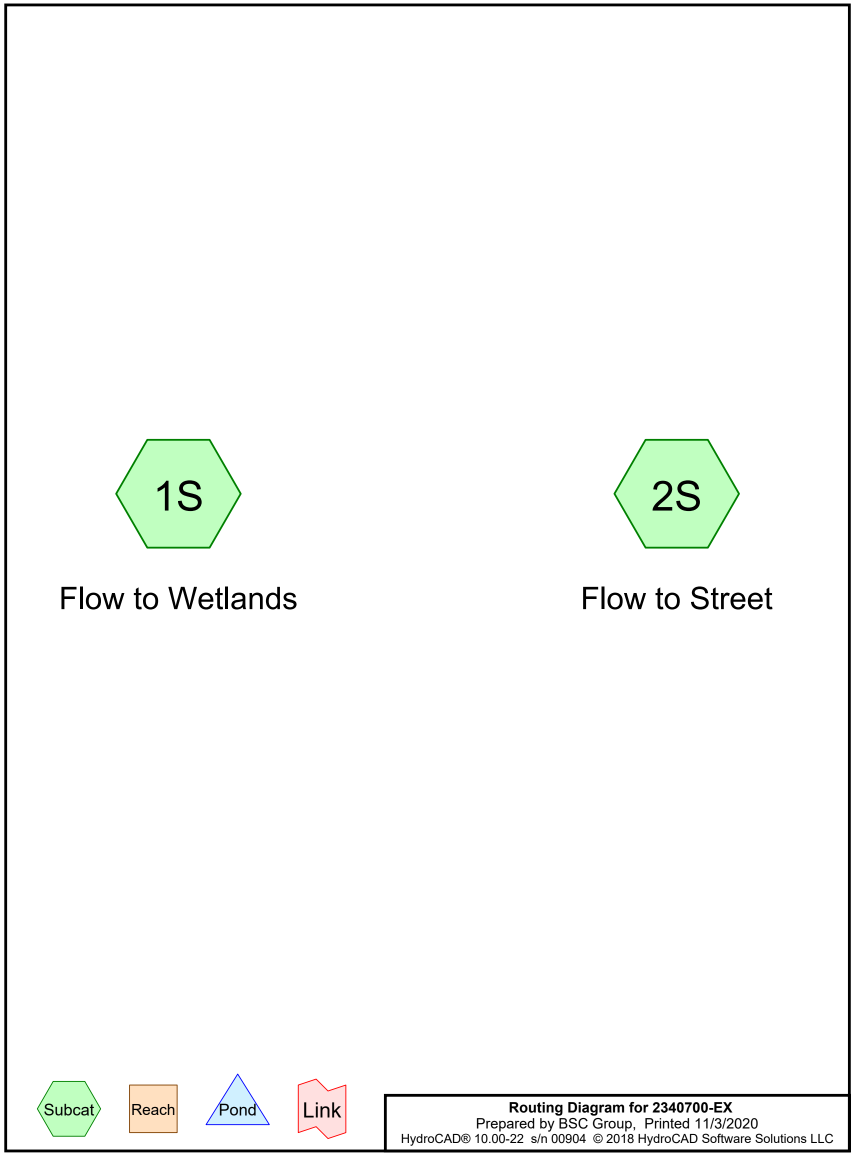
PREPARED FOR:
ARLINGTON LAND REALTY
84 SHERMAN STREET
CAMBRIDGE, MA

BSC GROUP
803 Summer Street
Boston, Massachusetts
02127
617 896 4300

SCALE: 1" = 60'
0 30 60 120 FEET

Job No.: 23407.00
Date: 11/3/2020
Scale: 1" = 60'
Revised:
Dwg No: EXW
File: C:\DRAINAGE DESIGN\2340700-EXW

5.02 Existing Hydrology Calculations (HydroCAD™ Printouts)



Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.021	98	Paved parking, HSG C (2S)
3.534	70	Woods, Good, HSG C (1S, 2S)
3.555	**70**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
3.555	HSG C	1S, 2S
0.000	HSG D	
0.000	Other	
3.555		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	0.021	0.000	0.000	0.021	Paved parking	2S
0.000	0.000	3.534	0.000	0.000	3.534	Woods, Good	1S, 2S
0.000	**0.000**	**3.555**	**0.000**	**0.000**	**3.555**	**TOTAL AREA**	

Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Flow to Wetlands Runoff Area=147,900 sf 0.00% Impervious Runoff Depth>0.84"
Flow Length=310' Tc=17.5 min CN=70 Runoff=2.1 cfs 0.238 af

Subcatchment 2S: Flow to Street Runoff Area=6,954 sf 13.30% Impervious Runoff Depth>1.06"
Flow Length=95' Tc=6.0 min CN=74 Runoff=0.2 cfs 0.014 af

Total Runoff Area = 3.555 ac Runoff Volume = 0.252 af Average Runoff Depth = 0.85"
99.40% Pervious = 3.534 ac 0.60% Impervious = 0.021 ac

Summary for Subcatchment 1S: Flow to Wetlands

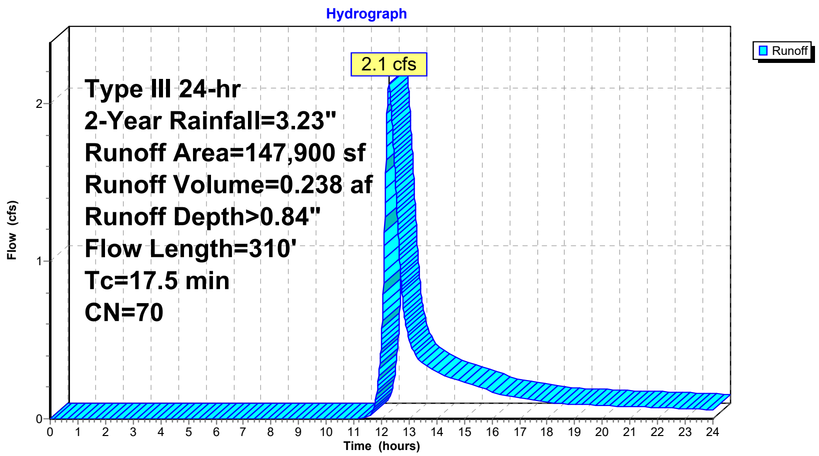
Runoff = 2.1 cfs @ 12.27 hrs, Volume= 0.238 af, Depth> 0.84"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.23"

Area (sf)	CN	Description
147,900	70	Woods, Good, HSG C
147,900		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.4	50	0.0240	0.07		**Sheet Flow, A to B** Woods: Light underbrush n= 0.400 P2= 3.23"
6.1	260	0.0200	0.71		**Shallow Concentrated Flow, B to C** Woodland Kv= 5.0 fps
17.5	310	Total			

Subcatchment 1S: Flow to Wetlands



Summary for Subcatchment 2S: Flow to Street

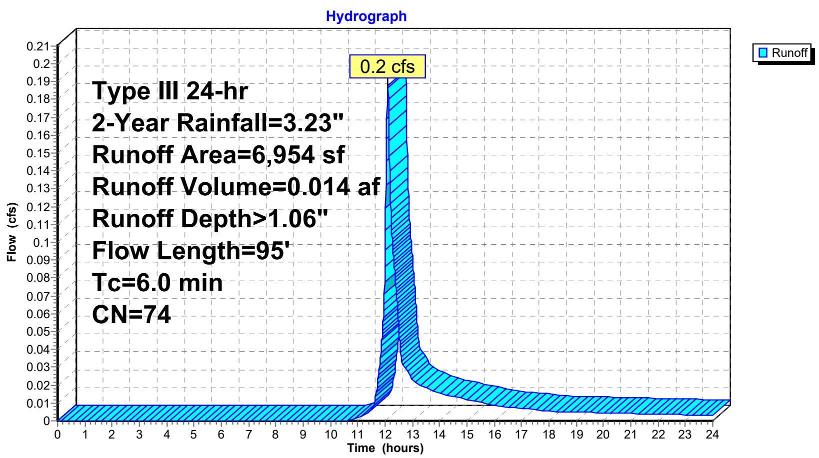
Runoff = 0.2 cfs @ 12.10 hrs, Volume= 0.014 af, Depth> 1.06"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.23"

Area (sf)	CN	Description
6,029	70	Woods, Good, HSG C
925	98	Paved parking, HSG C
6,954	74	Weighted Average
6,029		86.70% Pervious Area
925		13.30% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.5	20	0.0750	0.10		**Sheet Flow, A to B** Woods: Light underbrush n= 0.400 P2= 3.23"
1.8	75	0.0200	0.71		**Shallow Concentrated Flow, B to C** Woodland Kv= 5.0 fps
5.3	95	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 2S: Flow to Street



Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Flow to Wetlands Runoff Area=147,900 sf 0.00% Impervious Runoff Depth>1.95"
Flow Length=310' Tc=17.5 min CN=70 Runoff=5.4 cfs 0.553 af

Subcatchment 2S: Flow to Street Runoff Area=6,954 sf 13.30% Impervious Runoff Depth>2.28"
Flow Length=95' Tc=6.0 min CN=74 Runoff=0.4 cfs 0.030 af

Total Runoff Area = 3.555 ac Runoff Volume = 0.583 af Average Runoff Depth = 1.97"
99.40% Pervious = 3.534 ac 0.60% Impervious = 0.021 ac

Summary for Subcatchment 1S: Flow to Wetlands

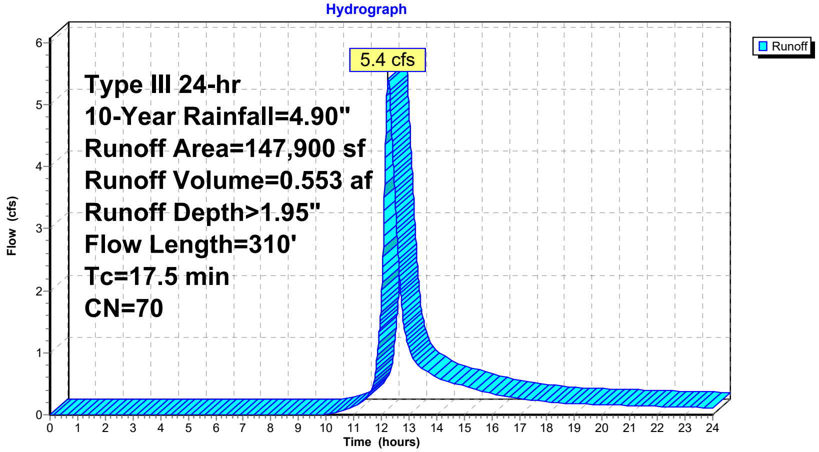
Runoff = 5.4 cfs @ 12.25 hrs, Volume= 0.553 af, Depth> 1.95"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.90"

Area (sf)	CN	Description
147,900	70	Woods, Good, HSG C
147,900		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.4	50	0.0240	0.07		**Sheet Flow, A to B** Woods: Light underbrush n= 0.400 P2= 3.23"
6.1	260	0.0200	0.71		**Shallow Concentrated Flow, B to C** Woodland Kv= 5.0 fps
17.5	310	Total			

Subcatchment 1S: Flow to Wetlands



Summary for Subcatchment 2S: Flow to Street

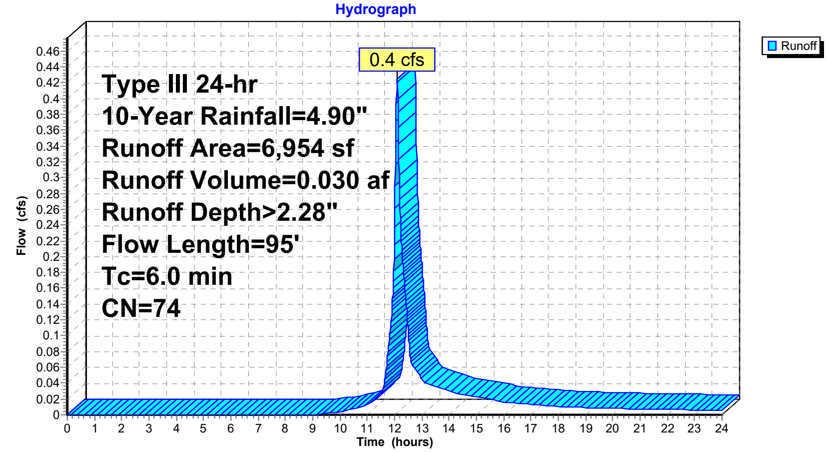
Runoff = 0.4 cfs @ 12.09 hrs, Volume= 0.030 af, Depth> 2.28"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.90"

Area (sf)	CN	Description
6,029	70	Woods, Good, HSG C
925	98	Paved parking, HSG C
6,954	74	Weighted Average
6,029		86.70% Pervious Area
925		13.30% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.5	20	0.0750	0.10		**Sheet Flow, A to B** Woods: Light underbrush n= 0.400 P2= 3.23"
1.8	75	0.0200	0.71		**Shallow Concentrated Flow, B to C** Woodland Kv= 5.0 fps
5.3	95	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 2S: Flow to Street



Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Flow to Wetlands Runoff Area=147,900 sf 0.00% Impervious Runoff Depth>2.95"
Flow Length=310' Tc=17.5 min CN=70 Runoff=8.3 cfs 0.836 af

Subcatchment 2S: Flow to Street Runoff Area=6,954 sf 13.30% Impervious Runoff Depth>3.35"
Flow Length=95' Tc=6.0 min CN=74 Runoff=0.6 cfs 0.045 af

Total Runoff Area = 3.555 ac Runoff Volume = 0.880 af Average Runoff Depth = 2.97"
99.40% Pervious = 3.534 ac 0.60% Impervious = 0.021 ac

Summary for Subcatchment 1S: Flow to Wetlands

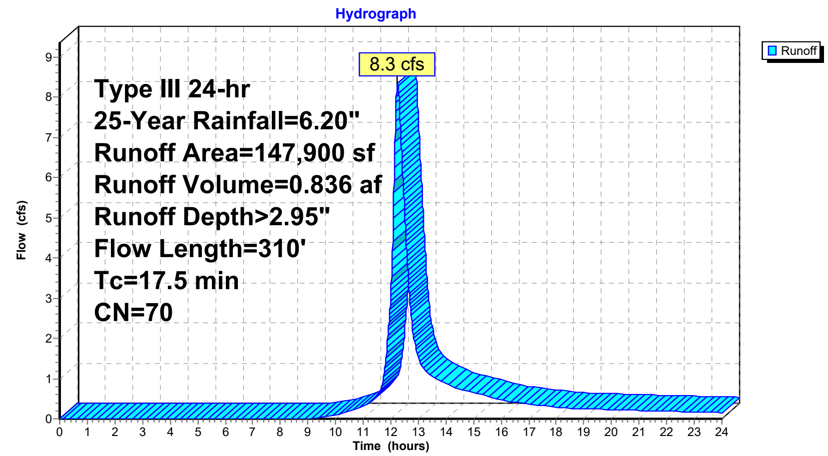
Runoff = 8.3 cfs @ 12.24 hrs, Volume= 0.836 af, Depth> 2.95"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=6.20"

Area (sf)	CN	Description
147,900	70	Woods, Good, HSG C
147,900		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.4	50	0.0240	0.07		**Sheet Flow, A to B** Woods: Light underbrush n= 0.400 P2= 3.23"
6.1	260	0.0200	0.71		**Shallow Concentrated Flow, B to C** Woodland Kv= 5.0 fps
17.5	310	Total			

Subcatchment 1S: Flow to Wetlands



Summary for Subcatchment 2S: Flow to Street

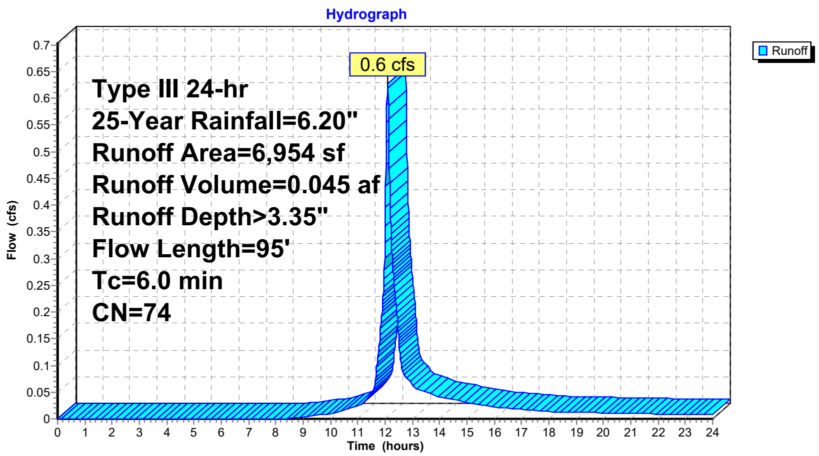
Runoff = 0.6 cfs @ 12.09 hrs, Volume= 0.045 af, Depth> 3.35"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=6.20"

Area (sf)	CN	Description
6,029	70	Woods, Good, HSG C
925	98	Paved parking, HSG C
6,954	74	Weighted Average
6,029		86.70% Pervious Area
925		13.30% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.5	20	0.0750	0.10		**Sheet Flow, A to B** Woods: Light underbrush n= 0.400 P2= 3.23"
1.8	75	0.0200	0.71		**Shallow Concentrated Flow, B to C** Woodland Kv= 5.0 fps
5.3	95	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 2S: Flow to Street



Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Flow to Wetlands Runoff Area=147,900 sf 0.00% Impervious Runoff Depth>3.96"
Flow Length=310' Tc=17.5 min CN=70 Runoff=11.3 cfs 1.122 af

Subcatchment 2S: Flow to Street Runoff Area=6,954 sf 13.30% Impervious Runoff Depth>4.41"
Flow Length=95' Tc=6.0 min CN=74 Runoff=0.8 cfs 0.059 af

Total Runoff Area = 3.555 ac Runoff Volume = 1.180 af Average Runoff Depth = 3.98"
99.40% Pervious = 3.534 ac 0.60% Impervious = 0.021 ac

Summary for Subcatchment 1S: Flow to Wetlands

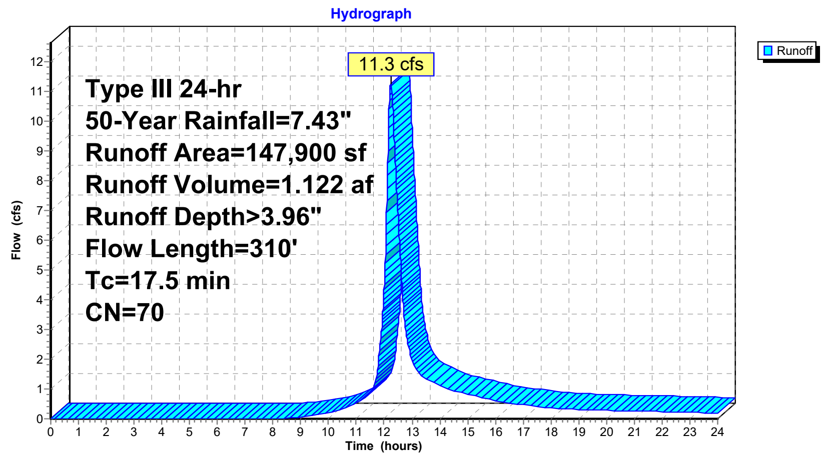
Runoff = 11.3 cfs @ 12.24 hrs, Volume= 1.122 af, Depth> 3.96"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 50-Year Rainfall=7.43"

Area (sf)	CN	Description
147,900	70	Woods, Good, HSG C
147,900		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.4	50	0.0240	0.07		**Sheet Flow, A to B** Woods: Light underbrush n= 0.400 P2= 3.23"
6.1	260	0.0200	0.71		**Shallow Concentrated Flow, B to C** Woodland Kv= 5.0 fps
17.5	310	Total			

Subcatchment 1S: Flow to Wetlands



Summary for Subcatchment 2S: Flow to Street

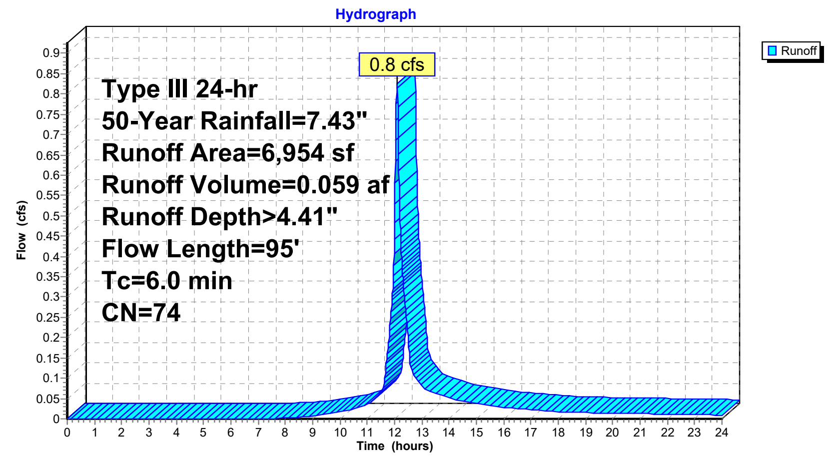
Runoff = 0.8 cfs @ 12.09 hrs, Volume= 0.059 af, Depth> 4.41"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 50-Year Rainfall=7.43"

Area (sf)	CN	Description
6,029	70	Woods, Good, HSG C
925	98	Paved parking, HSG C
6,954	74	Weighted Average
6,029		86.70% Pervious Area
925		13.30% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.5	20	0.0750	0.10		**Sheet Flow, A to B** Woods: Light underbrush n= 0.400 P2= 3.23"
1.8	75	0.0200	0.71		**Shallow Concentrated Flow, B to C** Woodland Kv= 5.0 fps
5.3	95	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 2S: Flow to Street



Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Flow to Wetlands Runoff Area=147,900 sf 0.00% Impervious Runoff Depth>5.22"
Flow Length=310' Tc=17.5 min CN=70 Runoff=14.9 cfs 1.477 af

Subcatchment 2S: Flow to Street Runoff Area=6,954 sf 13.30% Impervious Runoff Depth>5.72"
Flow Length=95' Tc=6.0 min CN=74 Runoff=1.1 cfs 0.076 af

Total Runoff Area = 3.555 ac Runoff Volume = 1.553 af Average Runoff Depth = 5.24"
99.40% Pervious = 3.534 ac 0.60% Impervious = 0.021 ac

Summary for Subcatchment 1S: Flow to Wetlands

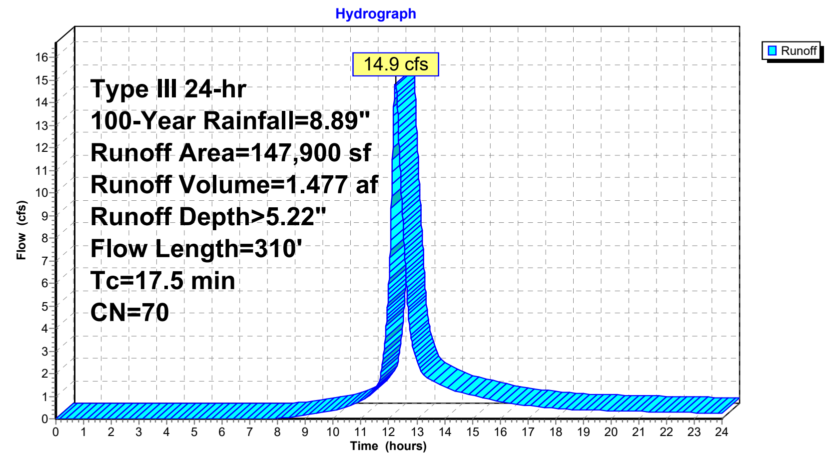
Runoff = 14.9 cfs @ 12.23 hrs, Volume= 1.477 af, Depth> 5.22"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.89"

Area (sf)	CN	Description
147,900	70	Woods, Good, HSG C
147,900		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.4	50	0.0240	0.07		**Sheet Flow, A to B** Woods: Light underbrush n= 0.400 P2= 3.23"
6.1	260	0.0200	0.71		**Shallow Concentrated Flow, B to C** Woodland Kv= 5.0 fps
17.5	310	Total			

Subcatchment 1S: Flow to Wetlands



Summary for Subcatchment 2S: Flow to Street

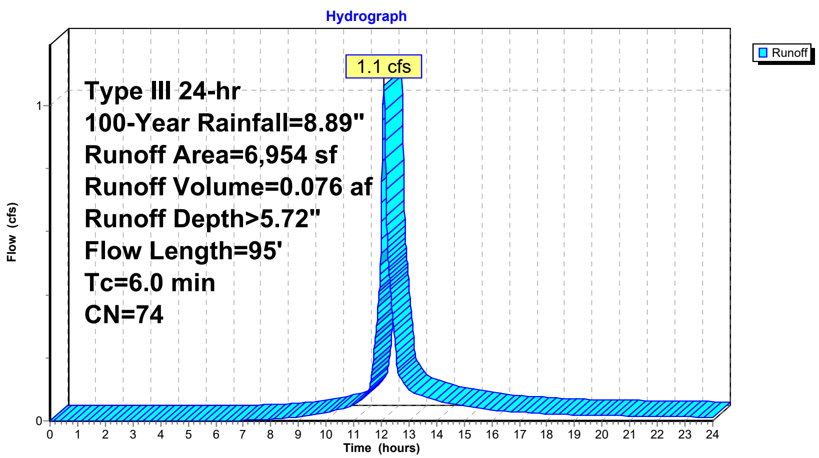
Runoff = 1.1 cfs @ 12.09 hrs, Volume= 0.076 af, Depth> 5.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.89"

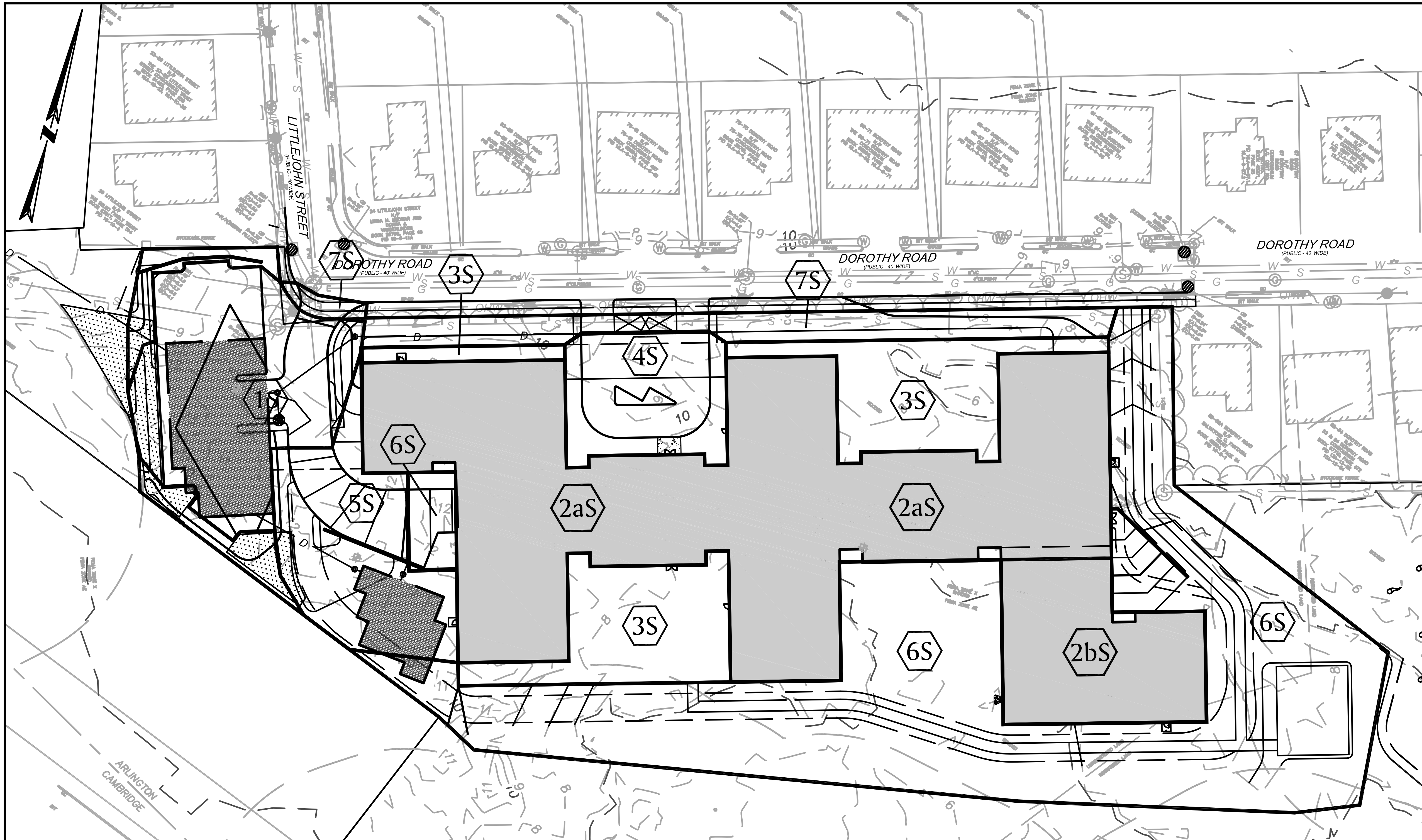
Area (sf)	CN	Description
6,029	70	Woods, Good, HSG C
925	98	Paved parking, HSG C
6,954	74	Weighted Average
6,029		86.70% Pervious Area
925		13.30% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.5	20	0.0750	0.10		**Sheet Flow, A to B** Woods: Light underbrush n= 0.400 P2= 3.23"
1.8	75	0.0200	0.71		**Shallow Concentrated Flow, B to C** Woodland Kv= 5.0 fps
5.3	95	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 2S: Flow to Street



5.03 PROPOSED WATERSHED PLAN



LEGEND

1S — SUBCATCHMENT

SUBCATCHMENT BOUNDARY

TIME OF CONCENTRATION FLOW PATH

SCALE: 1" = 60'

0 30 60 120 FEET

THORNDIKE PLACE

DOROTHY ROAD

ARLINGTON
MASSACHUSETTS
(MIDDLESEX COUNTY)

PROPOSED WATERSHED PLAN

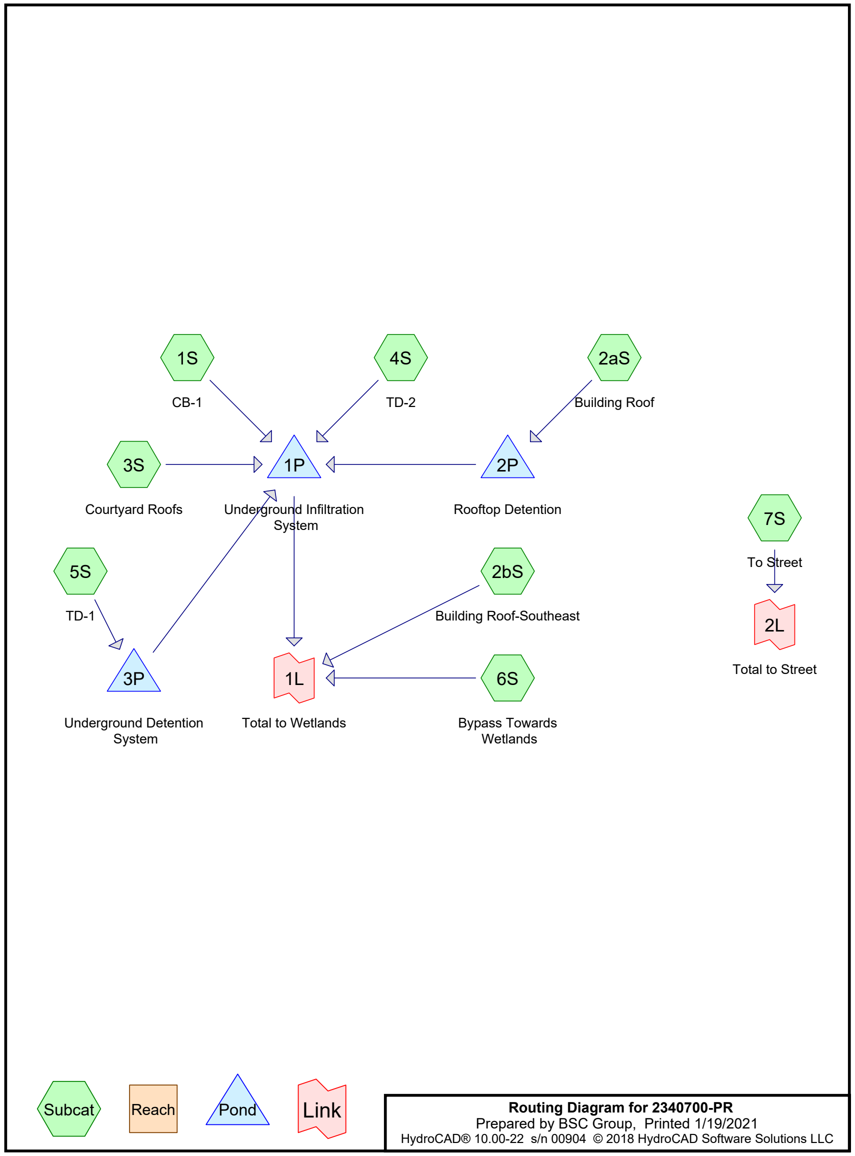
NOVEMBER 3, 2020

PREPARED FOR:
ARLINGTON LAND REALTY
84 SHERMAN STREET
CAMBRIDGE, MA

BSC GROUP
803 Summer Street
Boston, Massachusetts
02127
617 896 4300

Job No.: 23407.00 Date: 11/3/2020
Scale: 1" = 60' Revised: 01/12/2021
Dwg No: PRW
File: C\DRAINAGE DESIGN\2340700-PRW

5.04 PROPOSED HYDROLOGY CALCULATIONS (HYDROCAD™ PRINTOUTS)



Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
1.370	74	>75% Grass cover, Good, HSG C (1S, 5S, 6S, 7S)
0.466	98	Paved parking, HSG C (1S, 4S, 5S, 7S)
1.563	98	Roofs, HSG C (2aS, 2bS, 3S, 6S)
0.155	70	Woods, Good, HSG C (6S)
3.555	**88**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
3.555	HSG C	1S, 2aS, 2bS, 3S, 4S, 5S, 6S, 7S
0.000	HSG D	
0.000	Other	
3.555		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	1.370	0.000	0.000	1.370	>75% Grass cover, Good	1S, 5S, 6S, 7S
0.000	0.000	0.466	0.000	0.000	0.466	Paved parking	1S, 4S, 5S, 7S
0.000	0.000	1.563	0.000	0.000	1.563	Roofs	2aS, 2bS, 3S, 6S
0.000	0.000	0.155	0.000	0.000	0.155	Woods, Good	6S
0.000	**0.000**	**3.555**	**0.000**	**0.000**	**3.555**	**TOTAL AREA**	

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

Subcatchment 1S: CB-1 Runoff Area=14,030 sf 77.79% Impervious Runoff Depth=2.47"
Tc=6.0 min CN=93 Runoff=0.9 cfs 0.066 af

Subcatchment 2aS: Building Roof Runoff Area=42,854 sf 100.00% Impervious Runoff Depth=3.00"
Tc=6.0 min CN=98 Runoff=3.1 cfs 0.246 af

Subcatchment 2bS: Building Runoff Area=8,960 sf 100.00% Impervious Runoff Depth=3.00"
Tc=6.0 min CN=98 Runoff=0.6 cfs 0.051 af

Subcatchment 3S: Courtyard Roofs Runoff Area=14,820 sf 100.00% Impervious Runoff Depth=3.00"
Tc=6.0 min CN=98 Runoff=1.1 cfs 0.085 af

Subcatchment 4S: TD-2 Runoff Area=6,330 sf 100.00% Impervious Runoff Depth=3.00"
Tc=6.0 min CN=98 Runoff=0.5 cfs 0.036 af

Subcatchment 5S: TD-1 Runoff Area=9,284 sf 25.42% Impervious Runoff Depth=1.43"
Tc=6.0 min CN=80 Runoff=0.4 cfs 0.025 af

Subcatchment 6S: Bypass Towards Runoff Area=51,867 sf 2.84% Impervious Runoff Depth=1.06"
Tc=0.0 min CN=74 Runoff=1.7 cfs 0.105 af

Subcatchment 7S: To Street Runoff Area=6,703 sf 10.37% Impervious Runoff Depth=1.17"
Tc=6.0 min CN=76 Runoff=0.2 cfs 0.015 af

Pond 1P: Underground Infiltration System Peak Elev=7.00' Storage=8,849 cf Inflow=2.6 cfs 0.426 af
Discarded=0.1 cfs 0.334 af Primary=0.1 cfs 0.078 af Outflow=0.2 cfs 0.412 af

Pond 2P: Rooftop Detention Peak Elev=57.18' Storage=6,805 cf Inflow=3.1 cfs 0.246 af
Outflow=0.2 cfs 0.239 af

Pond 3P: Underground Detention System Peak Elev=2.63' Storage=1,102 cf Inflow=0.4 cfs 0.025 af
12.0" Round Culvert n=0.013 L=76.0' S=0.0050 '/' Outflow=0.0 cfs 0.000 af

Link 1L: Total to Wetlands Inflow=2.1 cfs 0.234 af
Primary=2.1 cfs 0.234 af

Link 2L: Total to Street Inflow=0.2 cfs 0.015 af
Primary=0.2 cfs 0.015 af

Total Runoff Area = 3.555 ac Runoff Volume = 0.630 af Average Runoff Depth = 2.13"
42.91% Pervious = 1.525 ac 57.09% Impervious = 2.029 ac

Summary for Subcatchment 1S: CB-1

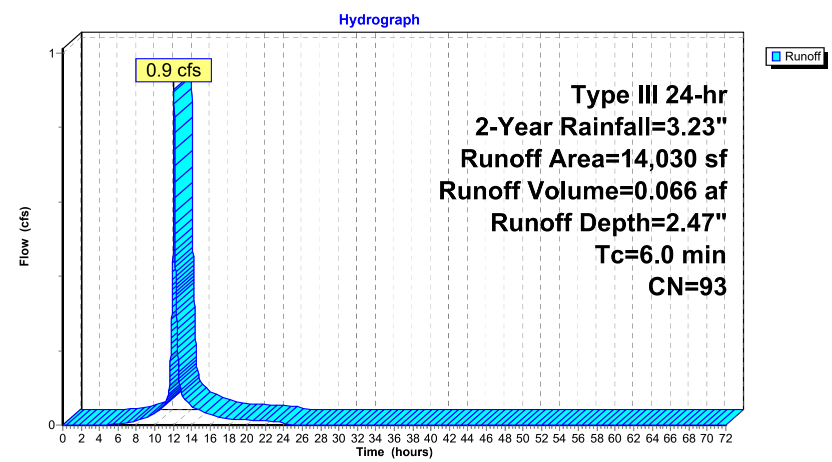
Runoff = 0.9 cfs @ 12.09 hrs, Volume= 0.066 af, Depth= 2.47"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.23"

Area (sf)	CN	Description
10,914	98	Paved parking, HSG C
3,116	74	>75% Grass cover, Good, HSG C
14,030	93	Weighted Average
3,116		22.21% Pervious Area
10,914		77.79% Impervious Area

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

Subcatchment 1S: CB-1



Summary for Subcatchment 2aS: Building Roof

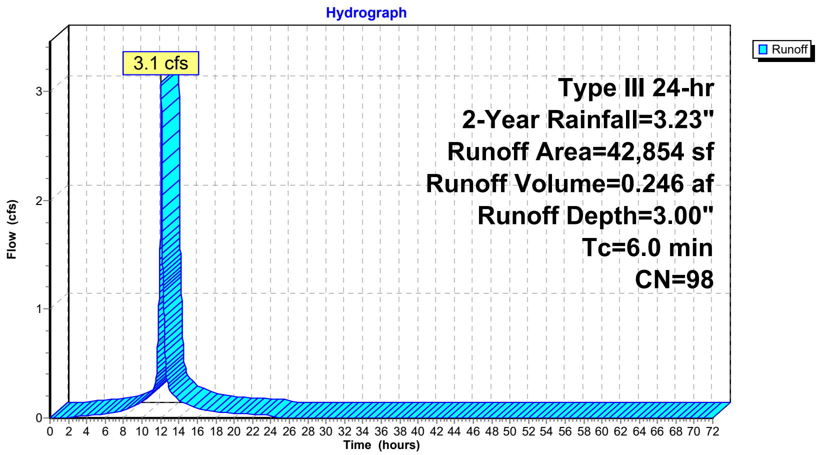
Runoff = 3.1 cfs @ 12.08 hrs, Volume= 0.246 af, Depth= 3.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.23"

Area (sf)	CN	Description
42,854	98	Roofs, HSG C
42,854		100.00% Impervious Area

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

Subcatchment 2aS: Building Roof



Summary for Subcatchment 2bS: Building Roof-Southeast

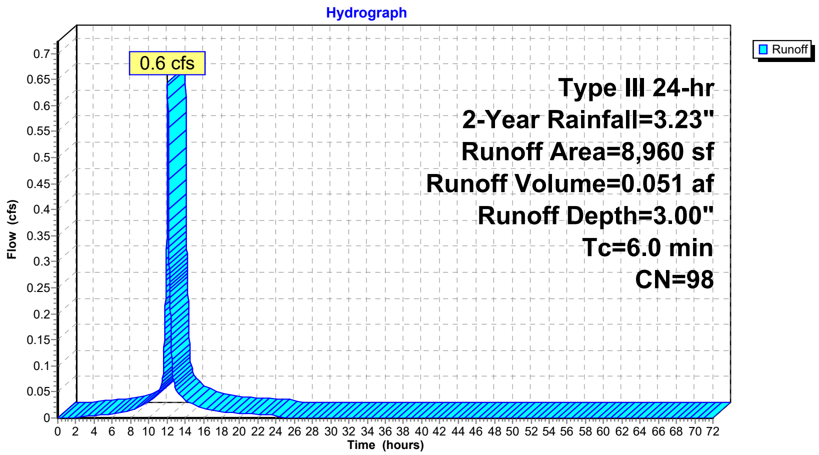
Runoff = 0.6 cfs @ 12.08 hrs, Volume= 0.051 af, Depth= 3.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.23"

Area (sf)	CN	Description
8,960	98	Roofs, HSG C
8,960		100.00% Impervious Area

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

Subcatchment 2bS: Building Roof-Southeast



Summary for Subcatchment 3S: Courtyard Roofs

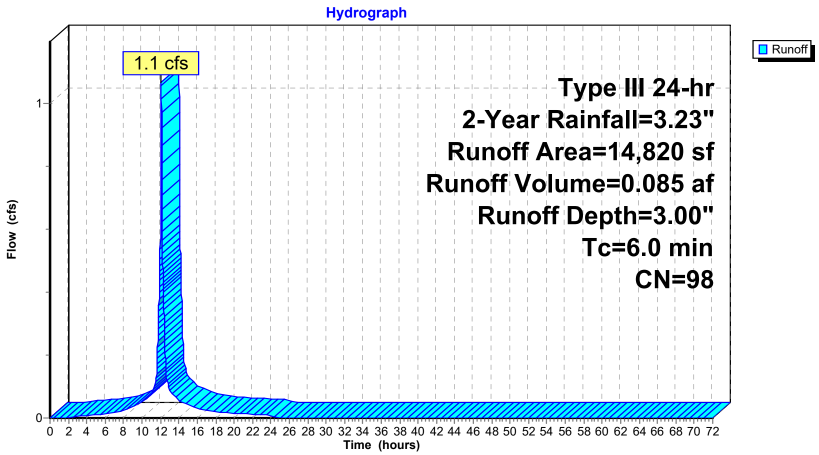
Runoff = 1.1 cfs @ 12.08 hrs, Volume= 0.085 af, Depth= 3.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.23"

Area (sf)	CN	Description
14,820	98	Roofs, HSG C
14,820		100.00% Impervious Area

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

Subcatchment 3S: Courtyard Roofs



Summary for Subcatchment 4S: TD-2

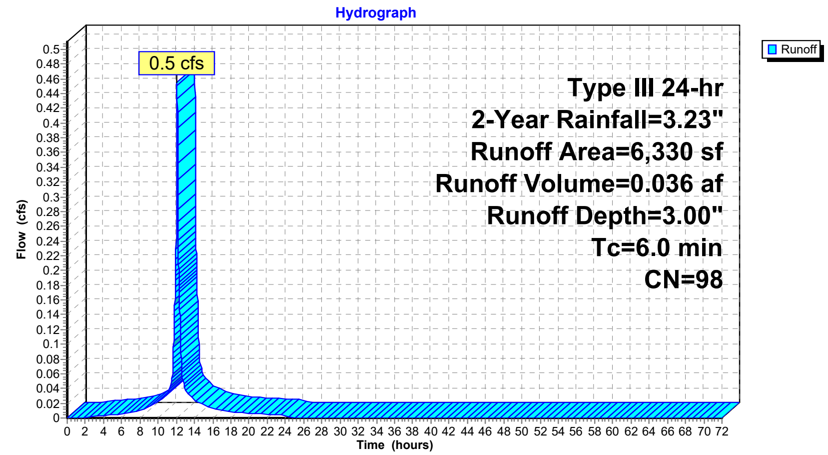
Runoff = 0.5 cfs @ 12.08 hrs, Volume= 0.036 af, Depth= 3.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.23"

Area (sf)	CN	Description
6,330	98	Paved parking, HSG C
6,330		100.00% Impervious Area

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

Subcatchment 4S: TD-2



Summary for Subcatchment 5S: TD-1

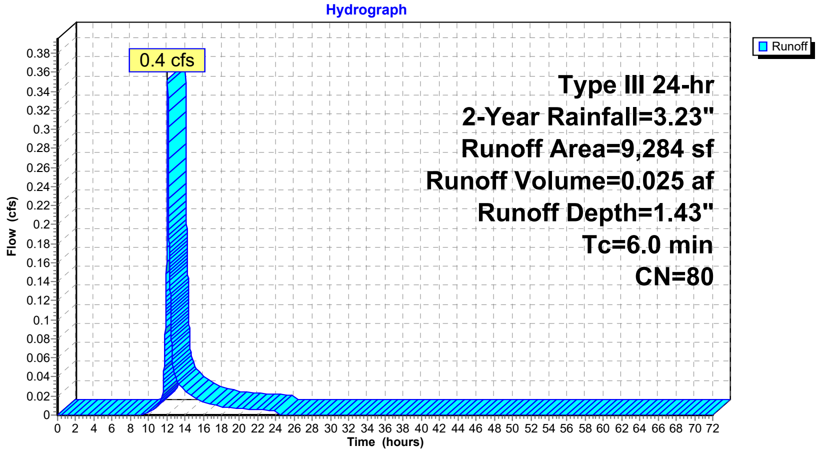
Runoff = 0.4 cfs @ 12.09 hrs, Volume= 0.025 af, Depth= 1.43"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.23"

Area (sf)	CN	Description
2,360	98	Paved parking, HSG C
6,924	74	>75% Grass cover, Good, HSG C
9,284	80	Weighted Average
6,924		74.58% Pervious Area
2,360		25.42% Impervious Area

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

Subcatchment 5S: TD-1



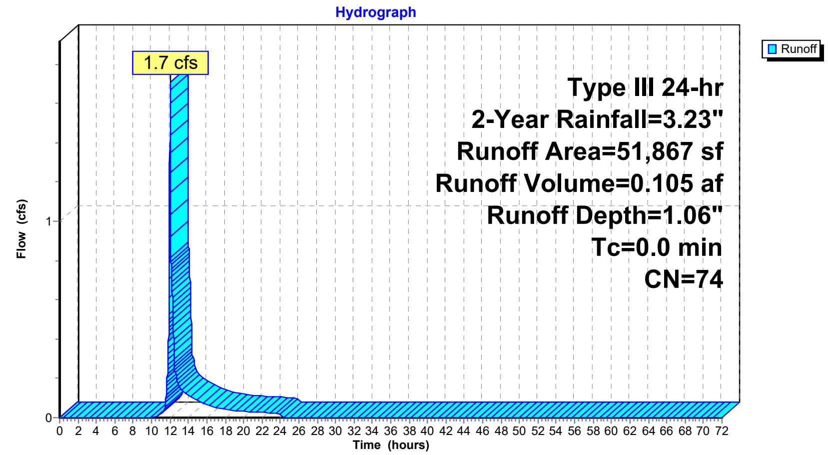
Summary for Subcatchment 6S: Bypass Towards Wetlands

Runoff = 1.7 cfs @ 12.00 hrs, Volume= 0.105 af, Depth= 1.06"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.23"

Area (sf)	CN	Description
6,751	70	Woods, Good, HSG C
43,644	74	>75% Grass cover, Good, HSG C
1,472	98	Roofs, HSG C
51,867	74	Weighted Average
50,395		97.16% Pervious Area
1,472		2.84% Impervious Area

Subcatchment 6S: Bypass Towards Wetlands



Summary for Subcatchment 7S: To Street

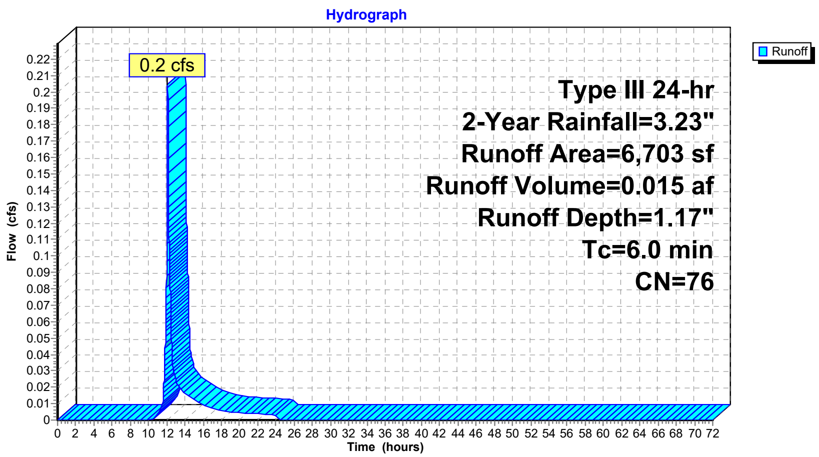
Runoff = 0.2 cfs @ 12.09 hrs, Volume= 0.015 af, Depth= 1.17"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.23"

Area (sf)	CN	Description
695	98	Paved parking, HSG C
6,008	74	>75% Grass cover, Good, HSG C
6,703	76	Weighted Average
6,008		89.63% Pervious Area
695		10.37% Impervious Area

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

Subcatchment 7S: To Street



Summary for Pond 1P: Underground Infiltration System

Inflow Area = 2.005 ac, 88.50% Impervious, Inflow Depth > 2.55" for 2-Year event
Inflow = 2.6 cfs @ 12.09 hrs, Volume= 0.426 af
Outflow = 0.2 cfs @ 19.63 hrs, Volume= 0.412 af, Atten= 93%, Lag= 452.4 min
Discarded = 0.1 cfs @ 8.86 hrs, Volume= 0.334 af
Primary = 0.1 cfs @ 19.63 hrs, Volume= 0.078 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 7.00' @ 19.63 hrs Surf.Area= 5,134 sf Storage= 8,849 cf

Plug-Flow detention time= 1,122.9 min calculated for 0.412 af (97% of inflow)
Center-of-Mass det. time= 1,050.2 min (2,153.2 - 1,103.0)

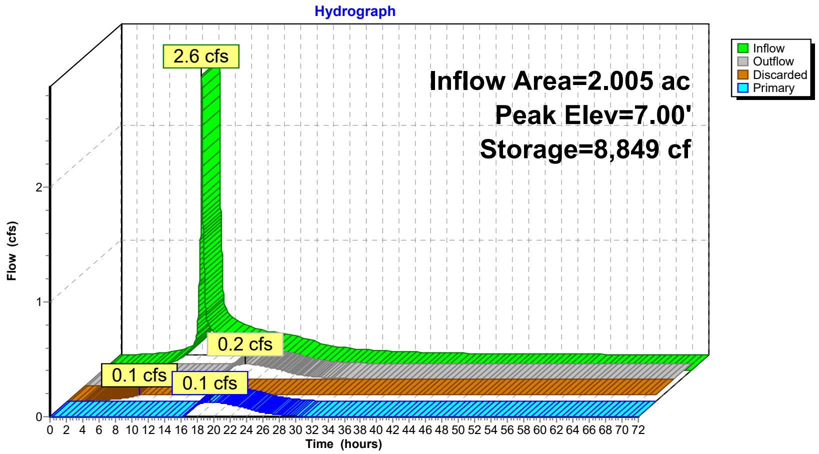
Volume	Invert	Avail.Storage	Storage Description
#1	5.00'	13,246 cf	**6.89'W x 14.06'L x 3.00'H StormTrap ST-1 Units (Irregular Shape)** x 53 15,403 cf Overall x 86.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Discarded	5.00'	**0.520 in/hr Exfiltration over Surface area**
#2	Primary	6.80'	**12.0" Round Culvert** L= 144.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 6.80' / 6.08' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Discarded OutFlow Max=0.1 cfs @ 8.86 hrs HW=5.03' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.1 cfs)

Primary OutFlow Max=0.1 cfs @ 19.63 hrs HW=7.00' (Free Discharge)
└─**2=Culvert** (Barrel Controls 0.1 cfs @ 1.66 fps)

Pond 1P: Underground Infiltration System



Summary for Pond 2P: Rooftop Detention

Inflow Area = 0.984 ac,100.00% Impervious, Inflow Depth = 3.00" for 2-Year event
Inflow = 3.1 cfs @ 12.08 hrs, Volume= 0.246 af
Outflow = 0.2 cfs @ 13.81 hrs, Volume= 0.239 af, Atten= 94%, Lag= 103.5 min
Primary = 0.2 cfs @ 13.81 hrs, Volume= 0.239 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 57.18' @ 13.81 hrs Surf.Area= 38,000 sf Storage= 6,805 cf

Plug-Flow detention time= 627.0 min calculated for 0.239 af (97% of inflow)
Center-of-Mass det. time= 609.4 min (1,365.6 - 756.2)

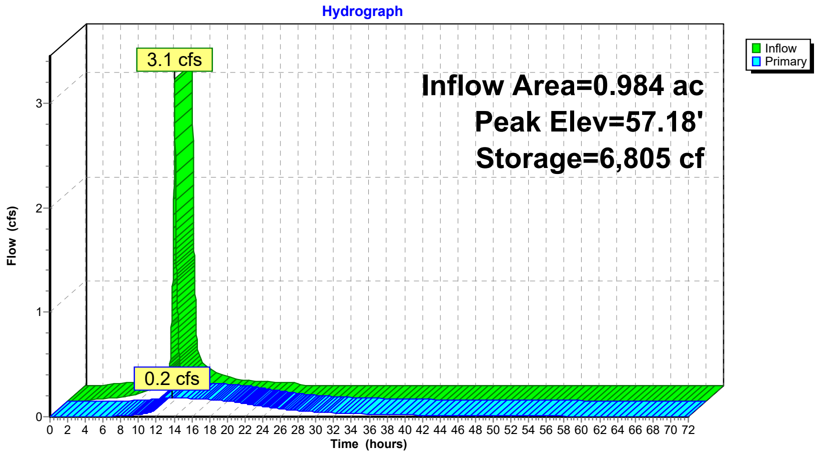
Volume	Invert	Avail.Storage	Storage Description
#1	57.00'	38,000 cf	**Rooftop Detention (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
57.00	38,000	0	0
58.00	38,000	38,000	38,000

Device	Routing	Invert	Outlet Devices
#1	Primary	6.42'	**18.0" Round Roof Drain** L= 52.0' CPP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 6.42' / 5.90' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#2	Device 1	57.00'	**4.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.2 cfs @ 13.81 hrs HW=57.18' (Free Discharge)
└1=**Roof Drain** (Passes 0.2 cfs of 53.1 cfs potential flow)
 └2=**Orifice/Grate** (Orifice Controls 0.2 cfs @ 2.04 fps)

Pond 2P: Rooftop Detention



Summary for Pond 3P: Underground Detention System

Inflow Area = 0.213 ac, 25.42% Impervious, Inflow Depth = 1.43" for 2-Year event
Inflow = 0.4 cfs @ 12.09 hrs, Volume= 0.025 af
Outflow = 0.0 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
Primary = 0.0 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 2.63' @ 24.34 hrs Surf.Area= 2,034 sf Storage= 1,102 cf

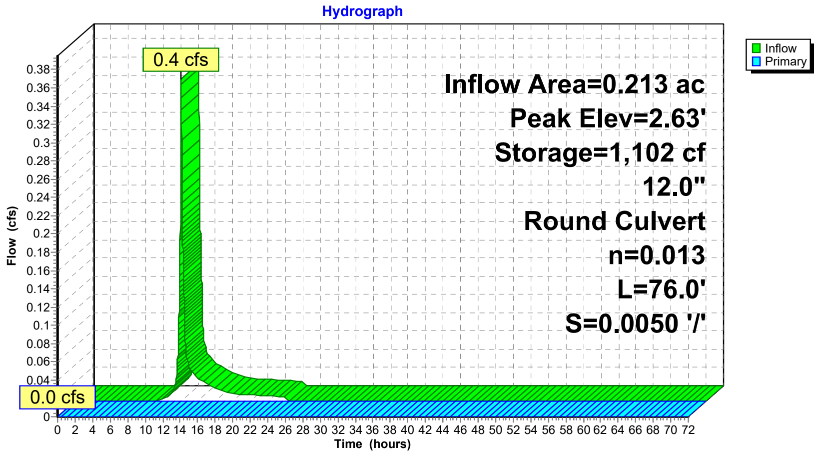
Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	2.00'	5,249 cf	**6.89'W x 14.06'L x 3.00'H StormTrap ST-1 Units (Irregular Shape)** x 21 6,103 cf Overall x 86.0% Voids
#2	3.00'	49 cf	**30.0" Round 30" Perf. HDPE Laid Flat** L= 10.0'
#3	3.00'	170 cf	**6.00'D x 6.00'H OCS-2**
		5,467 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	7.38'	**12.0" Round Culvert** L= 76.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 7.38' / 7.00' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=0.0 cfs @ 0.00 hrs HW=2.00' (Free Discharge)
└**1=Culvert** (Controls 0.0 cfs)

Pond 3P: Underground Detention System

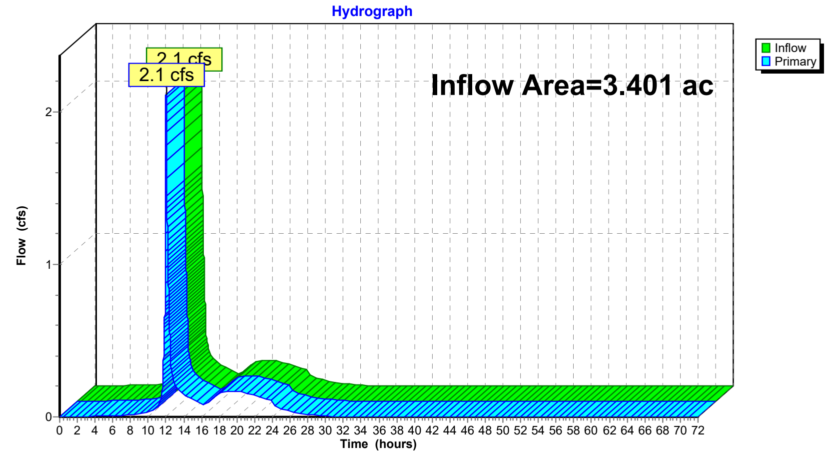


Summary for Link 1L: Total to Wetlands

Inflow Area =	3.401 ac, 59.21% Impervious, Inflow Depth = 0.83"	for 2-Year event
Inflow =	2.1 cfs @ 12.01 hrs, Volume=	0.234 af
Primary =	2.1 cfs @ 12.01 hrs, Volume=	0.234 af, Atten= 0%, Lag= 0.0 min

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

Link 1L: Total to Wetlands

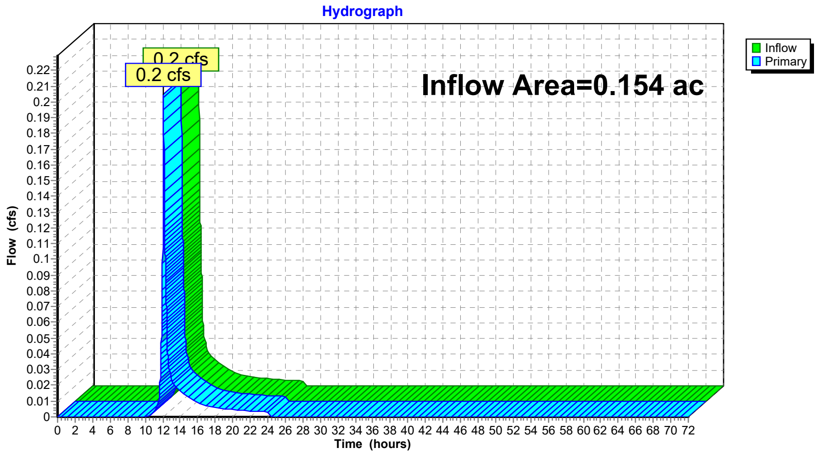


Summary for Link 2L: Total to Street

Inflow Area = 0.154 ac, 10.37% Impervious, Inflow Depth = 1.17" for 2-Year event
Inflow = 0.2 cfs @ 12.09 hrs, Volume= 0.015 af
Primary = 0.2 cfs @ 12.09 hrs, Volume= 0.015 af, Atten= 0%, Lag= 0.0 min

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

Link 2L: Total to Street



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

Subcatchment 1S: CB-1 Runoff Area=14,030 sf 77.79% Impervious Runoff Depth=4.10"
Tc=6.0 min CN=93 Runoff=1.5 cfs 0.110 af

Subcatchment 2aS: Building Roof Runoff Area=42,854 sf 100.00% Impervious Runoff Depth=4.66"
Tc=6.0 min CN=98 Runoff=4.7 cfs 0.382 af

Subcatchment 2bS: Building Runoff Area=8,960 sf 100.00% Impervious Runoff Depth=4.66"
Tc=6.0 min CN=98 Runoff=1.0 cfs 0.080 af

Subcatchment 3S: Courtyard Roofs Runoff Area=14,820 sf 100.00% Impervious Runoff Depth=4.66"
Tc=6.0 min CN=98 Runoff=1.6 cfs 0.132 af

Subcatchment 4S: TD-2 Runoff Area=6,330 sf 100.00% Impervious Runoff Depth=4.66"
Tc=6.0 min CN=98 Runoff=0.7 cfs 0.056 af

Subcatchment 5S: TD-1 Runoff Area=9,284 sf 25.42% Impervious Runoff Depth=2.81"
Tc=6.0 min CN=80 Runoff=0.7 cfs 0.050 af

Subcatchment 6S: Bypass Towards Runoff Area=51,867 sf 2.84% Impervious Runoff Depth=2.28"
Tc=0.0 min CN=74 Runoff=3.9 cfs 0.227 af

Subcatchment 7S: To Street Runoff Area=6,703 sf 10.37% Impervious Runoff Depth=2.45"
Tc=6.0 min CN=76 Runoff=0.4 cfs 0.031 af

Pond 1P: Underground Infiltration System Peak Elev=7.14' Storage=9,454 cf Inflow=4.0 cfs 0.673 af
Discarded=0.1 cfs 0.343 af Primary=0.4 cfs 0.286 af Outflow=0.4 cfs 0.629 af

Pond 2P: Rooftop Detention Peak Elev=57.28' Storage=10,801 cf Inflow=4.7 cfs 0.382 af
Outflow=0.2 cfs 0.374 af

Pond 3P: Underground Detention System Peak Elev=3.24' Storage=2,171 cf Inflow=0.7 cfs 0.050 af
12.0" Round Culvert n=0.013 L=76.0' S=0.0050 '/' Outflow=0.0 cfs 0.000 af

Link 1L: Total to Wetlands Inflow=4.5 cfs 0.593 af
Primary=4.5 cfs 0.593 af

Link 2L: Total to Street Inflow=0.4 cfs 0.031 af
Primary=0.4 cfs 0.031 af

Total Runoff Area = 3.555 ac Runoff Volume = 1.069 af Average Runoff Depth = 3.61"
42.91% Pervious = 1.525 ac 57.09% Impervious = 2.029 ac

Summary for Subcatchment 1S: CB-1

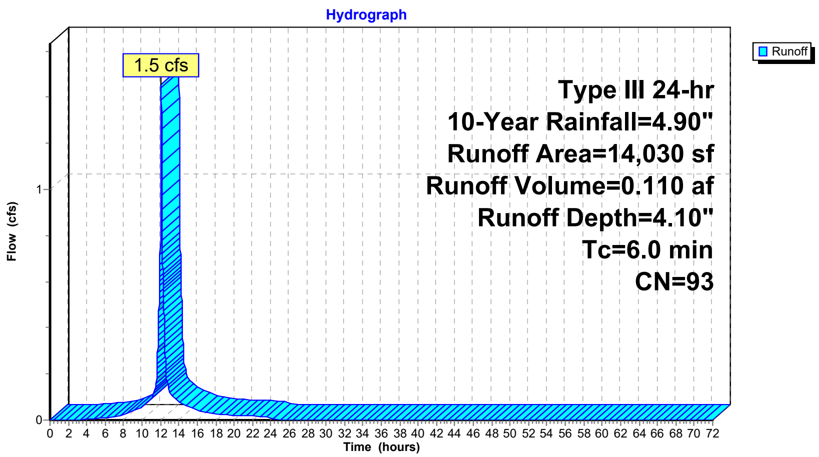
Runoff = 1.5 cfs @ 12.08 hrs, Volume= 0.110 af, Depth= 4.10"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.90"

Area (sf)	CN	Description
10,914	98	Paved parking, HSG C
3,116	74	>75% Grass cover, Good, HSG C
14,030	93	Weighted Average
3,116		22.21% Pervious Area
10,914		77.79% Impervious Area

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

Subcatchment 1S: CB-1



Summary for Subcatchment 2aS: Building Roof

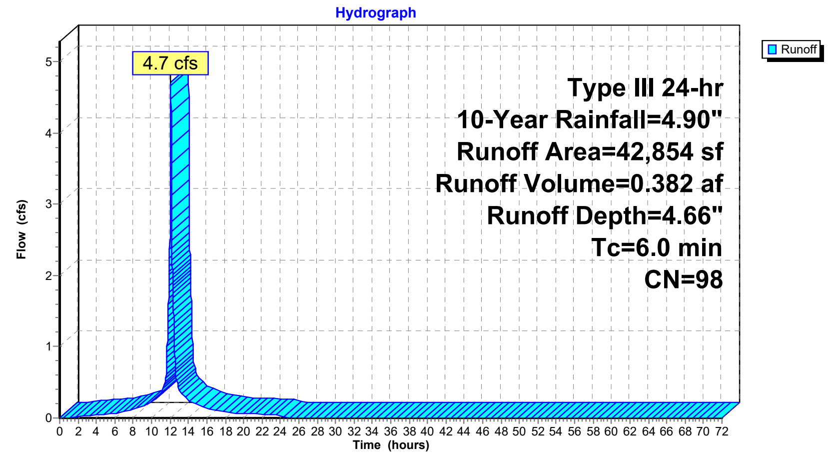
Runoff = 4.7 cfs @ 12.08 hrs, Volume= 0.382 af, Depth= 4.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.90"

Area (sf)	CN	Description
42,854	98	Roofs, HSG C
42,854		100.00% Impervious Area

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

Subcatchment 2aS: Building Roof



Summary for Subcatchment 2bS: Building Roof-Southeast

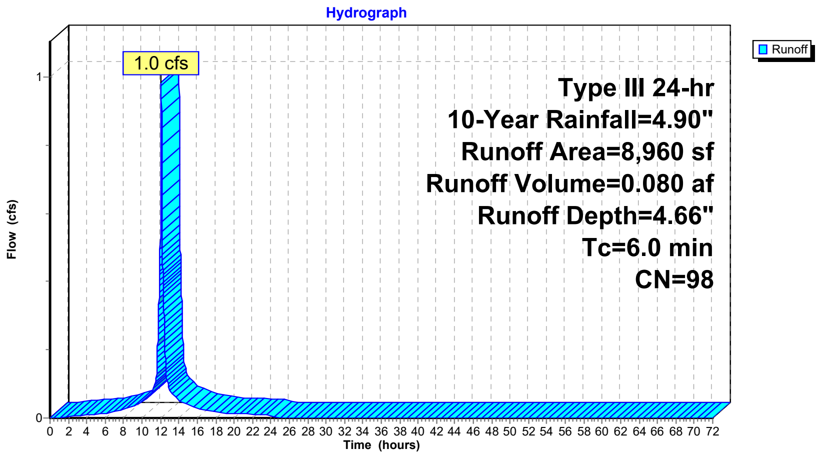
Runoff = 1.0 cfs @ 12.08 hrs, Volume= 0.080 af, Depth= 4.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.90"

Area (sf)	CN	Description
8,960	98	Roofs, HSG C
8,960		100.00% Impervious Area

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

Subcatchment 2bS: Building Roof-Southeast



Summary for Subcatchment 3S: Courtyard Roofs

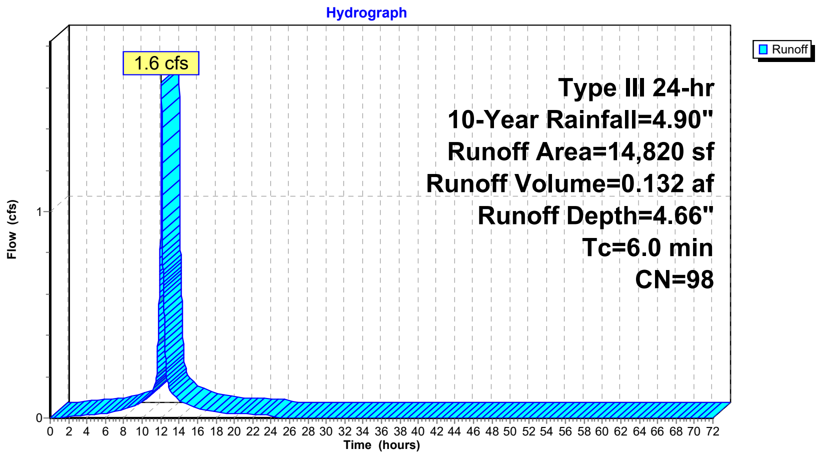
Runoff = 1.6 cfs @ 12.08 hrs, Volume= 0.132 af, Depth= 4.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.90"

Area (sf)	CN	Description
14,820	98	Roofs, HSG C
14,820		100.00% Impervious Area

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

Subcatchment 3S: Courtyard Roofs



Summary for Subcatchment 4S: TD-2

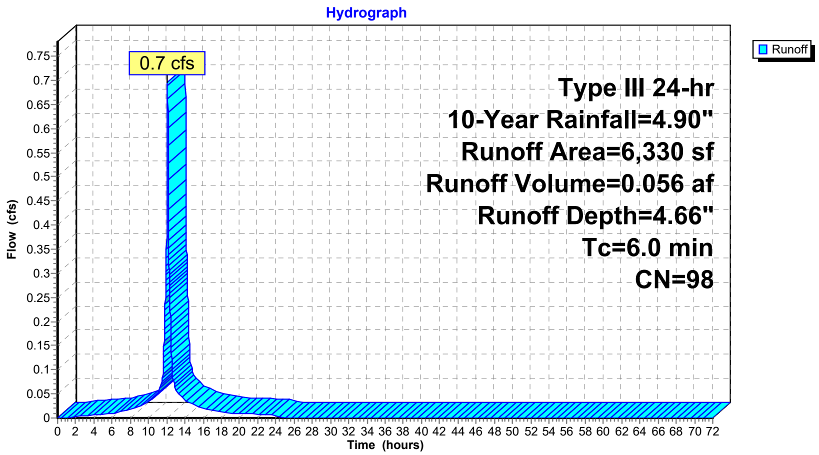
Runoff = 0.7 cfs @ 12.08 hrs, Volume= 0.056 af, Depth= 4.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.90"

Area (sf)	CN	Description
6,330	98	Paved parking, HSG C
6,330		100.00% Impervious Area

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

Subcatchment 4S: TD-2



Summary for Subcatchment 5S: TD-1

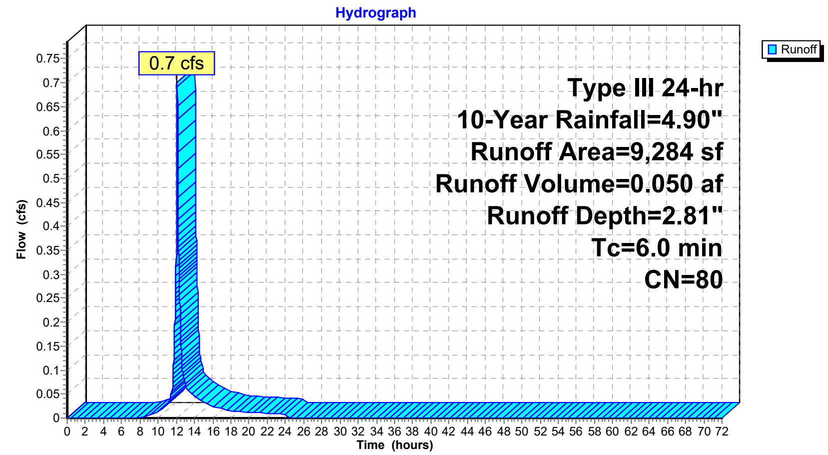
Runoff = 0.7 cfs @ 12.09 hrs, Volume= 0.050 af, Depth= 2.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.90"

Area (sf)	CN	Description
2,360	98	Paved parking, HSG C
6,924	74	>75% Grass cover, Good, HSG C
9,284	80	Weighted Average
6,924		74.58% Pervious Area
2,360		25.42% Impervious Area

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

Subcatchment 5S: TD-1



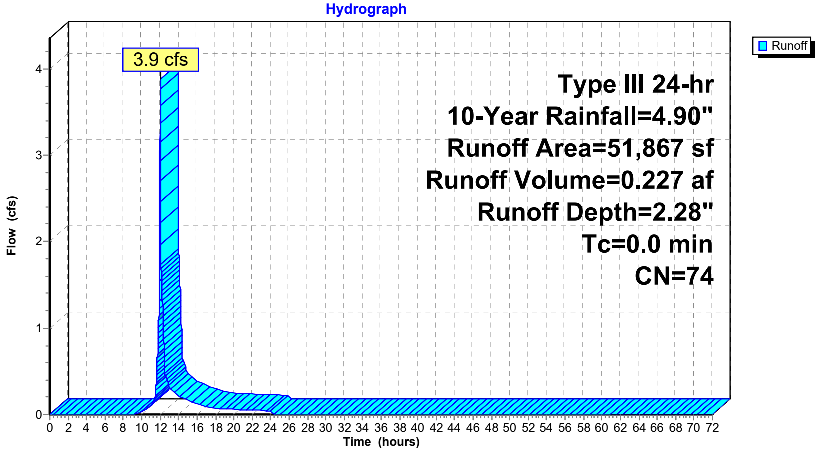
Summary for Subcatchment 6S: Bypass Towards Wetlands

Runoff = 3.9 cfs @ 12.00 hrs, Volume= 0.227 af, Depth= 2.28"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.90"

Area (sf)	CN	Description
6,751	70	Woods, Good, HSG C
43,644	74	>75% Grass cover, Good, HSG C
1,472	98	Roofs, HSG C
51,867	74	Weighted Average
50,395		97.16% Pervious Area
1,472		2.84% Impervious Area

Subcatchment 6S: Bypass Towards Wetlands



Summary for Subcatchment 7S: To Street

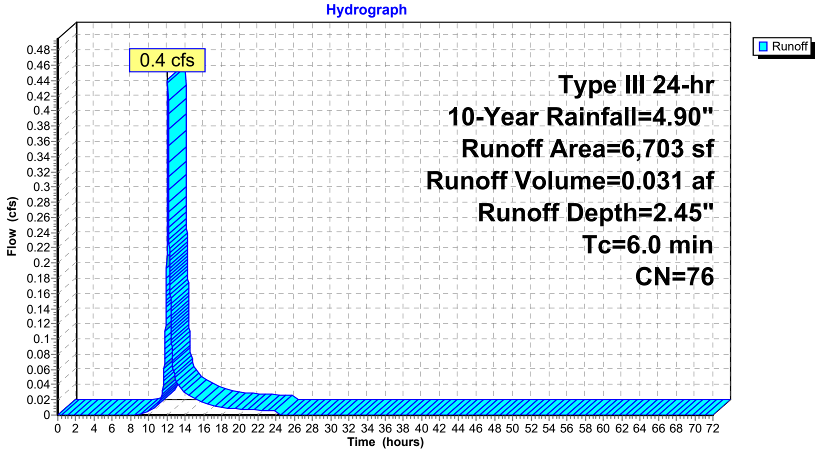
Runoff = 0.4 cfs @ 12.09 hrs, Volume= 0.031 af, Depth= 2.45"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.90"

Area (sf)	CN	Description
695	98	Paved parking, HSG C
6,008	74	>75% Grass cover, Good, HSG C
6,703	76	Weighted Average
6,008		89.63% Pervious Area
695		10.37% Impervious Area

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

Subcatchment 7S: To Street



Summary for Pond 1P: Underground Infiltration System

Inflow Area = 2.005 ac, 88.50% Impervious, Inflow Depth > 4.03" for 10-Year event
Inflow = 4.0 cfs @ 12.08 hrs, Volume= 0.673 af
Outflow = 0.4 cfs @ 14.14 hrs, Volume= 0.629 af, Atten= 90%, Lag= 123.4 min
Discarded = 0.1 cfs @ 7.18 hrs, Volume= 0.343 af
Primary = 0.4 cfs @ 14.14 hrs, Volume= 0.286 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 7.14' @ 14.14 hrs Surf.Area= 5,134 sf Storage= 9,454 cf

Plug-Flow detention time= 788.7 min calculated for 0.629 af (94% of inflow)
Center-of-Mass det. time= 676.4 min (1,799.9 - 1,123.6)

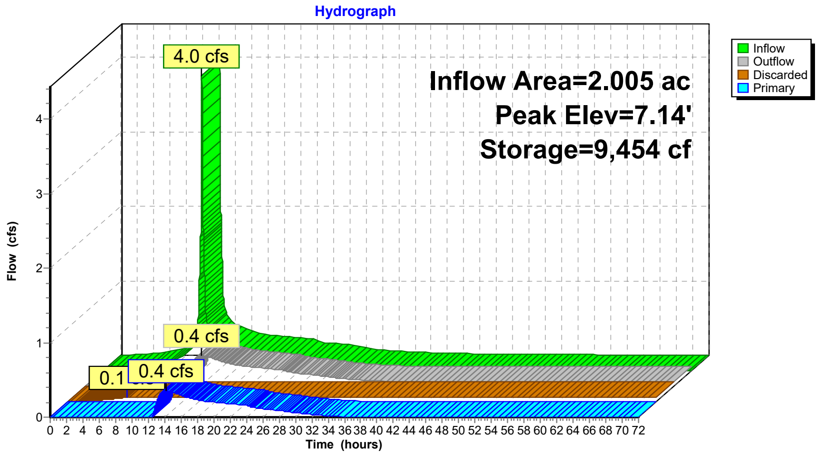
Volume	Invert	Avail.Storage	Storage Description
#1	5.00'	13,246 cf	**6.89'W x 14.06'L x 3.00'H StormTrap ST-1 Units (Irregular Shape)** x 53 15,403 cf Overall x 86.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Discarded	5.00'	**0.520 in/hr Exfiltration over Surface area**
#2	Primary	6.80'	**12.0" Round Culvert** L= 144.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 6.80' / 6.08' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Discarded OutFlow Max=0.1 cfs @ 7.18 hrs HW=5.03' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.1 cfs)

Primary OutFlow Max=0.4 cfs @ 14.14 hrs HW=7.14' (Free Discharge)
└─**2=Culvert** (Barrel Controls 0.4 cfs @ 2.23 fps)

Pond 1P: Underground Infiltration System



Summary for Pond 2P: Rooftop Detention

Inflow Area = 0.984 ac,100.00% Impervious, Inflow Depth = 4.66" for 10-Year event
Inflow = 4.7 cfs @ 12.08 hrs, Volume= 0.382 af
Outflow = 0.2 cfs @ 14.34 hrs, Volume= 0.374 af, Atten= 95%, Lag= 135.2 min
Primary = 0.2 cfs @ 14.34 hrs, Volume= 0.374 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 57.28' @ 14.34 hrs Surf.Area= 38,000 sf Storage= 10,801 cf

Plug-Flow detention time= 680.3 min calculated for 0.374 af (98% of inflow)
Center-of-Mass det. time= 666.1 min (1,414.4 - 748.4)

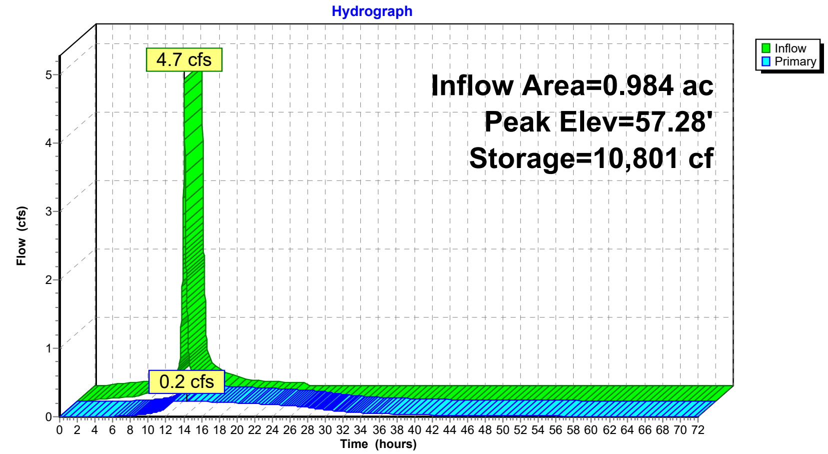
Volume	Invert	Avail.Storage	Storage Description
#1	57.00'	38,000 cf	**Rooftop Detention (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
57.00	38,000	0	0
58.00	38,000	38,000	38,000

Device	Routing	Invert	Outlet Devices
#1	Primary	6.42'	**18.0" Round Roof Drain** L= 52.0' CPP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 6.42' / 5.90' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#2	Device 1	57.00'	**4.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.2 cfs @ 14.34 hrs HW=57.28' (Free Discharge)
└─**1=Roof Drain** (Passes 0.2 cfs of 53.1 cfs potential flow)
  └─**2=Orifice/Grate** (Orifice Controls 0.2 cfs @ 2.57 fps)

Pond 2P: Rooftop Detention



Summary for Pond 3P: Underground Detention System

Inflow Area = 0.213 ac, 25.42% Impervious, Inflow Depth = 2.81" for 10-Year event
Inflow = 0.7 cfs @ 12.09 hrs, Volume= 0.050 af
Outflow = 0.0 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
Primary = 0.0 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 3.24' @ 24.34 hrs Surf.Area= 2,077 sf Storage= 2,171 cf

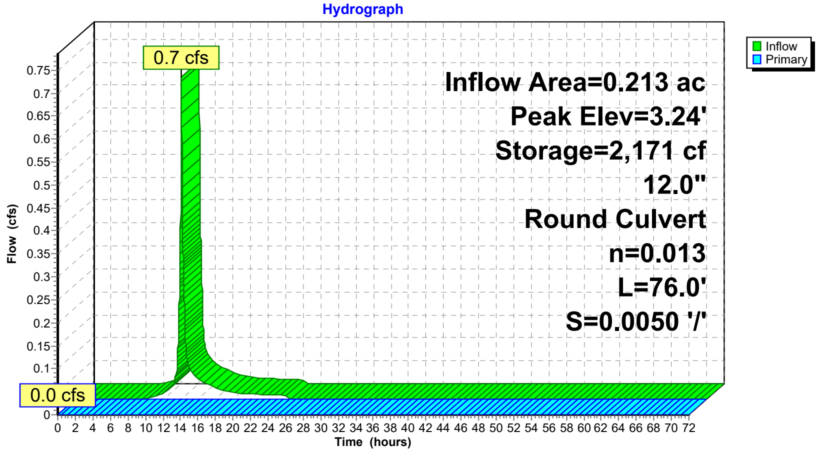
Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	2.00'	5,249 cf	**6.89'W x 14.06'L x 3.00'H StormTrap ST-1 Units (Irregular Shape)** x 21 6,103 cf Overall x 86.0% Voids
#2	3.00'	49 cf	**30.0" Round 30" Perf. HDPE Laid Flat** L= 10.0'
#3	3.00'	170 cf	**6.00'D x 6.00'H OCS-2**
		5,467 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	7.38'	**12.0" Round Culvert** L= 76.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 7.38' / 7.00' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=0.0 cfs @ 0.00 hrs HW=2.00' (Free Discharge)
└**1=Culvert** (Controls 0.0 cfs)

Pond 3P: Underground Detention System

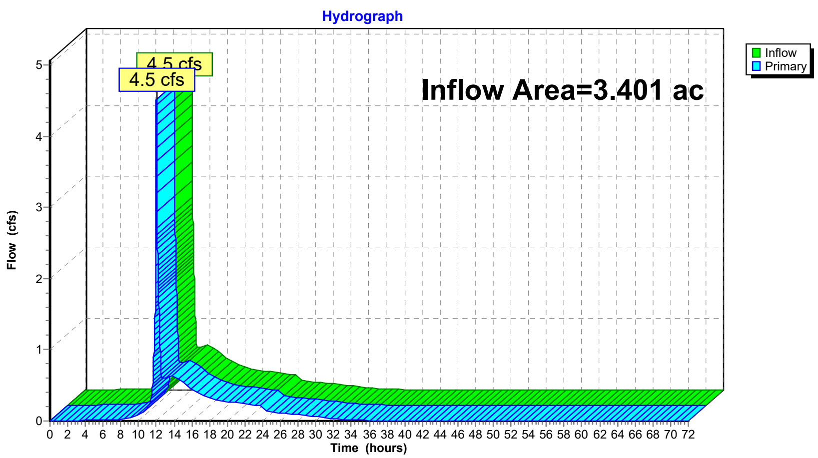


Summary for Link 1L: Total to Wetlands

Inflow Area = 3.401 ac, 59.21% Impervious, Inflow Depth = 2.09" for 10-Year event
Inflow = 4.5 cfs @ 12.00 hrs, Volume= 0.593 af
Primary = 4.5 cfs @ 12.00 hrs, Volume= 0.593 af, Atten= 0%, Lag= 0.0 min

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

Link 1L: Total to Wetlands

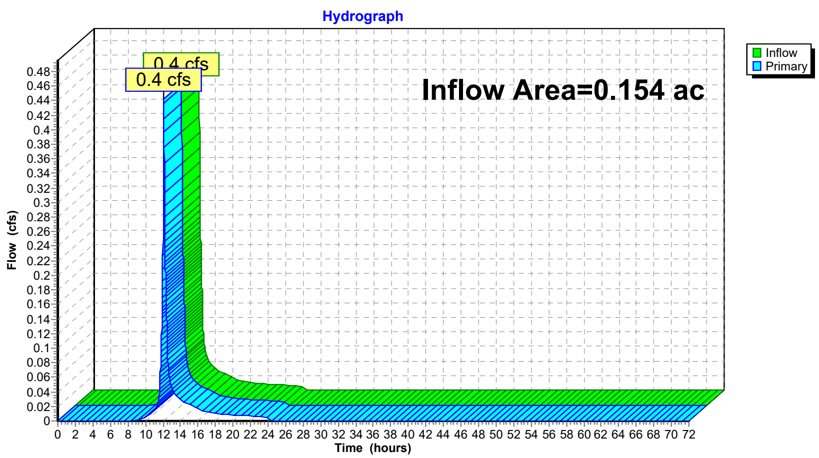


Summary for Link 2L: Total to Street

Inflow Area = 0.154 ac, 10.37% Impervious, Inflow Depth = 2.45" for 10-Year event
Inflow = 0.4 cfs @ 12.09 hrs, Volume= 0.031 af
Primary = 0.4 cfs @ 12.09 hrs, Volume= 0.031 af, Atten= 0%, Lag= 0.0 min

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

Link 2L: Total to Street



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

Subcatchment 1S: CB-1 Runoff Area=14,030 sf 77.79% Impervious Runoff Depth=5.38"
Tc=6.0 min CN=93 Runoff=1.9 cfs 0.144 af

Subcatchment 2aS: Building Roof Runoff Area=42,854 sf 100.00% Impervious Runoff Depth=5.96"
Tc=6.0 min CN=98 Runoff=6.0 cfs 0.489 af

Subcatchment 2bS: Building Runoff Area=8,960 sf 100.00% Impervious Runoff Depth=5.96"
Tc=6.0 min CN=98 Runoff=1.3 cfs 0.102 af

Subcatchment 3S: Courtyard Roofs Runoff Area=14,820 sf 100.00% Impervious Runoff Depth=5.96"
Tc=6.0 min CN=98 Runoff=2.1 cfs 0.169 af

Subcatchment 4S: TD-2 Runoff Area=6,330 sf 100.00% Impervious Runoff Depth=5.96"
Tc=6.0 min CN=98 Runoff=0.9 cfs 0.072 af

Subcatchment 5S: TD-1 Runoff Area=9,284 sf 25.42% Impervious Runoff Depth=3.96"
Tc=6.0 min CN=80 Runoff=1.0 cfs 0.070 af

Subcatchment 6S: Bypass Towards Runoff Area=51,867 sf 2.84% Impervious Runoff Depth=3.35"
Tc=0.0 min CN=74 Runoff=5.7 cfs 0.333 af

Subcatchment 7S: To Street Runoff Area=6,703 sf 10.37% Impervious Runoff Depth=3.55"
Tc=6.0 min CN=76 Runoff=0.6 cfs 0.046 af

Pond 1P: Underground Infiltration System Peak Elev=7.35' Storage=10,380 cf Inflow=5.0 cfs 0.865 af
Discarded=0.1 cfs 0.348 af Primary=0.9 cfs 0.454 af Outflow=0.9 cfs 0.802 af

Pond 2P: Rooftop Detention Peak Elev=57.37' Storage=13,982 cf Inflow=6.0 cfs 0.489 af
Outflow=0.3 cfs 0.479 af

Pond 3P: Underground Detention System Peak Elev=3.73' Storage=3,065 cf Inflow=1.0 cfs 0.070 af
12.0" Round Culvert n=0.013 L=76.0' S=0.0050 '/' Outflow=0.0 cfs 0.000 af

Link 1L: Total to Wetlands Inflow=6.5 cfs 0.889 af
Primary=6.5 cfs 0.889 af

Link 2L: Total to Street Inflow=0.6 cfs 0.046 af
Primary=0.6 cfs 0.046 af

Total Runoff Area = 3.555 ac Runoff Volume = 1.425 af Average Runoff Depth = 4.81"
42.91% Pervious = 1.525 ac 57.09% Impervious = 2.029 ac

Summary for Subcatchment 1S: CB-1

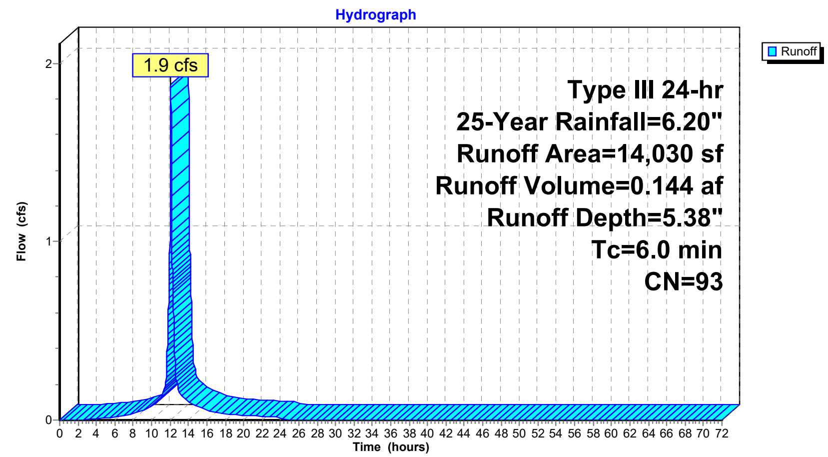
Runoff = 1.9 cfs @ 12.08 hrs, Volume= 0.144 af, Depth= 5.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=6.20"

Area (sf)	CN	Description
10,914	98	Paved parking, HSG C
3,116	74	>75% Grass cover, Good, HSG C
14,030	93	Weighted Average
3,116		22.21% Pervious Area
10,914		77.79% Impervious Area

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

Subcatchment 1S: CB-1



Summary for Subcatchment 2aS: Building Roof

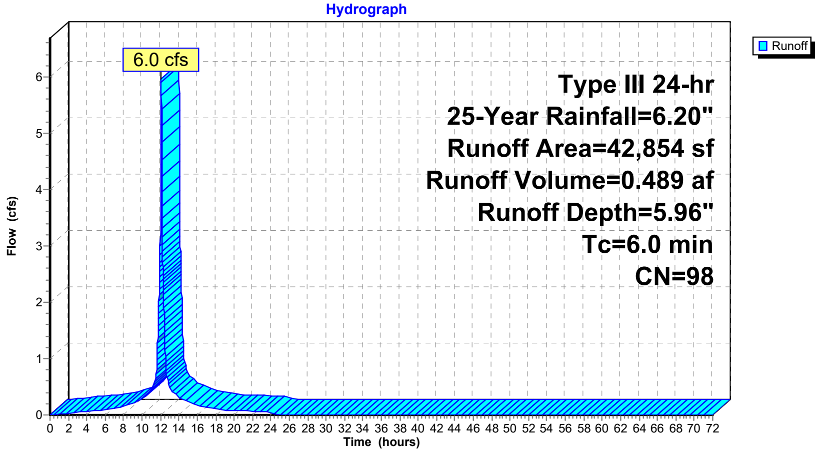
Runoff = 6.0 cfs @ 12.08 hrs, Volume= 0.489 af, Depth= 5.96"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=6.20"

Area (sf)	CN	Description
42,854	98	Roofs, HSG C
42,854		100.00% Impervious Area

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

Subcatchment 2aS: Building Roof



Summary for Subcatchment 2bS: Building Roof-Southeast

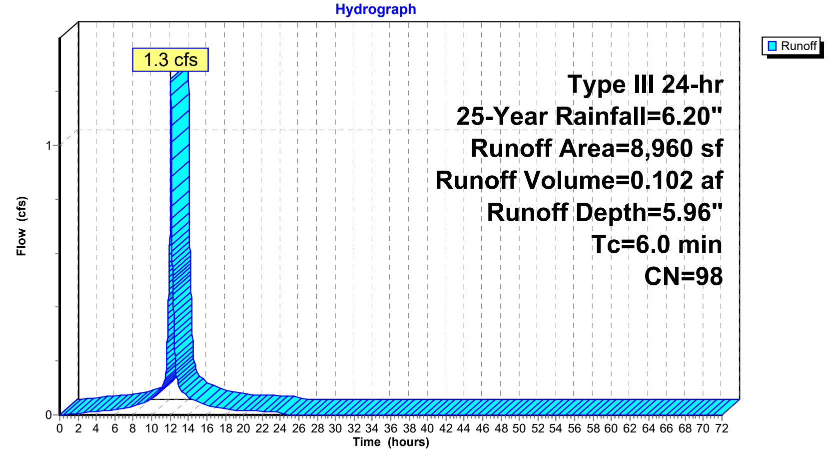
Runoff = 1.3 cfs @ 12.08 hrs, Volume= 0.102 af, Depth= 5.96"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=6.20"

Area (sf)	CN	Description
8,960	98	Roofs, HSG C
8,960		100.00% Impervious Area

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

Subcatchment 2bS: Building Roof-Southeast



Summary for Subcatchment 3S: Courtyard Roofs

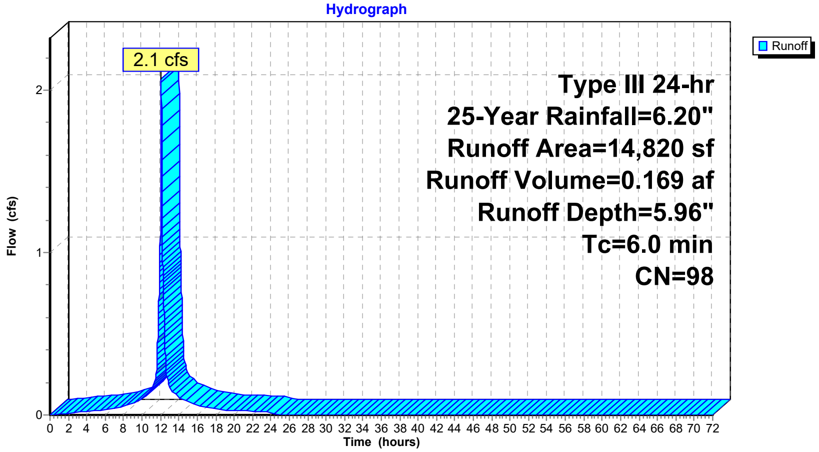
Runoff = 2.1 cfs @ 12.08 hrs, Volume= 0.169 af, Depth= 5.96"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=6.20"

Area (sf)	CN	Description
14,820	98	Roofs, HSG C
14,820		100.00% Impervious Area

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

Subcatchment 3S: Courtyard Roofs



Summary for Subcatchment 4S: TD-2

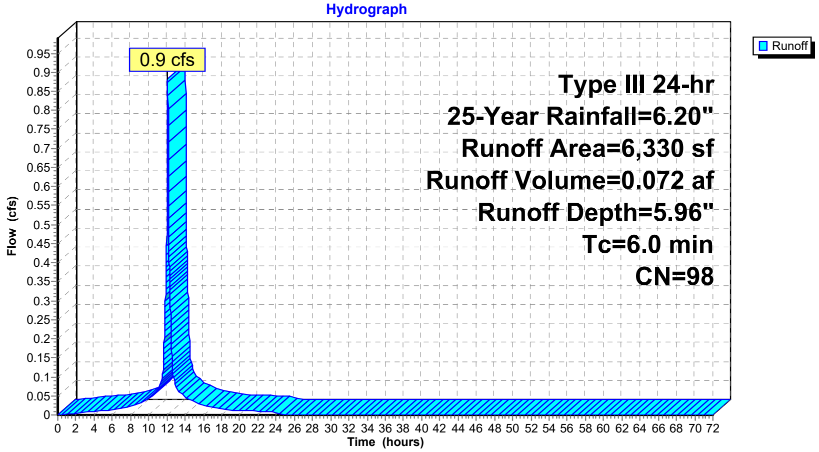
Runoff = 0.9 cfs @ 12.08 hrs, Volume= 0.072 af, Depth= 5.96"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=6.20"

Area (sf)	CN	Description
6,330	98	Paved parking, HSG C
6,330		100.00% Impervious Area

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

Subcatchment 4S: TD-2



Summary for Subcatchment 5S: TD-1

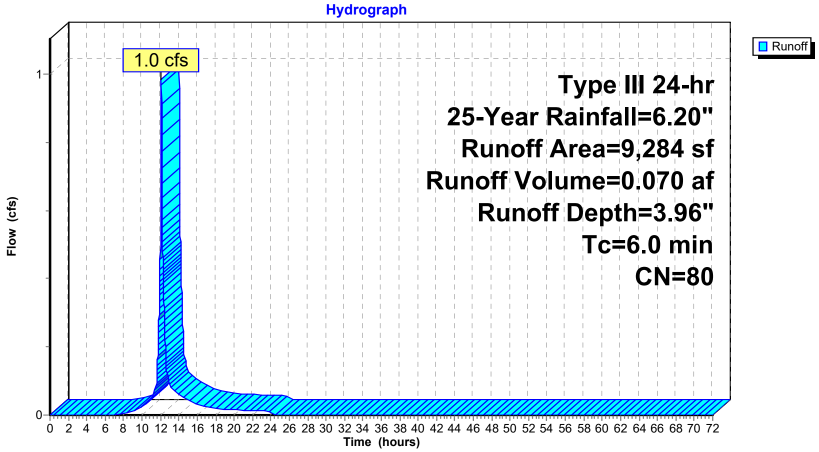
Runoff = 1.0 cfs @ 12.09 hrs, Volume= 0.070 af, Depth= 3.96"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=6.20"

Area (sf)	CN	Description
2,360	98	Paved parking, HSG C
6,924	74	>75% Grass cover, Good, HSG C
9,284	80	Weighted Average
6,924		74.58% Pervious Area
2,360		25.42% Impervious Area

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

Subcatchment 5S: TD-1



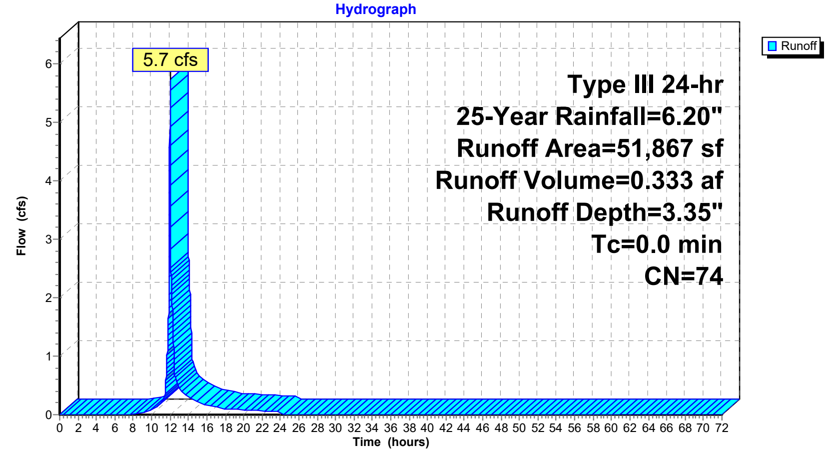
Summary for Subcatchment 6S: Bypass Towards Wetlands

Runoff = 5.7 cfs @ 12.00 hrs, Volume= 0.333 af, Depth= 3.35"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=6.20"

Area (sf)	CN	Description
6,751	70	Woods, Good, HSG C
43,644	74	>75% Grass cover, Good, HSG C
1,472	98	Roofs, HSG C
51,867	74	Weighted Average
50,395		97.16% Pervious Area
1,472		2.84% Impervious Area

Subcatchment 6S: Bypass Towards Wetlands



Summary for Subcatchment 7S: To Street

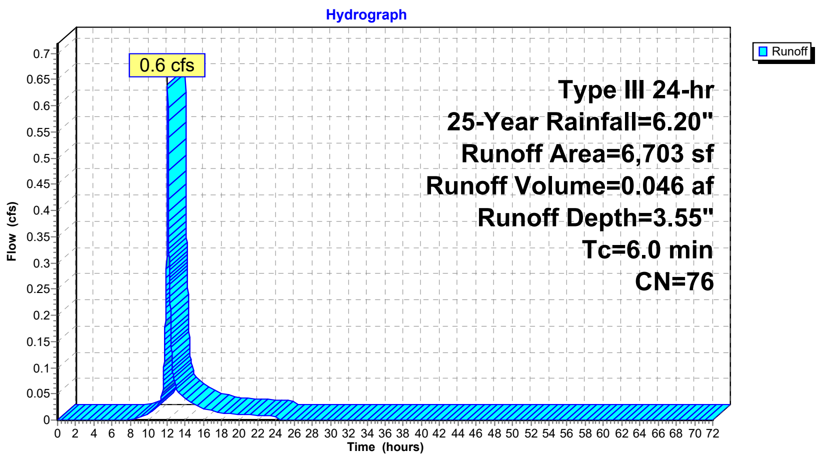
Runoff = 0.6 cfs @ 12.09 hrs, Volume= 0.046 af, Depth= 3.55"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=6.20"

Area (sf)	CN	Description
695	98	Paved parking, HSG C
6,008	74	>75% Grass cover, Good, HSG C
6,703	76	Weighted Average
6,008		89.63% Pervious Area
695		10.37% Impervious Area

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

Subcatchment 7S: To Street



Summary for Pond 1P: Underground Infiltration System

Inflow Area = 2.005 ac, 88.50% Impervious, Inflow Depth > 5.18" for 25-Year event
Inflow = 5.0 cfs @ 12.08 hrs, Volume= 0.865 af
Outflow = 0.9 cfs @ 12.58 hrs, Volume= 0.802 af, Atten= 82%, Lag= 29.9 min
Discarded = 0.1 cfs @ 6.09 hrs, Volume= 0.348 af
Primary = 0.9 cfs @ 12.58 hrs, Volume= 0.454 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 7.35' @ 12.58 hrs Surf.Area= 5,134 sf Storage= 10,380 cf

Plug-Flow detention time= 636.1 min calculated for 0.802 af (93% of inflow)
Center-of-Mass det. time= 513.0 min (1,660.3 - 1,147.3)

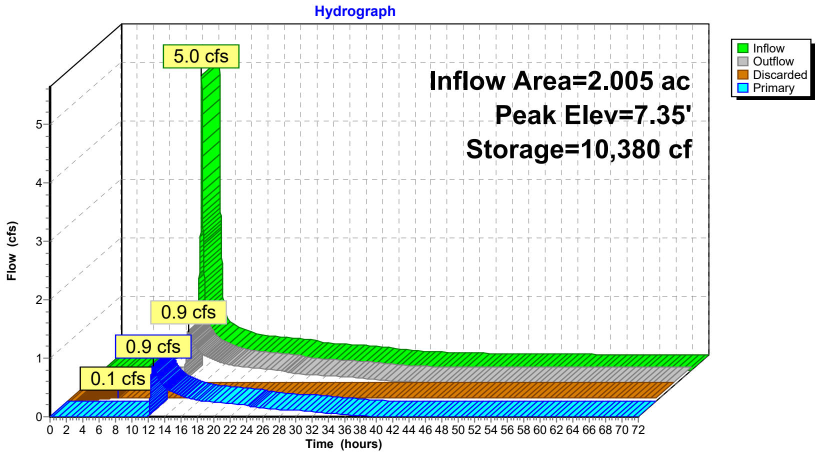
Volume	Invert	Avail.Storage	Storage Description
#1	5.00'	13,246 cf	**6.89'W x 14.06'L x 3.00'H StormTrap ST-1 Units (Irregular Shape)** x 53 15,403 cf Overall x 86.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Discarded	5.00'	**0.520 in/hr Exfiltration over Surface area**
#2	Primary	6.80'	**12.0" Round Culvert** L= 144.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 6.80' / 6.08' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Discarded OutFlow Max=0.1 cfs @ 6.09 hrs HW=5.03' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.1 cfs)

Primary OutFlow Max=0.9 cfs @ 12.58 hrs HW=7.35' (Free Discharge)
└**2=Culvert** (Barrel Controls 0.9 cfs @ 2.83 fps)

Pond 1P: Underground Infiltration System



Summary for Pond 2P: Rooftop Detention

Inflow Area = 0.984 ac,100.00% Impervious, Inflow Depth = 5.96" for 25-Year event
Inflow = 6.0 cfs @ 12.08 hrs, Volume= 0.489 af
Outflow = 0.3 cfs @ 14.75 hrs, Volume= 0.479 af, Atten= 96%, Lag= 159.7 min
Primary = 0.3 cfs @ 14.75 hrs, Volume= 0.479 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 57.37' @ 14.75 hrs Surf.Area= 38,000 sf Storage= 13,982 cf

Plug-Flow detention time= 731.4 min calculated for 0.479 af (98% of inflow)
Center-of-Mass det. time= 718.5 min (1,463.2 - 744.7)

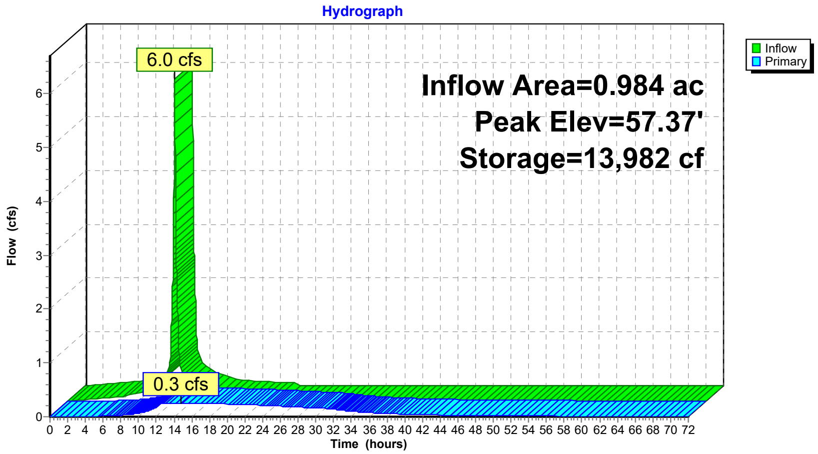
Volume	Invert	Avail.Storage	Storage Description
#1	57.00'	38,000 cf	**Rooftop Detention (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
57.00	38,000	0	0
58.00	38,000	38,000	38,000

Device	Routing	Invert	Outlet Devices
#1	Primary	6.42'	**18.0" Round Roof Drain** L= 52.0' CPP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 6.42' / 5.90' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#2	Device 1	57.00'	**4.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.3 cfs @ 14.75 hrs HW=57.37' (Free Discharge)
└─**1=Roof Drain** (Passes 0.3 cfs of 53.2 cfs potential flow)
└─**2=Orifice/Grate** (Orifice Controls 0.3 cfs @ 2.92 fps)

Pond 2P: Rooftop Detention



Summary for Pond 3P: Underground Detention System

Inflow Area = 0.213 ac, 25.42% Impervious, Inflow Depth = 3.96" for 25-Year event
Inflow = 1.0 cfs @ 12.09 hrs, Volume= 0.070 af
Outflow = 0.0 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
Primary = 0.0 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 3.73' @ 24.34 hrs Surf.Area= 2,085 sf Storage= 3,065 cf

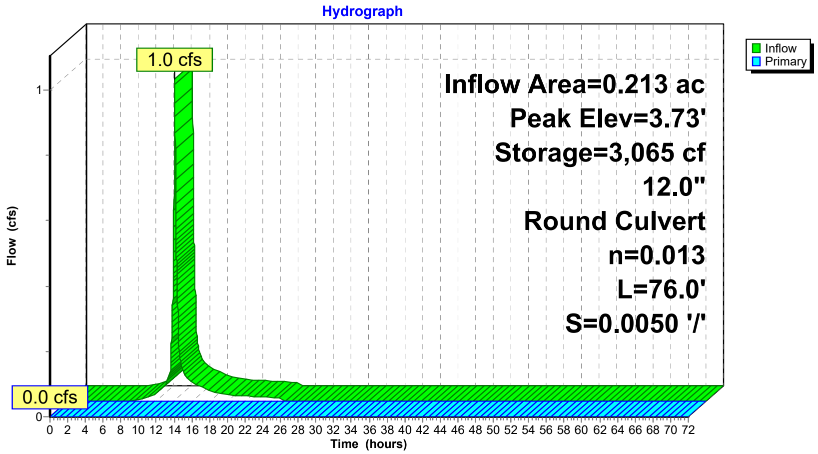
Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	2.00'	5,249 cf	**6.89'W x 14.06'L x 3.00'H StormTrap ST-1 Units (Irregular Shape)** x 21 6,103 cf Overall x 86.0% Voids
#2	3.00'	49 cf	**30.0" Round 30" Perf. HDPE Laid Flat** L= 10.0'
#3	3.00'	170 cf	**6.00'D x 6.00'H OCS-2**
		5,467 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	7.38'	**12.0" Round Culvert** L= 76.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 7.38' / 7.00' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=0.0 cfs @ 0.00 hrs HW=2.00' (Free Discharge)
└**1=Culvert** (Controls 0.0 cfs)

Pond 3P: Underground Detention System

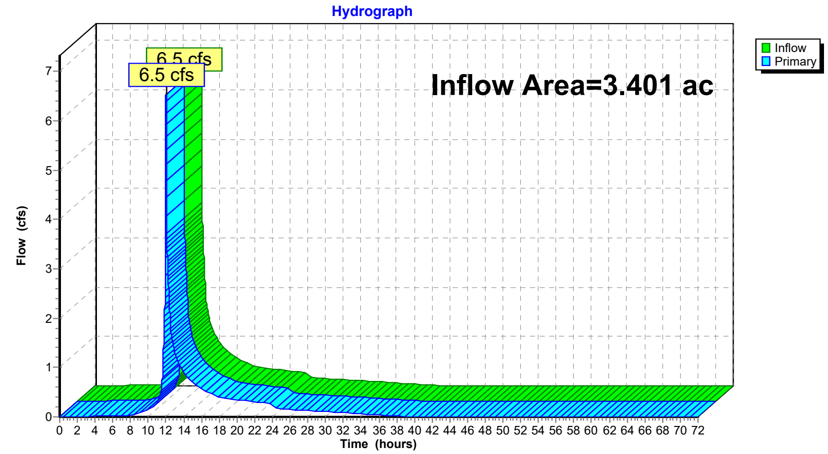


Summary for Link 1L: Total to Wetlands

Inflow Area = 3.401 ac, 59.21% Impervious, Inflow Depth = 3.14" for 25-Year event
Inflow = 6.5 cfs @ 12.00 hrs, Volume= 0.889 af
Primary = 6.5 cfs @ 12.00 hrs, Volume= 0.889 af, Atten= 0%, Lag= 0.0 min

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

Link 1L: Total to Wetlands

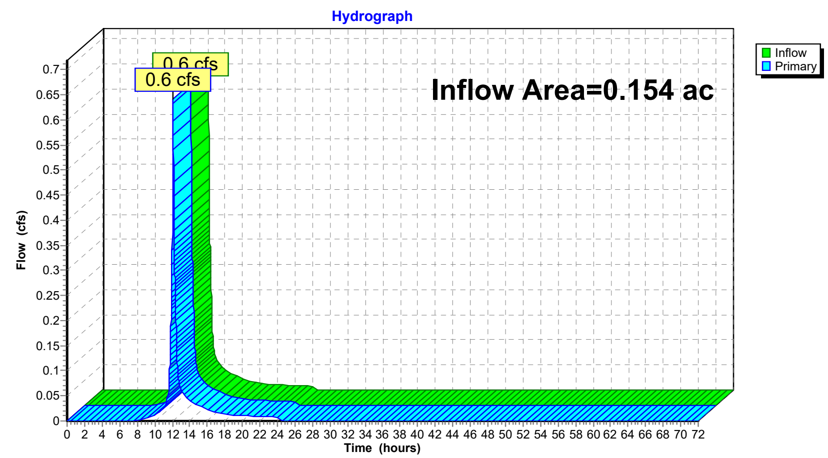


Summary for Link 2L: Total to Street

Inflow Area =	0.154 ac, 10.37% Impervious, Inflow Depth = 3.55"	for 25-Year event
Inflow =	0.6 cfs @ 12.09 hrs, Volume=	0.046 af
Primary =	0.6 cfs @ 12.09 hrs, Volume=	0.046 af, Atten= 0%, Lag= 0.0 min

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

Link 2L: Total to Street



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

Subcatchment 1S: CB-1 Runoff Area=14,030 sf 77.79% Impervious Runoff Depth=6.60"
Tc=6.0 min CN=93 Runoff=2.3 cfs 0.177 af

Subcatchment 2aS: Building Roof Runoff Area=42,854 sf 100.00% Impervious Runoff Depth=7.19"
Tc=6.0 min CN=98 Runoff=7.2 cfs 0.590 af

Subcatchment 2bS: Building Runoff Area=8,960 sf 100.00% Impervious Runoff Depth=7.19"
Tc=6.0 min CN=98 Runoff=1.5 cfs 0.123 af

Subcatchment 3S: Courtyard Roofs Runoff Area=14,820 sf 100.00% Impervious Runoff Depth=7.19"
Tc=6.0 min CN=98 Runoff=2.5 cfs 0.204 af

Subcatchment 4S: TD-2 Runoff Area=6,330 sf 100.00% Impervious Runoff Depth=7.19"
Tc=6.0 min CN=98 Runoff=1.1 cfs 0.087 af

Subcatchment 5S: TD-1 Runoff Area=9,284 sf 25.42% Impervious Runoff Depth=5.09"
Tc=6.0 min CN=80 Runoff=1.3 cfs 0.090 af

Subcatchment 6S: Bypass Towards Runoff Area=51,867 sf 2.84% Impervious Runoff Depth=4.42"
Tc=0.0 min CN=74 Runoff=7.5 cfs 0.438 af

Subcatchment 7S: To Street Runoff Area=6,703 sf 10.37% Impervious Runoff Depth=4.64"
Tc=6.0 min CN=76 Runoff=0.8 cfs 0.060 af

Pond 1P: Underground Infiltration System Peak Elev=7.63' Storage=11,630 cf Inflow=6.0 cfs 1.047 af
Discarded=0.1 cfs 0.352 af Primary=1.7 cfs 0.616 af Outflow=1.8 cfs 0.967 af

Pond 2P: Rooftop Detention Peak Elev=57.45' Storage=17,053 cf Inflow=7.2 cfs 0.590 af
Outflow=0.3 cfs 0.579 af

Pond 3P: Underground Detention System Peak Elev=4.22' Storage=3,940 cf Inflow=1.3 cfs 0.090 af
12.0" Round Culvert n=0.013 L=76.0' S=0.0050 '/' Outflow=0.0 cfs 0.000 af

Link 1L: Total to Wetlands Inflow=8.5 cfs 1.177 af
Primary=8.5 cfs 1.177 af

Link 2L: Total to Street Inflow=0.8 cfs 0.060 af
Primary=0.8 cfs 0.060 af

Total Runoff Area = 3.555 ac Runoff Volume = 1.769 af Average Runoff Depth = 5.97"
42.91% Pervious = 1.525 ac 57.09% Impervious = 2.029 ac

Summary for Subcatchment 1S: CB-1

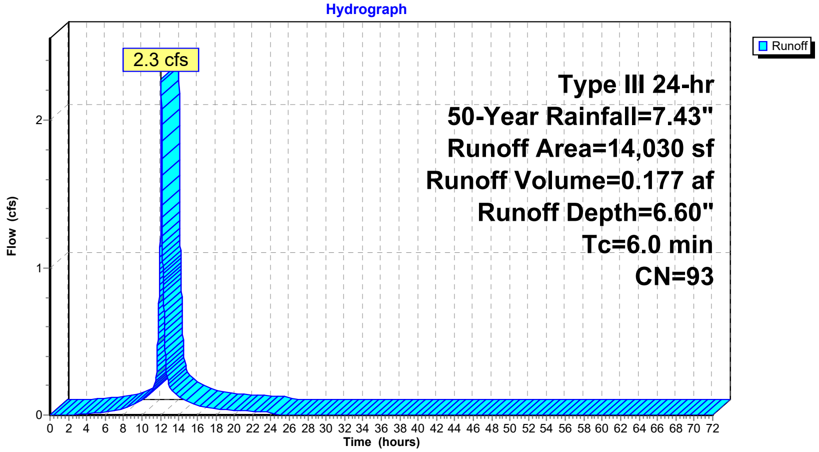
Runoff = 2.3 cfs @ 12.08 hrs, Volume= 0.177 af, Depth= 6.60"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 50-Year Rainfall=7.43"

Area (sf)	CN	Description
10,914	98	Paved parking, HSG C
3,116	74	>75% Grass cover, Good, HSG C
14,030	93	Weighted Average
3,116		22.21% Pervious Area
10,914		77.79% Impervious Area

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

Subcatchment 1S: CB-1



Summary for Subcatchment 2aS: Building Roof

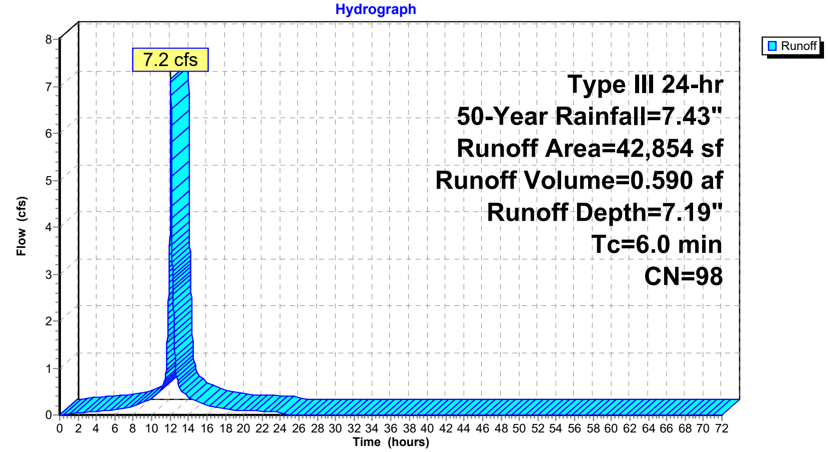
Runoff = 7.2 cfs @ 12.08 hrs, Volume= 0.590 af, Depth= 7.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 50-Year Rainfall=7.43"

Area (sf)	CN	Description
42,854	98	Roofs, HSG C
42,854		100.00% Impervious Area

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

Subcatchment 2aS: Building Roof



Summary for Subcatchment 2bS: Building Roof-Southeast

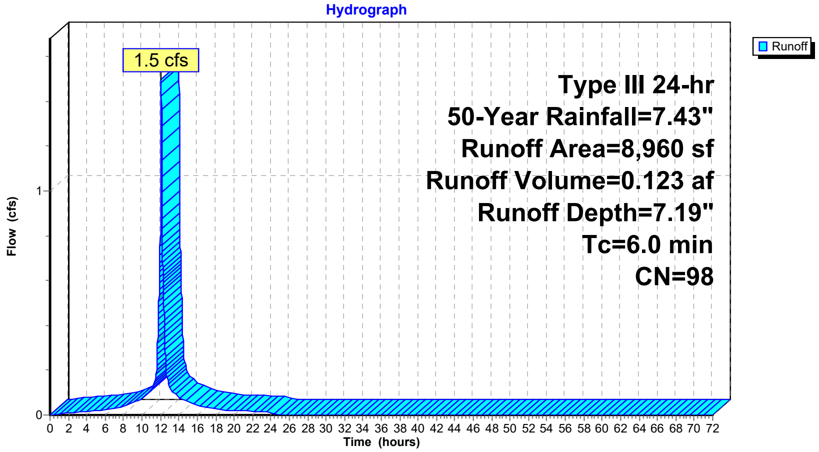
Runoff = 1.5 cfs @ 12.08 hrs, Volume= 0.123 af, Depth= 7.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 50-Year Rainfall=7.43"

Area (sf)	CN	Description
8,960	98	Roofs, HSG C
8,960		100.00% Impervious Area

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

Subcatchment 2bS: Building Roof-Southeast



Summary for Subcatchment 3S: Courtyard Roofs

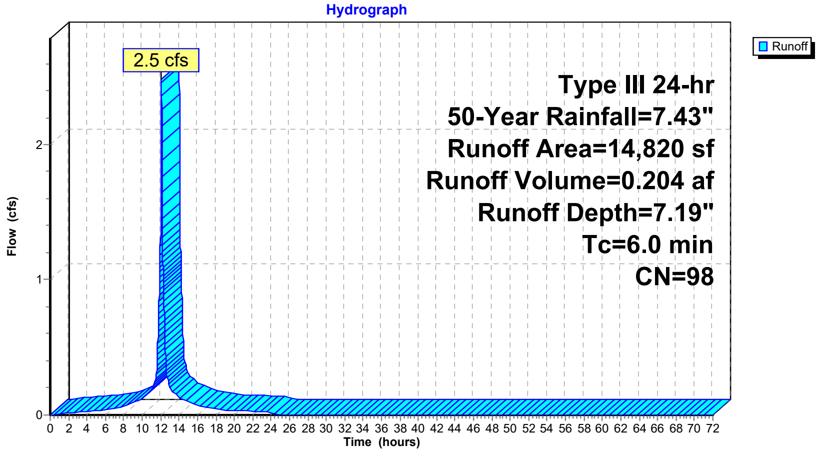
Runoff = 2.5 cfs @ 12.08 hrs, Volume= 0.204 af, Depth= 7.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 50-Year Rainfall=7.43"

Area (sf)	CN	Description
14,820	98	Roofs, HSG C
14,820		100.00% Impervious Area

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

Subcatchment 3S: Courtyard Roofs



Summary for Subcatchment 4S: TD-2

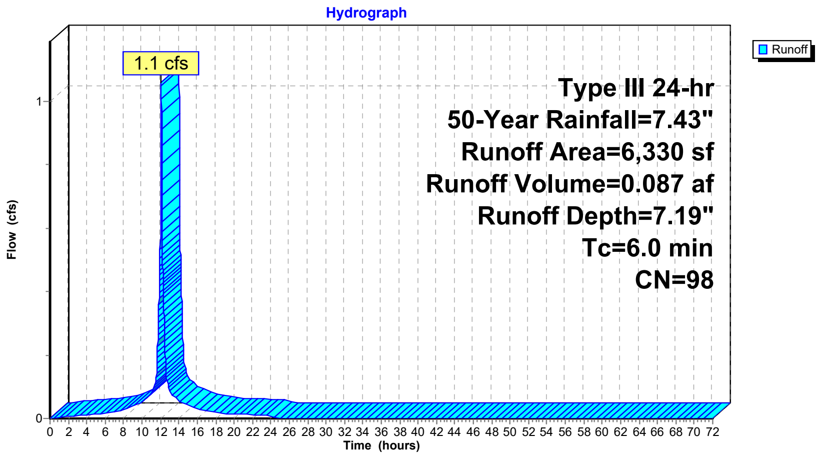
Runoff = 1.1 cfs @ 12.08 hrs, Volume= 0.087 af, Depth= 7.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 50-Year Rainfall=7.43"

Area (sf)	CN	Description
6,330	98	Paved parking, HSG C
6,330		100.00% Impervious Area

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

Subcatchment 4S: TD-2



Summary for Subcatchment 5S: TD-1

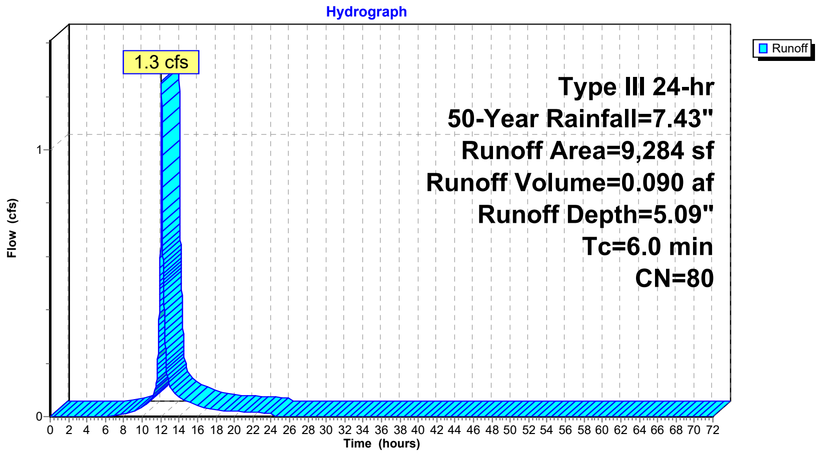
Runoff = 1.3 cfs @ 12.09 hrs, Volume= 0.090 af, Depth= 5.09"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 50-Year Rainfall=7.43"

Area (sf)	CN	Description
2,360	98	Paved parking, HSG C
6,924	74	>75% Grass cover, Good, HSG C
9,284	80	Weighted Average
6,924		74.58% Pervious Area
2,360		25.42% Impervious Area

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

Subcatchment 5S: TD-1



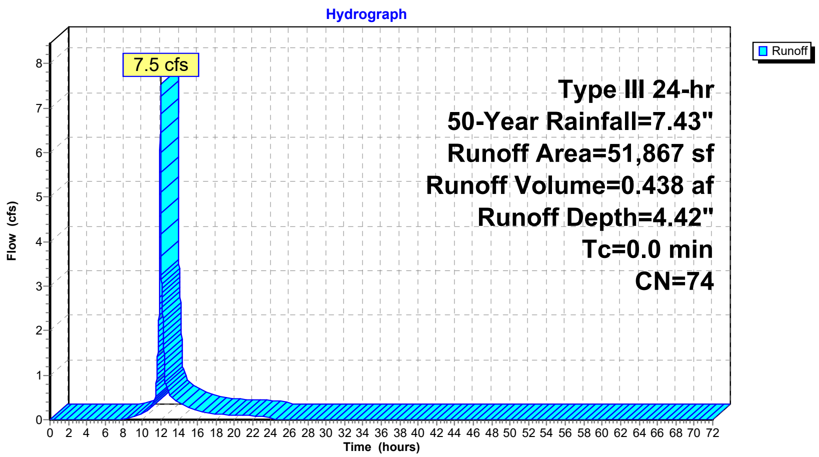
Summary for Subcatchment 6S: Bypass Towards Wetlands

Runoff = 7.5 cfs @ 12.00 hrs, Volume= 0.438 af, Depth= 4.42"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 50-Year Rainfall=7.43"

Area (sf)	CN	Description
6,751	70	Woods, Good, HSG C
43,644	74	>75% Grass cover, Good, HSG C
1,472	98	Roofs, HSG C
51,867	74	Weighted Average
50,395		97.16% Pervious Area
1,472		2.84% Impervious Area

Subcatchment 6S: Bypass Towards Wetlands



Summary for Subcatchment 7S: To Street

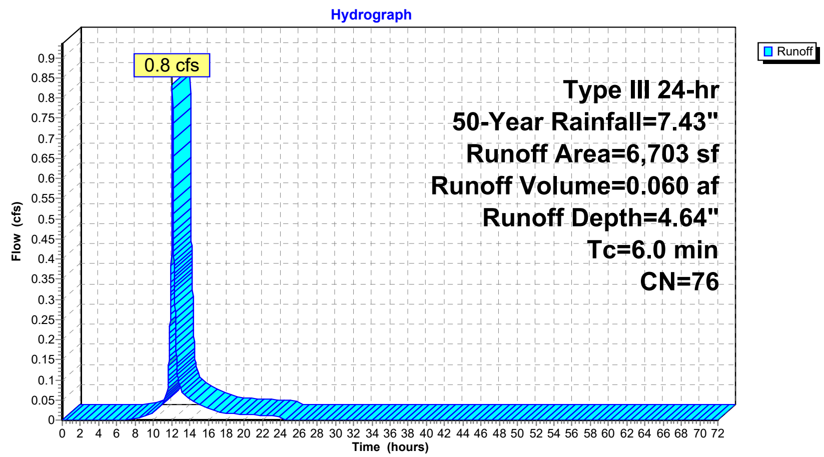
Runoff = 0.8 cfs @ 12.09 hrs, Volume= 0.060 af, Depth= 4.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 50-Year Rainfall=7.43"

Area (sf)	CN	Description
695	98	Paved parking, HSG C
6,008	74	>75% Grass cover, Good, HSG C
6,703	76	Weighted Average
6,008		89.63% Pervious Area
695		10.37% Impervious Area

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

Subcatchment 7S: To Street



Summary for Pond 1P: Underground Infiltration System

Inflow Area = 2.005 ac, 88.50% Impervious, Inflow Depth > 6.26" for 50-Year event
Inflow = 6.0 cfs @ 12.08 hrs, Volume= 1.047 af
Outflow = 1.8 cfs @ 12.44 hrs, Volume= 0.967 af, Atten= 70%, Lag= 21.3 min
Discarded = 0.1 cfs @ 5.04 hrs, Volume= 0.352 af
Primary = 1.7 cfs @ 12.44 hrs, Volume= 0.616 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 7.63' @ 12.44 hrs Surf.Area= 5,134 sf Storage= 11,630 cf

Plug-Flow detention time= 540.8 min calculated for 0.967 af (92% of inflow)
Center-of-Mass det. time= 411.3 min (1,582.2 - 1,170.9)

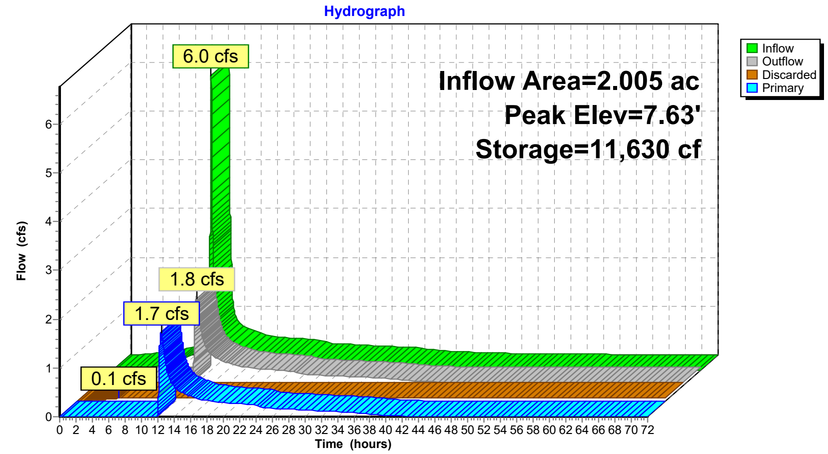
Volume	Invert	Avail.Storage	Storage Description
#1	5.00'	13,246 cf	**6.89'W x 14.06'L x 3.00'H StormTrap ST-1 Units (Irregular Shape)** x 53 15,403 cf Overall x 86.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Discarded	5.00'	**0.520 in/hr Exfiltration over Surface area**
#2	Primary	6.80'	**12.0" Round Culvert** L= 144.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 6.80' / 6.08' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Discarded OutFlow Max=0.1 cfs @ 5.04 hrs HW=5.03' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.1 cfs)

Primary OutFlow Max=1.7 cfs @ 12.44 hrs HW=7.63' (Free Discharge)
└─**2=Culvert** (Barrel Controls 1.7 cfs @ 3.35 fps)

Pond 1P: Underground Infiltration System



Summary for Pond 2P: Rooftop Detention

Inflow Area =	0.984 ac,100.00% Impervious, Inflow Depth = 7.19" for 50-Year event		
Inflow =	7.2 cfs @ 12.08 hrs, Volume=	0.590 af	
Outflow =	0.3 cfs @ 15.03 hrs, Volume=	0.579 af, Atten= 96%, Lag= 176.8 min	
Primary =	0.3 cfs @ 15.03 hrs, Volume=	0.579 af	

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 57.45' @ 15.03 hrs Surf.Area= 38,000 sf Storage= 17,053 cf

Plug-Flow detention time= 780.2 min calculated for 0.579 af (98% of inflow)
Center-of-Mass det. time= 767.9 min (1,510.1 - 742.2)

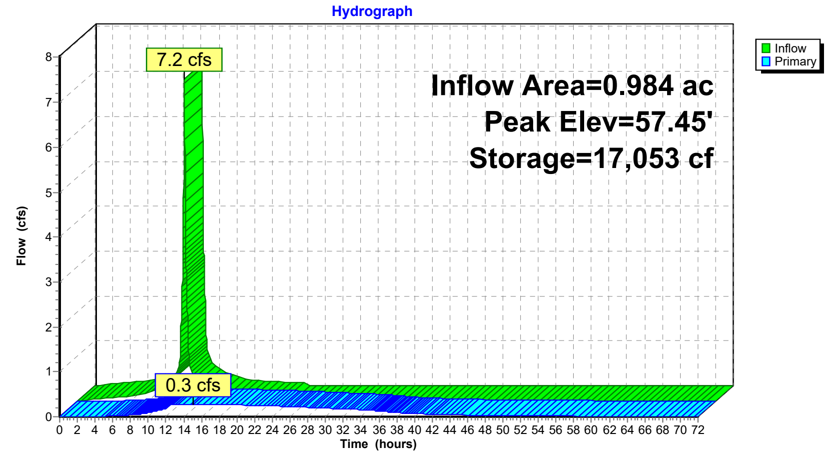
Volume	Invert	Avail.Storage	Storage Description
#1	57.00'	38,000 cf	**Rooftop Detention (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
57.00	38,000	0	0
58.00	38,000	38,000	38,000

Device	Routing	Invert	Outlet Devices
#1	Primary	6.42'	**18.0" Round Roof Drain** L= 52.0' CPP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 6.42' / 5.90' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#2	Device 1	57.00'	**4.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.3 cfs @ 15.03 hrs HW=57.45' (Free Discharge)
└─**1=Roof Drain** (Passes 0.3 cfs of 53.2 cfs potential flow)
  └─**2=Orifice/Grate** (Orifice Controls 0.3 cfs @ 3.23 fps)

Pond 2P: Rooftop Detention



Summary for Pond 3P: Underground Detention System

Inflow Area = 0.213 ac, 25.42% Impervious, Inflow Depth = 5.09" for 50-Year event
Inflow = 1.3 cfs @ 12.09 hrs, Volume= 0.090 af
Outflow = 0.0 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
Primary = 0.0 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 4.22' @ 24.34 hrs Surf.Area= 2,088 sf Storage= 3,940 cf

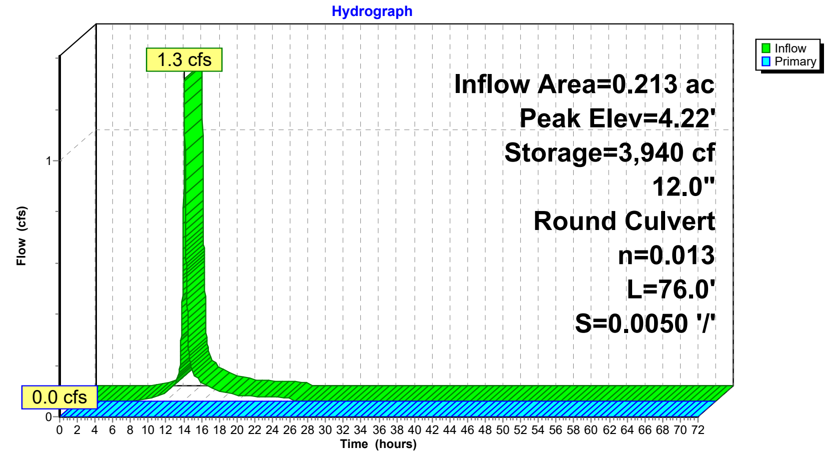
Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	2.00'	5,249 cf	**6.89'W x 14.06'L x 3.00'H StormTrap ST-1 Units (Irregular Shape)** x 21 6,103 cf Overall x 86.0% Voids
#2	3.00'	49 cf	**30.0" Round 30" Perf. HDPE Laid Flat** L= 10.0'
#3	3.00'	170 cf	**6.00'D x 6.00'H OCS-2**
		5,467 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	7.38'	**12.0" Round Culvert** L= 76.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 7.38' / 7.00' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=0.0 cfs @ 0.00 hrs HW=2.00' (Free Discharge)
└─**1=Culvert** (Controls 0.0 cfs)

Pond 3P: Underground Detention System

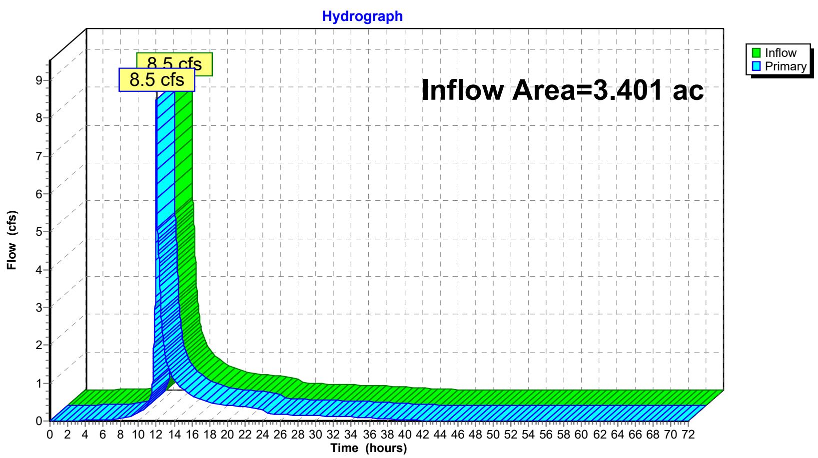


Summary for Link 1L: Total to Wetlands

Inflow Area = 3.401 ac, 59.21% Impervious, Inflow Depth = 4.15" for 50-Year event
Inflow = 8.5 cfs @ 12.00 hrs, Volume= 1.177 af
Primary = 8.5 cfs @ 12.00 hrs, Volume= 1.177 af, Atten= 0%, Lag= 0.0 min

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

Link 1L: Total to Wetlands

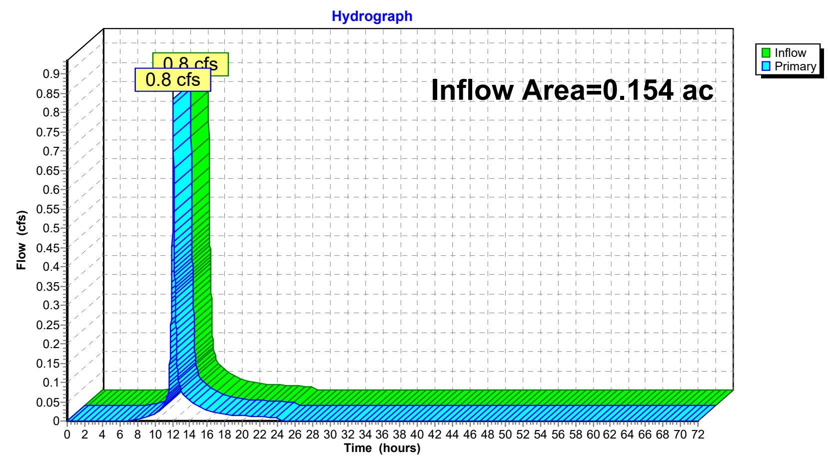


Summary for Link 2L: Total to Street

Inflow Area = 0.154 ac, 10.37% Impervious, Inflow Depth = 4.64" for 50-Year event
Inflow = 0.8 cfs @ 12.09 hrs, Volume= 0.060 af
Primary = 0.8 cfs @ 12.09 hrs, Volume= 0.060 af, Atten= 0%, Lag= 0.0 min

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

Link 2L: Total to Street



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

Subcatchment 1S: CB-1 Runoff Area=14,030 sf 77.79% Impervious Runoff Depth=8.05"
Tc=6.0 min CN=93 Runoff=2.8 cfs 0.216 af

Subcatchment 2aS: Building Roof Runoff Area=42,854 sf 100.00% Impervious Runoff Depth=8.65"
Tc=6.0 min CN=98 Runoff=8.6 cfs 0.709 af

Subcatchment 2bS: Building Runoff Area=8,960 sf 100.00% Impervious Runoff Depth=8.65"
Tc=6.0 min CN=98 Runoff=1.8 cfs 0.148 af

Subcatchment 3S: Courtyard Roofs Runoff Area=14,820 sf 100.00% Impervious Runoff Depth=8.65"
Tc=6.0 min CN=98 Runoff=3.0 cfs 0.245 af

Subcatchment 4S: TD-2 Runoff Area=6,330 sf 100.00% Impervious Runoff Depth=8.65"
Tc=6.0 min CN=98 Runoff=1.3 cfs 0.105 af

Subcatchment 5S: TD-1 Runoff Area=9,284 sf 25.42% Impervious Runoff Depth=6.46"
Tc=6.0 min CN=80 Runoff=1.6 cfs 0.115 af

Subcatchment 6S: Bypass Towards Runoff Area=51,867 sf 2.84% Impervious Runoff Depth=5.73"
Tc=0.0 min CN=74 Runoff=9.7 cfs 0.568 af

Subcatchment 7S: To Street Runoff Area=6,703 sf 10.37% Impervious Runoff Depth=5.97"
Tc=6.0 min CN=76 Runoff=1.1 cfs 0.077 af

Pond 1P: Underground Infiltration System Peak Elev=7.98' Storage=13,137 cf Inflow=7.2 cfs 1.262 af
Discarded=0.1 cfs 0.355 af Primary=2.6 cfs 0.811 af Outflow=2.7 cfs 1.166 af

Pond 2P: Rooftop Detention Peak Elev=57.55' Storage=20,776 cf Inflow=8.6 cfs 0.709 af
Outflow=0.3 cfs 0.696 af

Pond 3P: Underground Detention System Peak Elev=4.81' Storage=5,001 cf Inflow=1.6 cfs 0.115 af
12.0" Round Culvert n=0.013 L=76.0' S=0.0050 '/' Outflow=0.0 cfs 0.000 af

Link 1L: Total to Wetlands Inflow=11.4 cfs 1.528 af
Primary=11.4 cfs 1.528 af

Link 2L: Total to Street Inflow=1.1 cfs 0.077 af
Primary=1.1 cfs 0.077 af

Total Runoff Area = 3.555 ac Runoff Volume = 2.183 af Average Runoff Depth = 7.37"
42.91% Pervious = 1.525 ac 57.09% Impervious = 2.029 ac

Summary for Subcatchment 1S: CB-1

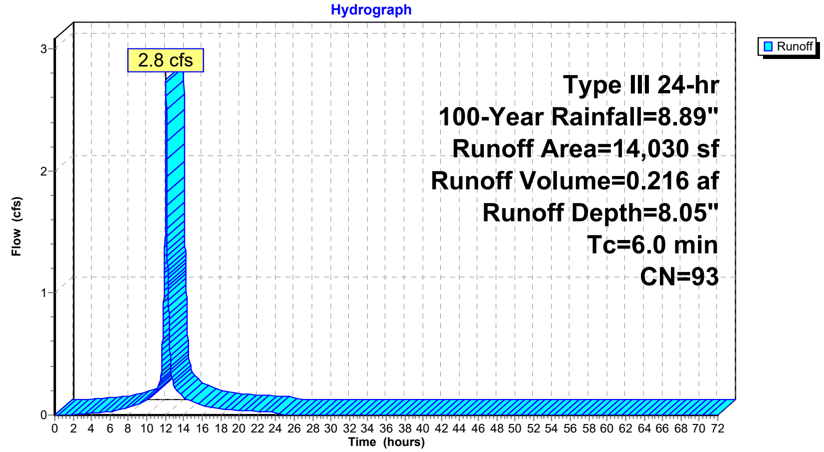
Runoff = 2.8 cfs @ 12.08 hrs, Volume= 0.216 af, Depth= 8.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.89"

Area (sf)	CN	Description
10,914	98	Paved parking, HSG C
3,116	74	>75% Grass cover, Good, HSG C
14,030	93	Weighted Average
3,116		22.21% Pervious Area
10,914		77.79% Impervious Area

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

Subcatchment 1S: CB-1



Summary for Subcatchment 2aS: Building Roof

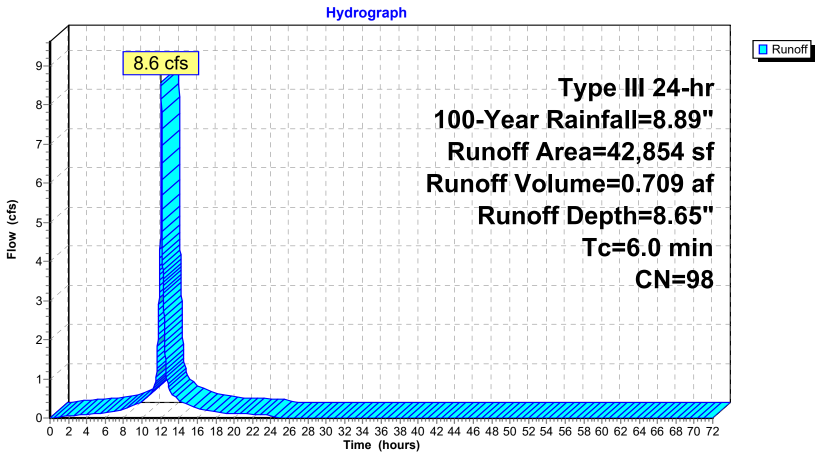
Runoff = 8.6 cfs @ 12.08 hrs, Volume= 0.709 af, Depth= 8.65"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.89"

Area (sf)	CN	Description
42,854	98	Roofs, HSG C
42,854		100.00% Impervious Area

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

Subcatchment 2aS: Building Roof



Summary for Subcatchment 2bS: Building Roof-Southeast

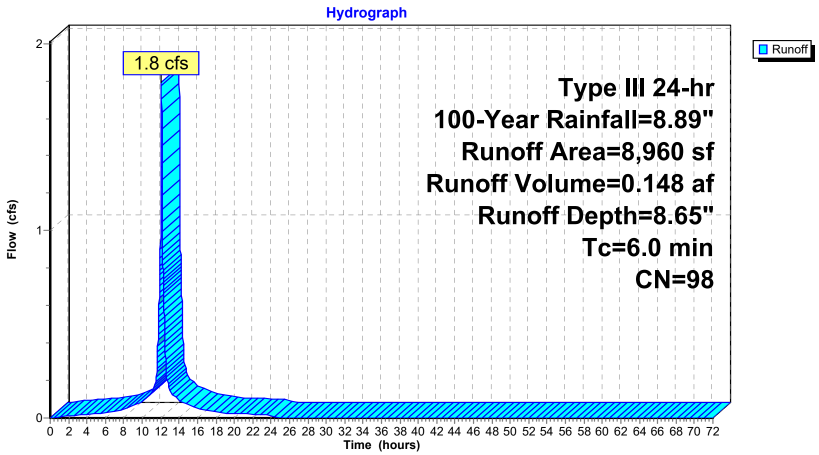
Runoff = 1.8 cfs @ 12.08 hrs, Volume= 0.148 af, Depth= 8.65"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.89"

Area (sf)	CN	Description
8,960	98	Roofs, HSG C
8,960		100.00% Impervious Area

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

Subcatchment 2bS: Building Roof-Southeast



Summary for Subcatchment 3S: Courtyard Roofs

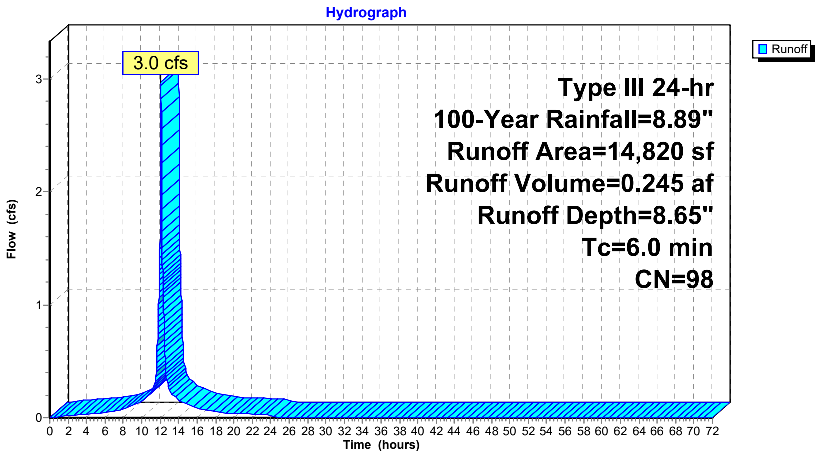
Runoff = 3.0 cfs @ 12.08 hrs, Volume= 0.245 af, Depth= 8.65"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.89"

Area (sf)	CN	Description
14,820	98	Roofs, HSG C
14,820		100.00% Impervious Area

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

Subcatchment 3S: Courtyard Roofs



Summary for Subcatchment 4S: TD-2

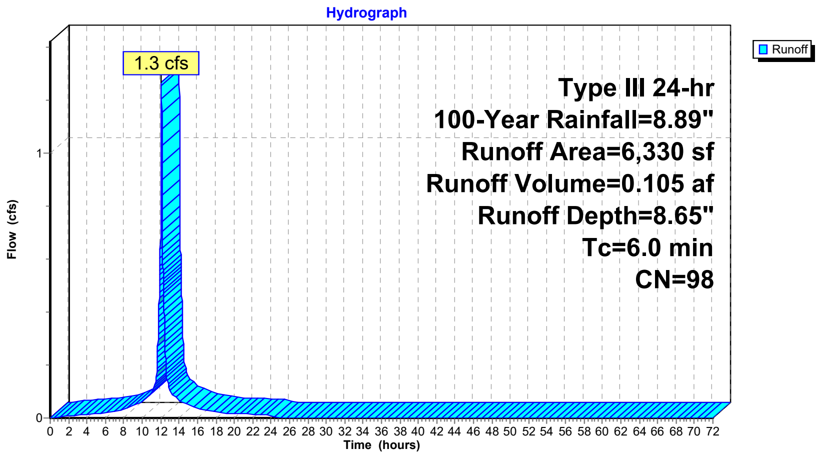
Runoff = 1.3 cfs @ 12.08 hrs, Volume= 0.105 af, Depth= 8.65"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.89"

Area (sf)	CN	Description
6,330	98	Paved parking, HSG C
6,330		100.00% Impervious Area

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

Subcatchment 4S: TD-2



Summary for Subcatchment 5S: TD-1

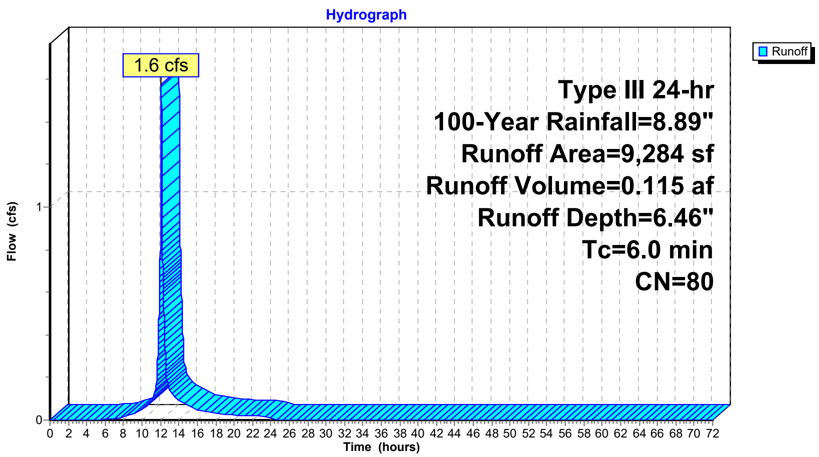
Runoff = 1.6 cfs @ 12.09 hrs, Volume= 0.115 af, Depth= 6.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.89"

Area (sf)	CN	Description
2,360	98	Paved parking, HSG C
6,924	74	>75% Grass cover, Good, HSG C
9,284	80	Weighted Average
6,924		74.58% Pervious Area
2,360		25.42% Impervious Area

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

Subcatchment 5S: TD-1



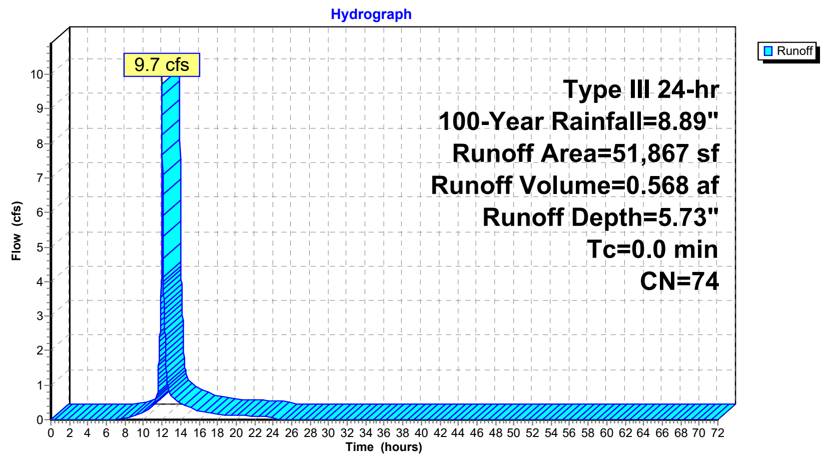
Summary for Subcatchment 6S: Bypass Towards Wetlands

Runoff = 9.7 cfs @ 12.00 hrs, Volume= 0.568 af, Depth= 5.73"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.89"

Area (sf)	CN	Description
6,751	70	Woods, Good, HSG C
43,644	74	>75% Grass cover, Good, HSG C
1,472	98	Roofs, HSG C
51,867	74	Weighted Average
50,395		97.16% Pervious Area
1,472		2.84% Impervious Area

Subcatchment 6S: Bypass Towards Wetlands



Summary for Subcatchment 7S: To Street

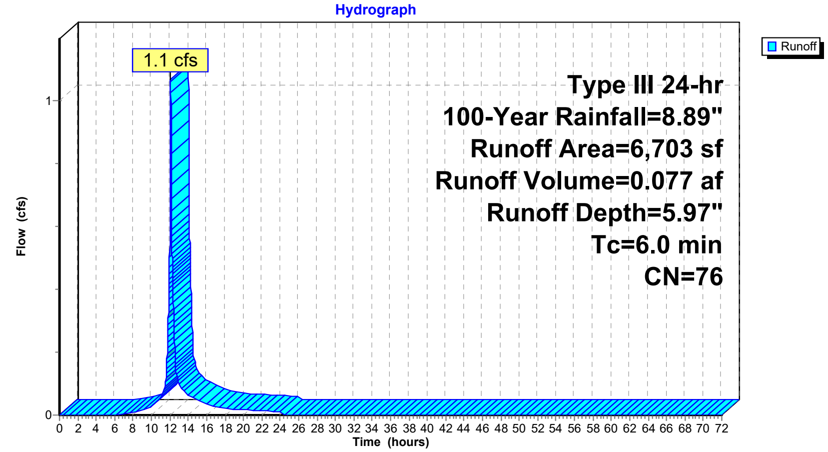
Runoff = 1.1 cfs @ 12.09 hrs, Volume= 0.077 af, Depth= 5.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.89"

Area (sf)	CN	Description
695	98	Paved parking, HSG C
6,008	74	>75% Grass cover, Good, HSG C
6,703	76	Weighted Average
6,008		89.63% Pervious Area
695		10.37% Impervious Area

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

Subcatchment 7S: To Street



Summary for Pond 1P: Underground Infiltration System

Inflow Area = 2.005 ac, 88.50% Impervious, Inflow Depth > 7.56" for 100-Year event
Inflow = 7.2 cfs @ 12.08 hrs, Volume= 1.262 af
Outflow = 2.7 cfs @ 12.35 hrs, Volume= 1.166 af, Atten= 63%, Lag= 15.9 min
Discarded = 0.1 cfs @ 4.14 hrs, Volume= 0.355 af
Primary = 2.6 cfs @ 12.35 hrs, Volume= 0.811 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 7.98' @ 12.35 hrs Surf.Area= 5,134 sf Storage= 13,137 cf

Plug-Flow detention time= 464.0 min calculated for 1.165 af (92% of inflow)
Center-of-Mass det. time= 328.5 min (1,527.7 - 1,199.2)

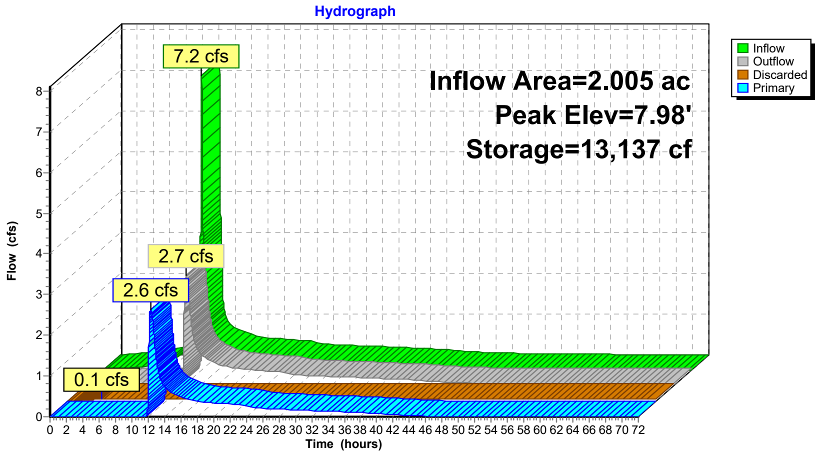
Volume	Invert	Avail.Storage	Storage Description
#1	5.00'	13,246 cf	**6.89'W x 14.06'L x 3.00'H StormTrap ST-1 Units (Irregular Shape)** x 53 15,403 cf Overall x 86.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Discarded	5.00'	**0.520 in/hr Exfiltration over Surface area**
#2	Primary	6.80'	**12.0" Round Culvert** L= 144.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 6.80' / 6.08' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Discarded OutFlow Max=0.1 cfs @ 4.14 hrs HW=5.03' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.1 cfs)

Primary OutFlow Max=2.6 cfs @ 12.35 hrs HW=7.98' (Free Discharge)
└**2=Culvert** (Barrel Controls 2.6 cfs @ 3.60 fps)

Pond 1P: Underground Infiltration System



Summary for Pond 2P: Rooftop Detention

Inflow Area = 0.984 ac,100.00% Impervious, Inflow Depth = 8.65" for 100-Year event
Inflow = 8.6 cfs @ 12.08 hrs, Volume= 0.709 af
Outflow = 0.3 cfs @ 15.29 hrs, Volume= 0.696 af, Atten= 96%, Lag= 192.3 min
Primary = 0.3 cfs @ 15.29 hrs, Volume= 0.696 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 57.55' @ 15.29 hrs Surf.Area= 38,000 sf Storage= 20,776 cf

Plug-Flow detention time= 837.0 min calculated for 0.696 af (98% of inflow)
Center-of-Mass det. time= 825.4 min (1,565.4 - 739.9)

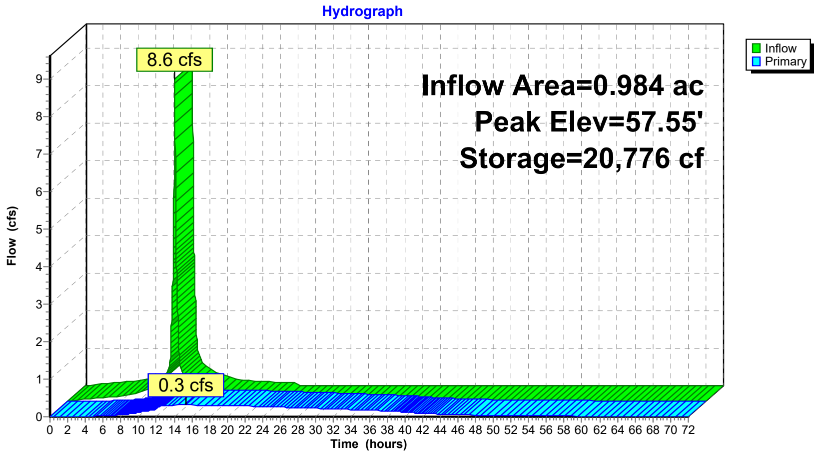
Volume	Invert	Avail.Storage	Storage Description
#1	57.00'	38,000 cf	**Rooftop Detention (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
57.00	38,000	0	0
58.00	38,000	38,000	38,000

Device	Routing	Invert	Outlet Devices
#1	Primary	6.42'	**18.0" Round Roof Drain** L= 52.0' CPP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 6.42' / 5.90' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#2	Device 1	57.00'	**4.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.3 cfs @ 15.29 hrs HW=57.55' (Free Discharge)
1=Roof Drain (Passes 0.3 cfs of 53.3 cfs potential flow)
2=Orifice/Grate (Orifice Controls 0.3 cfs @ 3.56 fps)

Pond 2P: Rooftop Detention



Summary for Pond 3P: Underground Detention System

Inflow Area = 0.213 ac, 25.42% Impervious, Inflow Depth = 6.46" for 100-Year event
Inflow = 1.6 cfs @ 12.09 hrs, Volume= 0.115 af
Outflow = 0.0 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
Primary = 0.0 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 4.81' @ 24.34 hrs Surf.Area= 2,085 sf Storage= 5,001 cf

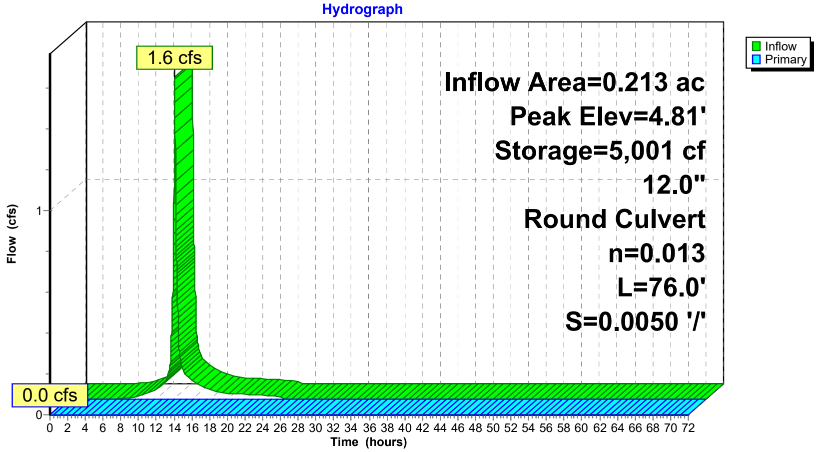
Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	2.00'	5,249 cf	**6.89'W x 14.06'L x 3.00'H StormTrap ST-1 Units (Irregular Shape)** x 21 6,103 cf Overall x 86.0% Voids
#2	3.00'	49 cf	**30.0" Round 30" Perf. HDPE Laid Flat** L= 10.0'
#3	3.00'	170 cf	**6.00'D x 6.00'H OCS-2**
		5,467 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	7.38'	**12.0" Round Culvert** L= 76.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 7.38' / 7.00' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=0.0 cfs @ 0.00 hrs HW=2.00' (Free Discharge)
└**1=Culvert** (Controls 0.0 cfs)

Pond 3P: Underground Detention System

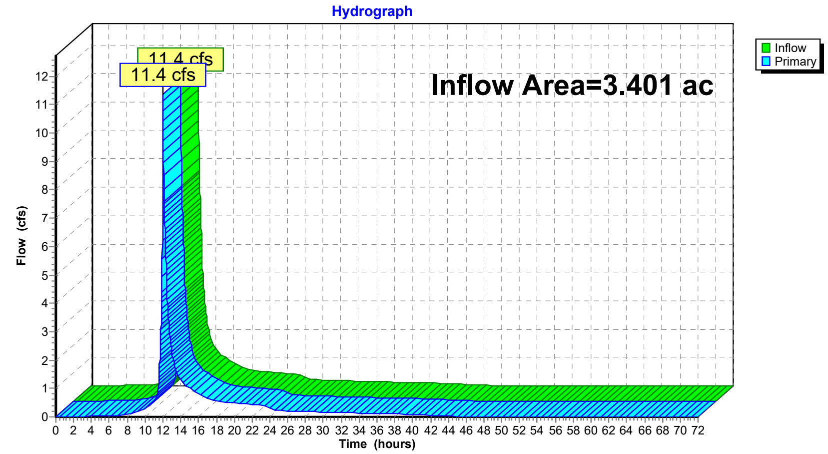


Summary for Link 1L: Total to Wetlands

Inflow Area =	3.401 ac, 59.21% Impervious, Inflow Depth = 5.39" for 100-Year event		
Inflow =	11.4 cfs @ 12.00 hrs, Volume=	1.528 af	
Primary =	11.4 cfs @ 12.00 hrs, Volume=	1.528 af, Atten= 0%, Lag= 0.0 min	

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

Link 1L: Total to Wetlands

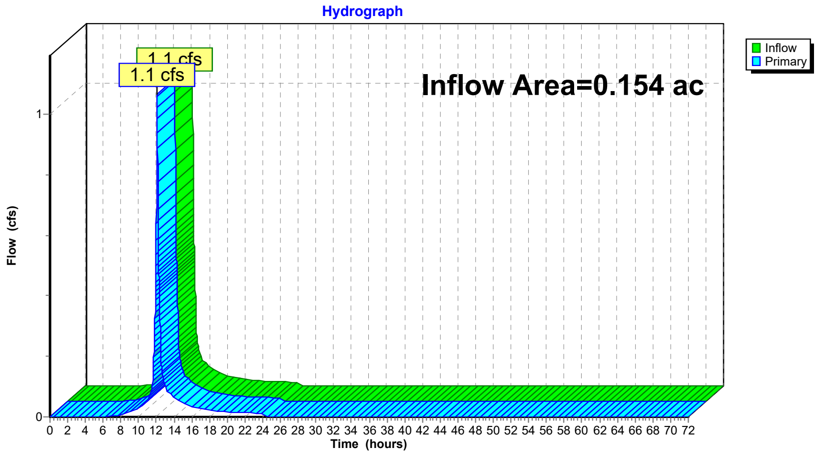


Summary for Link 2L: Total to Street

Inflow Area = 0.154 ac, 10.37% Impervious, Inflow Depth = 5.97" for 100-Year event
Inflow = 1.1 cfs @ 12.09 hrs, Volume= 0.077 af
Primary = 1.1 cfs @ 12.09 hrs, Volume= 0.077 af, Atten= 0%, Lag= 0.0 min

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

Link 2L: Total to Street



SECTION 6.0

ADDITIONAL DRAINAGE CALCULATIONS

6.01 TSS Removal Calculations

TSS Removal Calculation Worksheet

Location: Thorndike Place, Arlington, MA

Project: 23407.00

BSC GROUP

Prepared By: E. Derrig

Date: 1/8/2021

AREA 1 - CB-1

Total Impervious Area, Acres= 0.251

A	B	C	D	E
BMP	TSS Removal Rate	Starting TSS Load*	Amount Removed (BxC)	Remaining Load (C-D)
Deep Sump and Hooded Catchbasins	0.25	1.00	0.25	0.75
Hydrodynamic Separator	0.7	0.75	0.53	0.23
Infiltration Basin	0.8	0.23	0.18	0.05

TSS Removal = 0.96

AREA 2 - TD-1

Total Impervious Area, Acres= 0.054

A	B	C	D	E
BMP	TSS Removal Rate	Starting TSS Load*	Amount Removed (BxC)	Remaining Load (C-D)
Hydrodynamic Separator	0.7	1.00	0.70	0.30

TSS Removal = 0.70

AREA 3 - TD-2

Total Impervious Area, Acres= 0.145

A	B	C	D	E
BMP	TSS Removal Rate	Starting TSS Load*	Amount Removed (BxC)	Remaining Load (C-D)
Hydrodynamic Separator	0.7	1.00	0.70	0.30
Infiltration Basin	0.8	0.30	0.24	0.06

TSS Removal = 0.94

AREA 4 - Bypass to Street

Total Impervious Area, Acres= 0.016

A	B	C	D	E
BMP	TSS Removal Rate	Starting TSS Load*	Amount Removed (BxC)	Remaining Load (C-D)
		1.00		

TSS Removal =

Weighted Annual Average TSS Removal Rate

[TSS Removal-1 (Area-1) + TSS Revoval-2 (Area-2)+ ….] / [Area-1 + Area-2 + ...] = 0.89

Project Site TSS Removal = 0.89

6.02 GROUNDWATER RECHARGE VOLUME CALCULATIONS

<u>Required Recharge Volume</u>

Rv = F x Impervious Area

Where:

Rv = Recharge Volume

F=Target Depth Factor associated with each Hydrologic Soil Group

(F=0.25-inch for Soil Type C)

Impervious Area = Proposed Pavement and Rooftop area on-site

$$Rv = \left(\frac{0.25in}{12}\right)(88{,}469sft) =$$

Rv = 1,844 cf (required recharge volume)

As not all impervious surfaces are directed to an infiltration BMP, an adjusted Required Volume must be provided. The adjusted Required Volume (Rva) is calculated as:

$$Rva = \frac{Total\ Imp.Area}{Imp.Area\ to\ BMP}\,(\mathrm{Rv}) =$$

$$Rva = \left(\frac{88{,}469sft}{75{,}677sft}\right)(1{,}844cf) =$$

$$Rva = 2{,}156\ cf$$

<u>Storage Provided</u>

- Underground Infiltration System = 7,948 cubic feet provided.
  Refer to the HydroCAD calculations provided for more information.

Stage-Area-Storage for Pond 1P: Underground Infiltration System

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
5.00	**5,134**	0
5.05	5,134	221
5.10	5,134	442
5.15	5,134	662
5.20	5,134	883
5.25	5,134	1,104
5.30	5,134	1,325
5.35	5,134	1,545
5.40	5,134	1,766
5.45	5,134	1,987
5.50	5,134	2,208
5.55	5,134	2,429
5.60	5,134	2,649
5.65	5,134	2,870
5.70	5,134	3,091
5.75	5,134	3,312
5.80	5,134	3,532
5.85	5,134	3,753
5.90	5,134	3,974
5.95	5,134	4,195
6.00	5,134	4,415
6.05	5,134	4,636
6.10	5,134	4,857
6.15	5,134	5,078
6.20	5,134	5,299
6.25	5,134	5,519
6.30	5,134	5,740
6.35	5,134	5,961
6.40	5,134	6,182
6.45	5,134	6,402
6.50	5,134	6,623
6.55	5,134	6,844
6.60	5,134	7,065
6.65	5,134	7,286
6.70	5,134	7,506
6.75	5,134	7,727
6.80	5,134	7,948
6.85	5,134	8,169
6.90	5,134	8,389
6.95	5,134	8,610
7.00	5,134	8,831
7.05	5,134	9,052
7.10	5,134	9,273
7.15	5,134	9,493
7.20	5,134	9,714
7.25	5,134	9,935
7.30	5,134	10,156
7.35	5,134	10,376
7.40	5,134	10,597
7.45	5,134	10,818
7.50	5,134	11,039
7.55	5,134	11,259
7.60	5,134	11,480
7.65	5,134	11,701
7.70	5,134	11,922
7.75	5,134	12,143
7.80	5,134	12,363
7.85	5,134	12,584
7.90	5,134	12,805
7.95	5,134	13,026
8.00	5,134	**13,246**

7,948 cu.ft. of storage below outlet at elevation 6.80

Drawdown Within 72-Hours

Rv = Required Recharge Volume, cu.ft. (see above)

K = Saturated Hydraulic Conductivity, in/hr (from Rawls Table)

Bottom Area = Area of Infiltration System Bottom, sq.ft.

$$Time = \frac{Rv}{(K)(Bottom\ Area)}$$

$$Time = \left(\frac{2{,}156\ cu.ft.}{(0.52in/hr)(5{,}134sq.ft.)}\right) =$$

$$Time = 9.7\ hours$$

- 9.7 hours < 72 hours

6.03 WATER QUALITY VOLUME CALCULATIONS

Water Quality Volume Calculation

V_{WQ} = (D_{WQ}/12 inches/foot) * (A_{IMP} square feet)

V_{WQ} = Required Water Quality Volume (in cubic feet)
D_{WQ} = Water Quality Depth: **0.5-inch**
A_{IMP} = Total Impervious Area (in acres) used for driveways, parking, etc.

Underground Infiltration Systems and Bio-Retention Areas

A_{IMP} = 88,469 sq.ft.

V_{WQ} = (0.5 inches/12 inches/foot) * (88,469 sq.ft.)

V_{WQ} = 3,686 cubic feet (required volume), provided volume = 7,948 cubic feet (refer to the HydroCAD calculations provided in groundwater recharge section)

6.04 RIP-RAP OUTLET PROTECTION SIZING

OUTLET PROTECTION SIZING

BSC GROUP

Project No.	23407.00	**Calc By**	EAD
Subject	Outlet Protection Sizing Calcs	**Date**	1/8/2021
Location	Arlington, MA	**Checked by**	DRR
		Date	1/8/2021

FES-1

Q=Design Discharge, (ft^3/s) = 2.6 cfs

D=Culvert Diameter, (ft) = 1.00 ft

TW=Tailwater Depth, (ft) = 0.4 ft, (0.4xD for unknow tailwater, or enter known tailwater)

(Tailwater depth is to be limited to between 0.4D and 1.0D)

Riprap Rock Sizing

$$D_{50} = 0.2D\left[\frac{Q}{\sqrt{g}D^{2.5}}\right]^{4/3}\left[\frac{D}{TW}\right]$$

g=32.2 fps

D_{50} = median rock size, ft

$$D_{50} = 0.28\left|\frac{2.60}{5.67}\right|^{(4/3)}\left|\frac{1.00}{0.40}\right| = 0.25 \text{ ft}$$

= 2.97 inches

Table 1 : Riprap Classes and Apron Dimensions

Class	D_{50} (in)	Apron Length	Apron Depth	
1	**5**	**4D**	**$3.5D_{50}$**	**Use Class 1**
2	6	4D	$3.5D_{50}$	
3	10	5D	$3.3D_{50}$	
4	14	6D	$2.2D_{50}$	
5	20	7D	$2.0D_{50}$	
6	22	8D	$2.0D_{50}$	

Apron Dimensions

Length, L=5D	=	**5 ft**	
Depth=$3.3D_{50}$	=	**16.50 Inches**	
Width=3D+(2/3)L	=	**6.33 ft**	(at apron end)

Riprap Rock Sizing Gradation

Given Size	Size of Stone, inches		
100	**8**	to	**10**
85	**7**	to	**9**
50	**5**	to	**8**
15	**3**	to	**7**

Reference Note: Sizing based in accordance with HEC #14 as required by MassHighway Design Manual

OUTLET PROTECTION SIZING

BSC GROUP

Project No.	23407.00	**Calc By**	EAD
Subject	Outlet Protection Sizing Calcs	**Date**	1/8/2021
Location	Arlington, MA	**Checked by**	DRR
		Date	1/8/2021

Roof Drain

Q=Design Discharge, (ft^3/s) = 1.8 cfs

D=Culvert Diameter, (ft) = 0.33 ft

TW=Tailwater Depth, (ft) = 0.133333 ft, (0.4xD for unknow tailwater, or enter known tailwater)

(Tailwater depth is to be limited to between 0.4D and 1.0D)

Riprap Rock Sizing

$$D_{50} = 0.2D\left[\frac{Q}{\sqrt{g}D^{2.5}}\right]^{4/3}\left[\frac{D}{TW}\right]$$

g=32.2 fps

D_{50} = median rock size, ft

$$D_{50} = 0.28\left|\frac{1.80}{0.36}\right|^{(4/3)}\left|\frac{0.33}{0.13}\right| = 5.90 \text{ ft}$$

= **70.76 inches**

Table 1 : Riprap Classes and Apron Dimensions

Class	D_{50} (in)	Apron Length	Apron Depth	
1	**5**	**4D**	**3.5D_{50}**	**Use Class 1**
2	6	4D	3.5D_{50}	
3	10	5D	3.3D_{50}	
4	14	6D	2.2D_{50}	
5	20	7D	2.0D_{50}	
6	22	8D	2.0D_{50}	

Apron Dimensions

Length, L=5D = **2 ft**

Depth=3.3D_{50} = **16.50 Inches**

Width=3D+(2/3)L = **2.11 ft** (at apron end)

Riprap Rock Sizing Gradation

Given Size	Size of Stone, inches		
100	**8**	to	**10**
85	**7**	to	**9**
50	**5**	to	**8**
15	**3**	to	**7**

Reference Note: Sizing based in accordance with HEC #14 as required by MassHighway Design Manual

6.05 GROUNDWATER MOUNDING ANALYSIS

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Outflow (cfs)	Discarded (cfs)	Primary (cfs)
12	0.2	101	5.02	0	0	0
12.01	0.2	106	5.02	0	0	0
12.02	0.2	111	5.03	0.1	0.1	0
12.03	0.2	117	5.03	0.1	0.1	0
12.04	0.2	123	5.03	0.1	0.1	0
12.05	0.3	129	5.03	0.1	0.1	0
12.06	0.3	137	5.03	0.1	0.1	0
12.07	0.3	144	5.03	0.1	0.1	0
12.08	0.3	152	5.03	0.1	0.1	0
12.09	0.3	160	5.04	0.1	0.1	0
14.5	0	123	5.03	0.1	0.1	0
14.51	0	122	5.03	0.1	0.1	0
14.52	0	121	5.03	0.1	0.1	0
14.53	0	120	5.03	0.1	0.1	0
14.54	0	119	5.03	0.1	0.1	0
14.55	0	118	5.03	0.1	0.1	0
14.56	0	117	5.03	0.1	0.1	0
14.57	0	117	5.03	0.1	0.1	0
14.58	0	116	5.03	0.1	0.1	0
14.59	0	115	5.03	0.1	0.1	0
14.6	0	114	5.03	0.1	0.1	0
14.61	0	113	5.03	0.1	0.1	0
14.62	0	112	5.03	0.1	0.1	0
14.63	0	112	5.03	0.1	0.1	0
14.64	0	111	5.03	0.1	0.1	0
14.65	0	110	5.02	0.1	0.1	0
14.66	0	109	5.02	0.1	0.1	0
14.67	0	109	5.02	0.1	0.1	0
14.68	0	108	5.02	0.1	0.1	0
14.69	0	107	5.02	0	0	0
14.7	0	106	5.02	0	0	0

Infiltration System

88469	Impervious Surface (sft)
0.050	Required recharge volume (acre-ft)
0.100	Average infiltration rate (cfs)
8640.00	Average infiltration rate (cft/day)
5134	System bottom area (sft) estimated at 93'x55.2'
1.683	Percoloation/application rate (ft/day)
12.02	Infiltration start time
14.68	Infiltration end time
2.66	Time (hrs)
0.111	Time (days)
1.04	Hydraulic conductivity (ft/day)
0.138	Specific yield
10	Initial saturated thickness (ft)
1.35	**Increase in hydraulic head (ft)**

Note that full tabular hydrograph not printed for brevity

Input Values

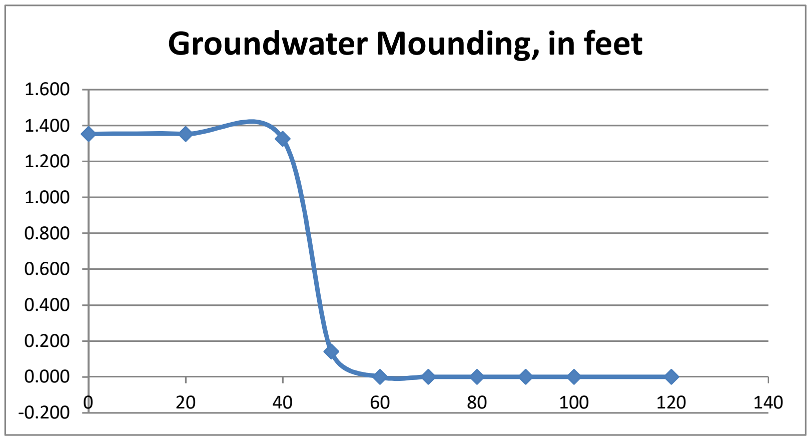
			inch/hour	feet/day
1.6830	*R*	Recharge (infiltration) rate (feet/day)	0.67	1.33
0.138	Sy	Specific yield, Sy (dimensionless, between 0 and 1)		
1.04	K	Horizontal hydraulic conductivity, Kh (feet/day)*	2.00	4.00
46.500	x	1/2 length of basin (x direction, in feet)		
27.600	y	1/2 width of basin (y direction, in feet)	hours	days
0.111	t	duration of infiltration period (days)	36	1.50
10.000	hi(0)	initial thickness of saturated zone (feet)		

In the repor
(USGS SIR 2(
(ft/d) is assu
hydraulic co

11.354	h(max)	maximum thickness of saturated zone (beneath center of basin at end of infiltration period)
1.354	Δh(max)	maximum groundwater mounding (beneath center of basin at end of infiltration period)

Ground-water Mounding, in feet	Distance from center of basin in x direction, in feet
1.354	0
1.354	20
1.326	40
0.141	50
0.001	60
0.000	70
0.000	80
0.000	90
0.000	100
0.000	120

Re-Calculate Now



Disclaimer

This spreadsheet solving the Hantush (1967) equation for ground-water mounding beneath an infiltration basin is made available to the general public as a convenience for those wishing to replicate values documented in the USGS Scientific Investigations Report 2010-5102 "Groundwater mounding beneath hypothetical stormwater infiltration basins" or to calculate values based on user-specified site conditions. Any changes made to the spreadsheet (other than values identified as user-specified) after transmission from the USGS could have unintended, undesirable consequences. These consequences could include, but may not be limited to: erroneous output, numerical instabilities, and violations of underlying assumptions that are inherent in results presented in the accompanying USGS published report. The USGS assumes no responsibility for the consequences of any changes made to the spreadsheet. If changes are made to the spreadsheet, the user is responsible for documenting the changes and justifying the results and conclusions.

6.06 ILLICIT DISCHARGE COMPLIANCE STATEMENT

Illicit Discharge Compliance Statement

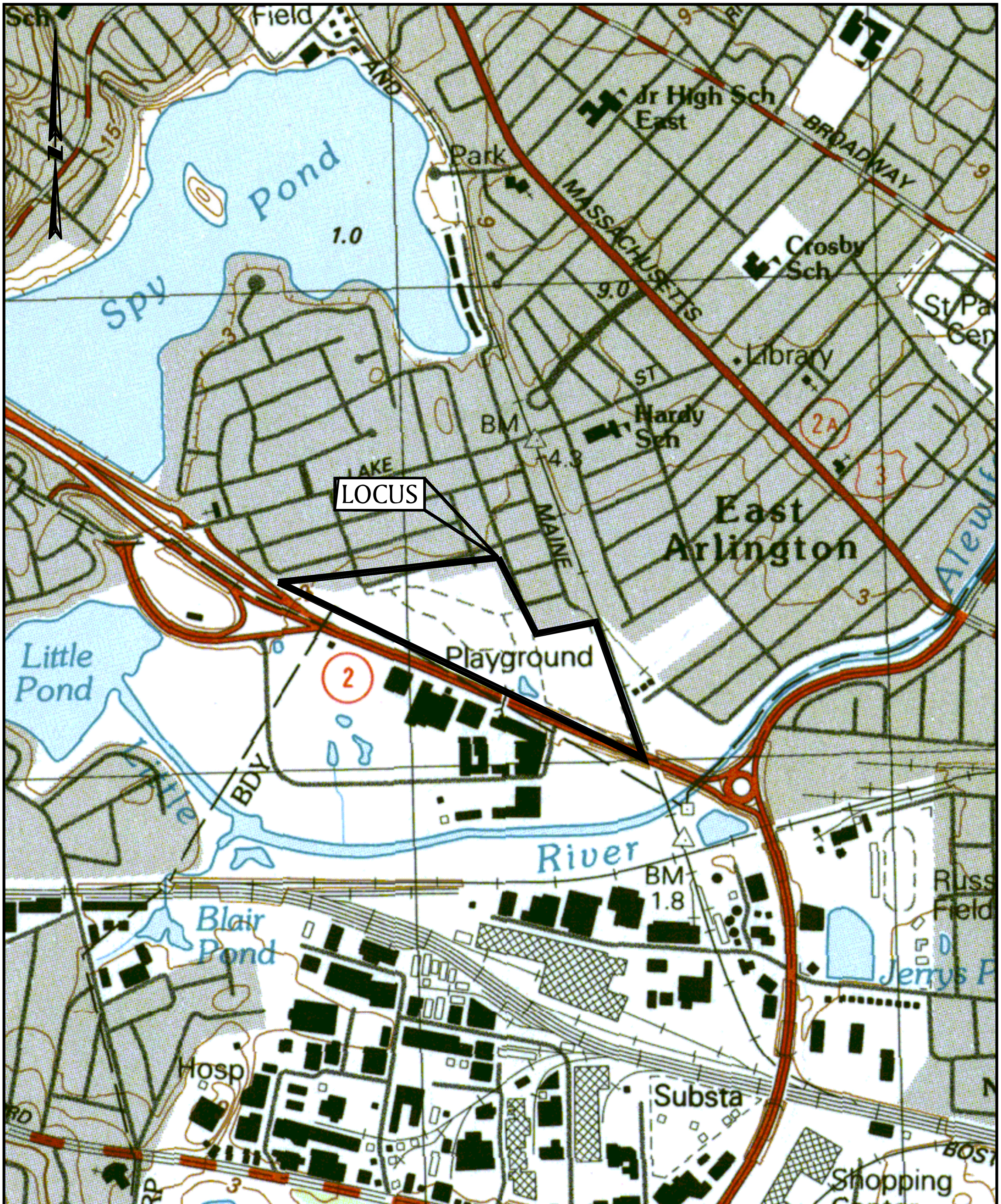
This statement is to document that, to the best of my knowledge and belief, there are no and will be no illicit discharges to the stormwater management systems or protected wetland resource areas for the Thorndike Place residential development on Dorothy Road in Arlington, Massachusetts.

____
Authorized Signature/Title

____
Date

APPENDIX A

USGS LOCUS MAP



PREPARED FOR: ARLINGTON LAND REALTY, LLC 84 SHERMAN ST, 2ND FLOOR CAMBRIDGE, MA 02140	USGS LOCUS MAP	BSC GROUP 803 Summer Street Boston, Massachusetts 02127 617 896 4300
	THORNDIKE PLACE DOROTHY ROAD ARLINGTON, MA	Job No.: 23407.00 Date: 11/3/2020 Scale: 1"=1,000' Revised: Dwg. No: Figure: 1 OF 1

File: 2340700\C\Drainage\2340700-EX WATERSHED

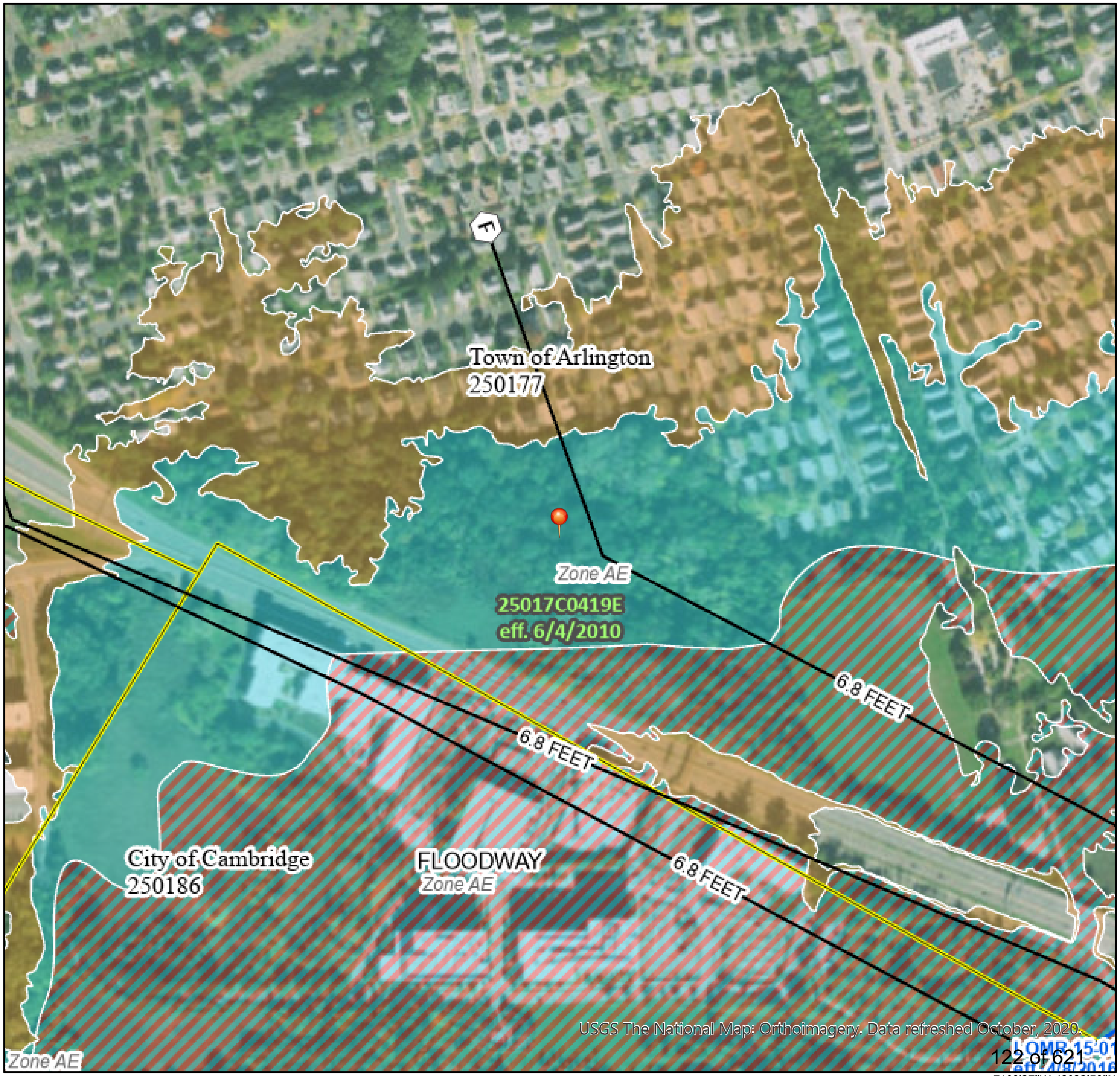
APPENDIX B

FEMA MAP

National Flood Hazard Layer FIRMette

FEMA

71°9'15"W 42°24'17"N



71°8'37"W 42°23'50"N

Feet

0 250 500 1,000 1,500 2,000

1:6,000

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 / 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
- Coastal Transect
- 513 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 11/2/2020 at 3:34 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

WEB SOIL SURVEY

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for
Middlesex County, Massachusetts

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Soil Map

Map Scale: 1:4,500 if printed on A landscape (11" x 8.5") sheet.

Meters: 0, 50, 100, 200, 300

Feet: 0, 200, 400, 800, 1200

N

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

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Map Unit Polygons

Soil Map Unit Lines

Soil Map Unit Points

Special Point Features

Blowout

Borrow Pit

Clay Spot

Closed Depression

Gravel Pit

Gravelly Spot

Landfill

Lava Flow

Marsh or swamp

Mine or Quarry

Miscellaneous Water

Perennial Water

Rock Outcrop

Saline Spot

Sandy Spot

Severely Eroded Spot

Sinkhole

Slide or Slip

Sodic Spot

Spoil Area

Stony Spot

Very Stony Spot

Wet Spot

Other

Special Line Features

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: Middlesex County, Massachusetts
Survey Area Data: Version 20, Jun 9, 2020

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

Date(s) aerial images were photographed: Sep 11, 2019—Oct 5, 2019

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
51A	Swansea muck, 0 to 1 percent slopes	4.3	4.6%
52A	Freetown muck, 0 to 1 percent slopes	10.4	11.2%
603	Urban land, wet substratum	32.1	34.5%
626B	Merrimac-Urban land complex, 0 to 8 percent slopes	14.3	15.4%
655	Udorthents, wet substratum	31.9	34.3%
Totals for Area of Interest		**92.9**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Middlesex County, Massachusetts

51A—Swansea muck, 0 to 1 percent slopes

Map Unit Setting

National map unit symbol: 2trl2
Elevation: 0 to 1,140 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Swansea and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Swansea

Setting

Landform: Swamps, bogs
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Highly decomposed organic material over loose sandy and gravelly glaciofluvial deposits

Typical profile

Oa1 - 0 to 24 inches: muck
Oa2 - 24 to 34 inches: muck
Cg - 34 to 79 inches: coarse sand

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.14 to 14.17 in/hr)
Depth to water table: About 0 to 6 inches
Frequency of flooding: Rare
Frequency of ponding: Frequent
Available water capacity: Very high (about 16.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8w
Hydrologic Soil Group: B/D
Ecological site: F144AY043MA - Acidic Organic Wetlands
Hydric soil rating: Yes

Minor Components

Freetown

Percent of map unit: 10 percent
Landform: Bogs, swamps

Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Whitman

Percent of map unit: 5 percent
Landform: Depressions, drainageways
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Scarboro

Percent of map unit: 5 percent
Landform: Drainageways, depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope, tread, dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

52A—Freetown muck, 0 to 1 percent slopes

Map Unit Setting

National map unit symbol: 2t2q9
Elevation: 0 to 1,110 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Freetown and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Freetown

Setting

Landform: Depressions, depressions, bogs, marshes, kettles, swamps
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread, dip
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Highly decomposed organic material

Typical profile

Oe - 0 to 2 inches: mucky peat
Oa - 2 to 79 inches: muck

Properties and qualities

Slope: 0 to 1 percent
Surface area covered with cobbles, stones or boulders: 0.0 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.14 to 14.17 in/hr)
Depth to water table: About 0 to 6 inches
Frequency of flooding: Rare
Frequency of ponding: Frequent
Available water capacity: Very high (about 19.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: B/D
Ecological site: F144AY043MA - Acidic Organic Wetlands
Hydric soil rating: Yes

Minor Components

Swansea

Percent of map unit: 5 percent
Landform: Kettles, depressions, depressions, marshes, swamps, bogs
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread, dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Scarboro

Percent of map unit: 5 percent
Landform: Depressions, drainageways
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope, tread, dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Whitman

Percent of map unit: 5 percent
Landform: Depressions, drainageways
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

603—Urban land, wet substratum

Map Unit Setting

National map unit symbol: 9951
Mean annual precipitation: 32 to 50 inches
Mean annual air temperature: 45 to 50 degrees F
Frost-free period: 110 to 200 days
Farmland classification: Not prime farmland

Map Unit Composition

Urban land: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Urban Land

Setting

Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Excavated and filled land over alluvium and/or marine deposits

Minor Components

Udorthents, loamy

Percent of map unit: 10 percent
Hydric soil rating: No

Rock outcrop

Percent of map unit: 5 percent
Landform: Ledges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Head slope
Down-slope shape: Concave
Across-slope shape: Concave

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

Map Unit Setting

National map unit symbol: 2tyr9
Elevation: 0 to 820 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F

Frost-free period: 140 to 250 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Merrimac

Setting

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

Typical profile

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

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to very high (1.42 to 99.90 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 2 percent
Maximum salinity: Nonsaline (0.0 to 1.4 mmhos/cm)
Sodium adsorption ratio, maximum: 1.0
Available water capacity: Low (about 4.6 inches)

Interpretive groups

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

Description of Urban Land

Typical profile

M - 0 to 10 inches: cemented material

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: 0 inches to manufactured layer

Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 to 0.00 in/hr)
Available water capacity: Very low (about 0.0 inches)

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

Minor Components

Windsor
Percent of map unit: 5 percent
Landform: Dunes, outwash terraces, deltas, outwash plains
Landform position (three-dimensional): Tread, riser
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear
Hydric soil rating: No

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

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

655—Udorthents, wet substratum

Map Unit Setting
National map unit symbol: vr1n
Elevation: 0 to 3,000 feet
Mean annual precipitation: 32 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 110 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Udorthents, wet substratum, and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Udorthents, Wet Substratum

Setting

Parent material: Loamy alluvium and/or sandy glaciofluvial deposits and/or loamy glaciolacustrine deposits and/or loamy marine deposits and/or loamy basal till and/or loamy lodgment till

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: More than 80 inches
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None

Minor Components

Urban land

Percent of map unit: 8 percent
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear

Freetown

Percent of map unit: 4 percent
Landform: Depressions, bogs
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Swansea

Percent of map unit: 3 percent
Landform: Bogs, depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

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APPENDIX D

TEST PIT LOGS

Commonwealth of Massachusetts
City/Town of Arlington

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

A. Facility Information

Arlington Land Realty, LLC
Owner Name

Dorothy Road
Street Address

16-8-2, 16-8-3, 16-8-4, 16-8-5, 16-8-6, 16-8-7A
Map/Lot #

Arlington
City

MA
State

02474
Zip Code

B. Site Information

1. (Check one) ☒ New Construction ☐ Upgrade ☐ Repair

2. Soil Survey Available? ☒ Yes ☐ No If yes: Web Soil Survey (Source) 655, 51A (Soil Map Unit)

   Udorthents, Swansea Muck
   Soil Name

   Fill throughout site; clay base layer in one test pit
   Soil Limitations

   Glaciofluvial deposit
   Soil Parent material

   Depression
   Landform

3. Surficial Geological Report Available? ☒ Yes ☐ No If yes: 2018/USGS (Year Published/Source) Glaciomarine fine deposits, stagnant ice deposits (Map Unit)

   fine/very fine sand down to very fine sand, silt, silty clay, and clay
   Description of Geologic Map Unit:

4. Flood Rate Insurance Map Within a regulatory floodway? ☐ Yes ☒ No

5. Within a velocity zone? ☐ Yes ☒ No

6. Within a Mapped Wetland Area? ☒ Yes ☐ No If yes, MassGIS Wetland Data Layer: Shallow marsh meadow (Wetland Type)

7. Current Water Resource Conditions (USGS): 11/25/2020 (Month/Day/ Year) Range: ☒ Above Normal ☐ Normal ☐ Below Normal

8. Other references reviewed: Not in Zone I, II, or IWPA (OLIVER)

Commonwealth of Massachusetts
City/Town of Arlington

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 #) 11/25/2020 (Date) 7:45 AM (Time) Cloudy, 30deg (Weather) 42.40 N (Latitude) 71.15 W (Longitude:)

1. Land Use Woodland adjacent to residential/highway (e.g., woodland, agricultural field, vacant lot, etc.) Forest (Vegetation) Some large boulders (Surface Stones (e.g., cobbles, stones, boulders, etc.)) 0-2% (Slope (%))

   Description of Location: ______

2. Soil Parent Material: Glaciofluvial deposits Depression (Landform) SU (Position on Landscape (SU, SH, BS, FS, TS))

3. Distances from: Open Water Body >100 feet Drainage Way >100 feet Wetlands >100 feet
   Property Line >100 feet Drinking Water Well >100 feet Other ____ feet

4. Unsuitable Materials Present: ☒ Yes ☐ No If Yes: ☐ Disturbed Soil ☒ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☒ Yes ☐ No If yes: 108" Depth Weeping from Pit 108" Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0"-10	A	SL	7.5YR 2.5/1	--	--	--	0	0	massive	friable	
10"-36"	B (fill)	gravelly sandy loam	10YR 3/3	--	--	--	10	2-4	massive	very friable	
36"-48"											
48"-108"	C1 (fill)	gravelly sandy loam	10YR 2/1	--	--	--	15-20	4-6	massive	very friable	
36"-78"	C2 (fill)	loamy sand	10YR 5/4	--	--	--	0	0	single grain	loose	sandy layer (only on E side of test pit)
78"-108"	2C2 (fill)	gravelly sandy loam	10YR 2/1	--	--	--	15-20	4-6	massive	very friable	gravelly layer below sandy layer on E side of test pit

Additional Notes:
Elevation of TP-1 = 12.0. Groundwater at bottom of test pit (9' - elevation 3.0). Test pit mostly fill

Commonwealth of Massachusetts
City/Town of Arlington

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 #) 11/25/2020 8:45AM (Time) Cloudy, 35deg (Weather) 42.40 N (Latitude) 71.15 W (Longitude:)

1. Land Use: Woodland adjacent to residential/highway (e.g., woodland, agricultural field, vacant lot, etc.) Forest (Vegetation) Some large boulders around (Surface Stones (e.g., cobbles, stones, boulders, etc.)) 0-2% (Slope (%))

Description of Location: ______

2. Soil Parent Material: Glaciofluvial deposits Depression (Landform) SU (Position on Landscape (SU, SH, BS, FS, TS))

3. Distances from: Open Water Body >100 feet Drainage Way >100 feet Wetlands >100 feet
Property Line >100 feet Drinking Water Well >100 feet Other ______ feet

4. Unsuitable Materials Present: ☒ Yes ☐ No If Yes: ☐ Disturbed Soil ☒ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☒ No If yes: ______ Depth Weeping from Pit ______ Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA)	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-7	A	sandy loam	10YR 2.5/1	--	--	--	0	0	massive	friable	
7-132	C (fill)	gravelly sandy loam	10YR 3/2	--	--	--	15-20	4-6	massive	friable	

Additional Notes:
Elevation of TP-2 = 11.2. Estimated groundwater elevation (to bottom of test pit) = 0.2. Fill throughout test pit. No groundwater observed

Commonwealth of Massachusetts
City/Town of Arlington

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

D. Determination of High Groundwater Elevation

1. Method Used:

	Obs. Hole # TP-1	Obs. Hole # TP-2
☒ Depth observed standing water in observation hole	108 inches	_____ inches
☐ Depth weeping from side of observation hole	_____ inches	_____ inches
☐ Depth to soil redoximorphic features (mottles)	_____ inches	_____ inches
☐ Depth to adjusted seasonal high groundwater (S_h) (USGS methodology)	_____ inches	_____ inches

Index Well Number ______________ Reading Date ______________

$S_h = S_c – [S_r \times (OW_c – OW_{max})/OW_r]$

Obs. Hole/Well# _____ S_c _____ S_r _____ OW_c _____ OW_{max} _____ OW_r _____ S_h _____

2. Estimated Depth to High Groundwater: 108 inches

E. Depth of Pervious Material

1. Depth of Naturally Occurring Pervious Material

a. Does at least four feet of naturally occurring pervious material exist in all areas observed throughout the area proposed for the soil absorption system?

☐ Yes ☒ No

b. If yes, at what depth was it observed (exclude A and O Horizons)? Upper boundary: _____ inches Lower boundary: _____ inches

c. If no, at what depth was impervious material observed? Upper boundary: 108 inches Lower boundary: >108 (fill material) inches

Commonwealth of Massachusetts
City/Town of Arlington

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.

	11/25/2020
Signature of Soil Evaluator	Date
Emily Derrig SE14158	12/1/2020
Typed or Printed Name of Soil Evaluator / License #	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:

Commonwealth of Massachusetts
City/Town of Arlington

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

A. Facility Information

Arlington Land Realty, LLC
Owner Name

Dorothy Road
Street Address

16-8-2, 16-8-3, 16-8-4, 16-8-5, 16-8-6, 16-8-7A
Map/Lot #

Arlington
City

MA
State

02474
Zip Code

B. Site Information

1. (Check one) ☒ New Construction ☐ Upgrade ☐ Repair

2. Soil Survey Available? ☒ Yes ☐ No If yes: Web Soil Survey (Source) 655, 51A (Soil Map Unit)

   Udorthents, Swansea Muck
   Soil Name

   Fill throughout site; clay base layer in one test pit
   Soil Limitations

   Glaciofluvial deposit
   Soil Parent material

   Depression
   Landform

3. Surficial Geological Report Available? ☒ Yes ☐ No If yes: 2018/USGS (Year Published/Source) Glaciomarine fine deposits, stagnant ice deposits (Map Unit)

   fine/very fine sand down to very fine sand, silt, silty clay, and clay
   Description of Geologic Map Unit:

4. Flood Rate Insurance Map Within a regulatory floodway? ☐ Yes ☒ No

5. Within a velocity zone? ☐ Yes ☒ No

6. Within a Mapped Wetland Area? ☒ Yes ☐ No If yes, MassGIS Wetland Data Layer: Shallow marsh meadow (Wetland Type)

7. Current Water Resource Conditions (USGS): 11/25/2020 (Month/Day/ Year) Range: ☒ Above Normal ☐ Normal ☐ Below Normal

8. Other references reviewed: Not in Zone I, II, or IWPA (OLIVER)

Commonwealth of Massachusetts
City/Town of Arlington

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 #) 11/25/2020 (Date) 9:45 AM (Time) Cloudy, 40deg (Weather) 42.40 N (Latitude) 71.15 W (Longitude:)

1. Land Use: Woodland adjacent to residential/highway (e.g., woodland, agricultural field, vacant lot, etc.) Forest (Vegetation) Some large boulders (Surface Stones (e.g., cobbles, stones, boulders, etc.)) 0-2% (Slope (%))

   Description of Location: ______

2. Soil Parent Material: Glaciofluvial deposits Depression (Landform) FS (Position on Landscape (SU, SH, BS, FS, TS))

3. Distances from: Open Water Body >100 feet Drainage Way >100 feet Wetlands >100 feet
   Property Line >100 feet Drinking Water Well >100 feet Other ______ feet

4. Unsuitable Materials Present: ☒ Yes ☐ No If Yes: ☐ Disturbed Soil ☒ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☒ Yes ☐ No If yes: 84" Depth Weeping from Pit 144" 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"-8"	A	SL	10YR 2/1	--	--	--	0	0	massive	very friable	
8"-84"	B	SL	7.5YR 2.5/2	36"	7.5YR 5/8	2-4%	2-4	0	massive	friable	
84"-108"	C1	Sandy Clay Loam	10YR 2/1	--	--	--	0	0	massive	firm	
108"-144"	C2	Clay	GLEY 2 4/5B	--	--	--	0	0	massive	very firm	

Additional Notes:
TP-3 Elevation = 6.5. Groundwater observed at bottom of test pit (12') and weeping from sides at 7' - estimated groundwater elevation = -0.5

Commonwealth of Massachusetts
City/Town of Arlington

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: ______ Hole # ______ Date ______ Time ______ Weather ______ Latitude ______ Longitude:

1. Land Use: ______ (e.g., woodland, agricultural field, vacant lot, etc.) ______ Vegetation ______ Surface Stones (e.g., cobbles, stones, boulders, etc.) ______ Slope (%)

   Description of Location: ______

2. Soil Parent Material: ______ ______ Landform ______ Position on Landscape (SU, SH, BS, FS, TS)

3. Distances from: Open Water Body ______ feet Drainage Way ______ feet Wetlands ______ feet
   Property Line ______ feet Drinking Water Well ______ feet Other ______ feet

4. Unsuitable Materials Present: ☐ Yes ☐ No If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☐ No If yes: ______ Depth Weeping from Pit ______ Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA)	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			

Additional Notes:

______

Commonwealth of Massachusetts
City/Town of Arlington

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

D. Determination of High Groundwater Elevation

1. Method Used:

	Obs. Hole # TP-3	Obs. Hole # _____
☒ Depth observed standing water in observation hole	132 inches	_____ inches
☒ Depth weeping from side of observation hole	84 inches	_____ inches
☐ Depth to soil redoximorphic features (mottles)	_____ inches	_____ inches
☐ Depth to adjusted seasonal high groundwater (S_h) (USGS methodology)	_____ inches	_____ inches

Index Well Number ______________________ Reading Date ______________________

$S_h = S_c - [S_r \times (OW_c - OW_{max})/OW_r]$

Obs. Hole/Well# _____ S_c _____ S_r _____ OW_c _____ OW_{max} _____ OW_r _____ S_h _____

2. Estimated Depth to High Groundwater: 84 inches

E. Depth of Pervious Material

1. Depth of Naturally Occurring Pervious Material

a. Does at least four feet of naturally occurring pervious material exist in all areas observed throughout the area proposed for the soil absorption system?

☐ Yes ☒ No

b. If yes, at what depth was it observed (exclude A and O Horizons)? Upper boundary: _____ inches Lower boundary: _____ inches

c. If no, at what depth was impervious material observed? Upper boundary: 84 inches Lower boundary: 132 inches

Commonwealth of Massachusetts
City/Town of Arlington

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

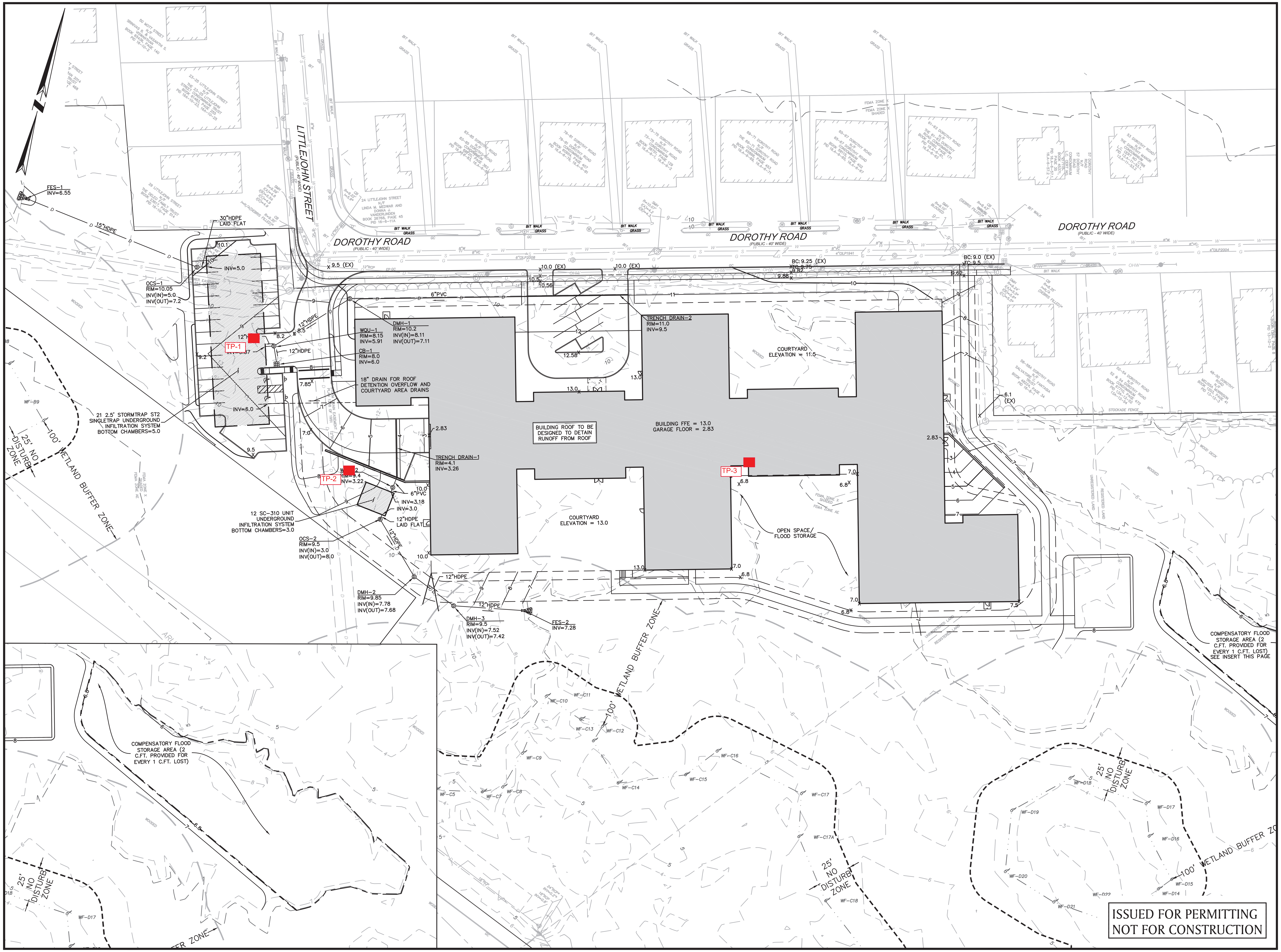
F. Certification

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.

	11/25/2020
Signature of Soil Evaluator	Date
Emily Derrig SE14158	12/1/2020
Typed or Printed Name of Soil Evaluator / License #	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:



ISSUED FOR PERMITTING
NOT FOR CONSTRUCTION

PROFESSIONAL ENGINEER

DATE

THORNDIKE PLACE

DOROTHY ROAD

IN

ARLINGTON
MASSACHUSETTS
(MIDDLESEX COUNTY)

GRADING &
DRAINAGE PLAN

MARCH 13, 2020

REVISIONS:

NO.	DATE	DESC.
1	9/18/20	NEW BUILDING FOOTPRINT
2	10/22/20	WETLAND DELINEATION
3	11/03/20	REVISED BUILDING

PREPARED FOR:
ARLINGTON LAND REALTY, LLC
84 SHERMAN STREET, 2ND FLOOR
CAMBRIDGE, MA 02140

BSC GROUP
803 Summer Street
Boston, Massachusetts
02127
617 896 4300

SCALE: 1" = 30'

FILE: \Civil_Drawings\2340700-GR
DWG.:
JOB. NO: 23407.00
SHEET C-105

APPENDIX E

NORTHEAST REGIONAL CLIMATE CENTER EXTREME PRECIPITATION TABLES FOR PROJECT SITE

Extreme Precipitation Tables

Northeast Regional Climate Center

Data represents point estimates calculated from partial duration series. All precipitation amounts are displayed in inches.

Smoothing	Yes
State	Massachusetts
Location	
Longitude	71.149 degrees West
Latitude	42.401 degrees North
Elevation	0 feet
Date/Time	Mon, 02 Nov 2020 12:25:10 -0500

Extreme Precipitation Estimates

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.28	0.43	0.53	0.70	0.87	1.10	**1yr**	0.75	1.04	1.28	1.63	2.09	2.69	2.94	**1yr**	2.38	2.83	3.29	3.98	4.65	**1yr**
2yr	0.35	0.54	0.67	0.88	1.11	1.40	**2yr**	0.96	1.28	1.62	2.04	2.57	3.23	3.59	**2yr**	2.86	3.45	3.95	4.70	5.35	**2yr**
5yr	0.42	0.65	0.81	1.09	1.39	1.77	**5yr**	1.20	1.61	2.06	2.60	3.26	4.09	4.56	**5yr**	3.62	4.38	5.00	5.97	6.69	**5yr**
10yr	0.47	0.74	0.93	1.27	1.65	2.12	**10yr**	1.42	1.91	2.47	3.12	3.92	4.90	5.47	**10yr**	4.33	5.26	5.99	7.15	7.92	**10yr**
25yr	0.56	0.89	1.13	1.56	2.06	2.67	**25yr**	1.78	2.40	3.13	3.96	4.98	6.20	6.96	**25yr**	5.49	6.69	7.59	9.10	9.91	**25yr**
50yr	0.63	1.01	1.30	1.82	2.45	3.21	**50yr**	2.12	2.86	3.77	4.78	5.98	7.43	8.36	**50yr**	6.57	8.03	9.08	10.92	11.75	**50yr**
100yr	0.73	1.18	1.52	2.14	2.92	3.84	**100yr**	2.52	3.40	4.52	5.73	7.17	8.89	10.04	**100yr**	7.87	9.65	10.88	13.10	13.94	**100yr**
200yr	0.83	1.36	1.76	2.52	3.47	4.60	**200yr**	2.99	4.05	5.43	6.89	8.61	10.65	12.07	**200yr**	9.43	11.60	13.03	15.73	16.54	**200yr**
500yr	1.01	1.65	2.16	3.13	4.37	5.83	**500yr**	3.77	5.11	6.90	8.77	10.97	13.54	15.40	**500yr**	11.98	14.81	16.55	20.05	20.75	**500yr**

Lower Confidence Limits

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.25	0.38	0.46	0.62	0.76	0.85	**1yr**	0.66	0.83	1.15	1.44	1.78	2.44	2.50	**1yr**	2.16	2.41	2.93	3.53	4.05	**1yr**
2yr	0.33	0.51	0.63	0.85	1.05	1.26	**2yr**	0.91	1.23	1.45	1.91	2.48	3.13	3.47	**2yr**	2.77	3.33	3.82	4.53	5.18	**2yr**
5yr	0.39	0.60	0.75	1.02	1.30	1.51	**5yr**	1.12	1.47	1.73	2.24	2.89	3.77	4.18	**5yr**	3.34	4.02	4.59	5.47	6.17	**5yr**
10yr	0.44	0.67	0.83	1.16	1.50	1.73	**10yr**	1.29	1.69	1.95	2.53	3.24	4.35	4.83	**10yr**	3.85	4.65	5.27	6.29	7.01	**10yr**
25yr	0.50	0.77	0.95	1.36	1.79	2.05	**25yr**	1.54	2.00	2.31	2.96	3.78	5.23	5.82	**25yr**	4.63	5.60	6.31	7.52	8.29	**25yr**
50yr	0.56	0.85	1.06	1.52	2.05	2.35	**50yr**	1.77	2.30	2.61	3.34	4.24	5.99	6.70	**50yr**	5.30	6.44	7.22	8.60	9.39	**50yr**
100yr	0.63	0.95	1.18	1.71	2.35	2.68	**100yr**	2.03	2.62	2.96	3.62	4.77	6.89	7.70	**100yr**	6.10	7.41	8.27	9.79	10.65	**100yr**
200yr	0.70	1.06	1.34	1.94	2.71	3.06	**200yr**	2.34	2.99	3.36	4.05	5.37	7.91	8.86	**200yr**	7.00	8.52	9.46	11.12	12.03	**200yr**
500yr	0.82	1.23	1.58	2.29	3.26	3.65	**500yr**	2.81	3.57	3.97	4.70	6.29	9.50	10.64	**500yr**	8.41	10.23	11.30	13.12	14.12	**500yr**

Upper Confidence Limits

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.31	0.48	0.58	0.79	0.97	1.13	**1yr**	0.83	1.11	1.32	1.77	2.25	2.86	3.17	**1yr**	2.53	3.05	3.51	4.29	5.03	**1yr**
2yr	0.36	0.56	0.69	0.94	1.15	1.36	**2yr**	1.00	1.33	1.57	2.08	2.68	3.35	3.74	**2yr**	2.97	3.59	4.11	4.89	5.55	**2yr**
5yr	0.45	0.70	0.86	1.19	1.51	1.79	**5yr**	1.30	1.75	2.05	2.66	3.39	4.44	5.00	**5yr**	3.93	4.81	5.43	6.48	7.21	**5yr**
10yr	0.55	0.84	1.05	1.46	1.89	2.20	**10yr**	1.63	2.15	2.55	3.22	4.07	5.51	6.25	**10yr**	4.88	6.01	6.72	8.04	8.83	**10yr**
25yr	0.71	1.08	1.35	1.92	2.53	2.90	**25yr**	2.19	2.83	3.39	4.16	5.17	7.32	8.42	**25yr**	6.48	8.09	8.92	10.74	11.56	**25yr**
50yr	0.86	1.31	1.64	2.35	3.17	3.59	**50yr**	2.73	3.51	4.21	5.05	6.22	9.08	10.54	**50yr**	8.04	10.14	11.04	13.40	14.18	**50yr**
100yr	1.06	1.60	2.00	2.89	3.96	4.42	**100yr**	3.42	4.32	5.22	6.37	7.47	11.28	13.22	**100yr**	9.98	12.71	13.68	16.75	17.43	**100yr**
200yr	1.29	1.94	2.45	3.55	4.95	5.46	**200yr**	4.27	5.34	6.49	7.78	8.96	14.02	16.60	**200yr**	12.41	15.96	16.97	20.95	21.46	**200yr**
500yr	1.68	2.50	3.21	4.67	6.63	7.20	**500yr**	5.72	7.04	8.66	10.14	11.41	18.71	22.44	**500yr**	16.56	21.58	22.57	28.20	28.29	**500yr**

Powered by ACIS
Northeast Regional Climate Center

BSC GROUP
Transportation ▪ Energy ▪ Land Development

803 Summer Street
Boston, MA 02127

Tel: 617-896-4300

www.bscgroup.com

January 22, 2021

Jenny Raitt, Director
Department of Planning and Community Development
Town of Arlington
50 Pleasant Street
Arlington, Massachusetts 02476

RE: Response 1 to Peer Review Comments – Stormwater Management
Thorndike Place Comprehensive Permit Application

Dear Ms. Raitt:

On behalf of the Applicant, Arlington Land Realty LLC, BSC Group, Inc. (BSC) is pleased to provide the following written responses to peer review comments as well as the attached supplemental and revised design documents for the Thorndike Place residential project on Dorothy Road in Arlington, Massachusetts. This letter responds to comments provided by BETA Group, Inc. (BETA) in a letter to you dated November 20, 2020 as well as comments provided by Mr. Wayne Chouinard, Town Engineer in a memorandum to you dated December 4, 2020. Please note that this letter is only responding to comments from both parties regarding stormwater management for the project. Other elements of the project for which BETA and/or Mr. Chouinard provided comments will be addressed under separate cover. The section headings and comment numbers below correspond to the original November 20, 2020 comments from BETA followed by the December 4, 2020 memorandum from Mr. Chouinard. For clarity, we have repeated original comments in standard text and then provided a summary of our response in italics.

Site Plans

1. The proposed erosion control barrier is shown on the Site Preparation plan only.

   Recommendation: The applicant should also show the erosion control barrier on the Layout, Grading and Utility Plans.

   Response: The erosion control barriers have been added to the Layout, Grading, and Utility Plans. The revised Grading & Drainage Plan is enclosed. The other plans will be submitted under separate cover.

4. General – The applicant proposes to provide stormwater detention/retention on the building roof. The applicant should provide design plans/calcs of the proposed building roof (when developed) for review by an architect and/or structural engineer.

   Response: Runoff calculations have been revised to include discharge from the roof detention system in all storms analyzed. This overflow will be at a controlled rate and will flow into the underground infiltration system in the parking lot west of the building. The detailed design of the rooftop detention will be provided as the architectural and plumbing construction plans are developed. In addition, approximately 9,000 square feet

Engineers
Environmental Scientists
Custom Software Developers
Landscape Architects
Planners
Surveyors

of the southeast corner of the building roof will discharge directly to the surface through a roof drain. Please see the enclosed, revised Stormwater Report for additional information and calculations.

5. The applicant proposed a subsurface "Stormtrap" infiltration chamber system on the west side of the project site. The proposed system is located directly on top of an existing 14-inch sewer line. This presents a potential issue regarding accessing the existing sewer line for future maintenance or repair requirements.

   Recommendation: The Applicant should confirm with the Arlington Public Works and/or Sewer Department that the proposed location of the infiltration system is acceptable.

   Response: The system in question has been relocated south of the sewer line to allow Town access should it be needed. Please refer to the enclosed revised Grading & Drainage Plan.

6. Grading and Drainage Plan – The proposed 15-inch drainpipe from OCS-1 to FES-1 has minimal cover.

   Recommendation: The applicant should revise the proposed grading in this area to provide adequate cover over the proposed drain.

   Response: This pipe has been reduced in size to 12-inch HDPE and the grading as proposed provides sufficient cover. Please see the enclosed revised Grading & Drainage Plan.

9. Civil and Landscape Details (sheet 1) – The applicant has provided a Silt fence with Haybales erosion control barrier detail.

   Recommendation: The applicant should utilize an 18-inch diameter compost-filled silt sock with silt fence in lieu of staked haybales for erosion control measures.

   Response: The perimeter erosion controls have been revised as recommended and are shown on the enclosed revised Site Preparation Plan and Grading & Drainage Plan. A detail of the 18-inch diameter compost-filled silt sock with silt fence has been added to the enclosed Civil and Landscape Details (Sheet C-200).

10. The applicant should provide a detail of the proposed Outlet Control Structures #1 and #2. Also, the applicant should review OCS-2 as it appears that the structure is too shallow to be constructed as shown.

    Response: The revised stormwater management system only includes one outlet control structure (OCS, previously designated at OCS-2), as shown on the revised Grading & Drainage Plan. This structure is a 6-foot diameter manhole with an outlet pipe higher than the inlet pipe. A detail has been added to the enclosed Civil & Landscape Details Sheet C-203...

12. Recommend the applicant confirm that any footing of the proposed retaining wall near the driveway garage entrance will not conflict with the existing drainage pipe located in the same area.

    Response: The garage ramp retaining wall and associated grading have been revised to eliminate any potential conflict with the existing drainage pipe and is shown on the revised Grading & Drainage Plan.

Stormwater Management

14. The Applicant should provide onsite soil exploration / test pit data for review, specifically within the footprints of the two proposed subsurface infiltration chamber systems. The test pit data is required at a minimum to determine the seasonal high groundwater elevations within the project limits.

    Response: In November 2020, BSC performed three soil test pits on site. The results of these test pits confirmed the soils mapping and previously performed borings with regard to seasonal high groundwater. Locations of the test pits are shown on the enclosed revised Grading & Drainage Plan. Test pit logs are included in Appendix D and more detailed information is provided in Section 1.02 of the revised Stormwater Report.

15. The proposed site building roof will be designed to provide stormwater detention, with a roof drain connection to the proposed subsurface infiltration chamber system #1 located west of the building. The HydroCAD model included with the Stormwater Report shows zero runoff leaving the roof area for all storms up to and including the 100-year design storm. Discussions with the applicant indicate the disposition of this retained stormwater has not yet been finalized. Until the disposition of the retained rooftop stormwater is known, its effects on the proposed stormwater BMPs cannot be evaluated.

    Response: Runoff calculations have been revised to include discharge from the roof detention system in all storms analyzed. This overflow will be at a controlled rate and will flow into the underground infiltration system in the parking lot west of the building. The detailed design of the rooftop detention will be provided as the architectural and plumbing construction plans are developed. In addition, approximately 9,000 square feet of the southeast corner of the building roof will discharge directly to the surface through roof a roof drain. Please see the enclosed, revised Stormwater Report for additional information and calculations.

16. The proposed infiltration chamber system #1 receives stormwater from a proposed CB located between the site access drive and proposed parking area west of the site building. The rim elevation of this CB is 8.0. The results of the HydroCAD model indicate that the 50-yr flood elevation within the infiltration system is elev. 8.28. This flood elevation will cause stormwater to surcharge out of the CB grate and overflow down the access driveway to the lower garage level.

    Recommendation: The Applicant should reevaluate the proposed infiltration chamber system #1 to provide adequate stormwater capacity so that there is no onsite surface surcharge for any of the proposed design storms.

    Response: The infiltration system has been revised, both in footprint and storage volume and the area around the catch basin regraded (rim elevation 8.84) so that no surcharge will occur. Please refer to the enclosed revised Grading & Drainage Plan.

17. The proposed infiltration chamber system #2 located near the southwest corner of the site building receives stormwater from a proposed trench drain located across the access driveway to the lower garage level. The rim elevation of the proposed trench drain is 4.1. The results of the HydroCAD model indicate that the 2-yr flood elevation within the infiltration chamber system is elev. 8.40. This is not possible. The applicant is currently reevaluating the design of Infiltration Chamber System #2.

    Response: The proposed system has been resized and the area around the trench drain regraded so that no surcharge will occur.

18. The applicant should provide groundwater mounding calculations as the two proposed infiltration chamber systems are designed to provide peak rate mitigation and appear to be within 4-ft of estimated seasonal high groundwater.

    Response: A groundwater mounding analysis of the underground recharge system has been performed and is included in Section 6.05 of the Stormwater Report. The analysis shows that the groundwater mound is less than the provided separation to groundwater.

19. The HydroCAD model included in the stormwater report analyzes the proposed stormwater BMPs over a 24-hr time period.

    Recommendation: The applicant should increase the analysis time period to 72 hours to allow the BMPs to demonstrate their drain down capacity after the storm event concludes.

    Response: The analysis time period has been extended to 72-hours as requested. In addition, a drawdown calculation in accordance with Volume 3, Chapter 1 of the Massachusetts Stormwater Handbook has been performed demonstrating that the infiltration system will drain within 72-hours. This information is included in Section 6.02 of the accompanying Stormwater Report.

20. MassDEP Stormwater Standard #10 – The applicant should provide a signed Illicit Discharge Compliance statement.

    Response: An illicit discharge compliance statement has been included in Section 6.06 of the Stormwater Report and will be signed by the Applicant prior to issuance of permits.

<u>Construction</u>

24. Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan – Section 3.10.4 Equipment/Vehicle Maintenance and Fueling Areas:

    Recommendation: We recommend adding a provision prohibiting refueling of vehicles or equipment within 100-feet of any onsite resource area.

    Response: A prohibition on refueling and maintenance has been added in Section 3.10.5 of the Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan as recommended.

25. Recommend the applicant add a provision to the Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan that "Dorothy Road shall be swept clean on a daily basis of any soils tracked onto it from the project site".

    Response: A daily sweeping requirement has been added in Section 3.10.1 of the Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan as recommended.

<u>Stormwater/Resource Areas (Mr. Chouinard's Memorandum, p.2[1])</u>

- See previous comments pertaining to status of Isolated Vegetated Wetlands sent by email on December 3, 2020.

    Response: An updated memorandum on wetland resource areas including Isolated Vegetated Wetlands as well as an updated Existing Environmental Resources Plan (Sheet C-100) are being submitted under separate cover.

---

[1] Comments in original memorandum are bulleted, not numbered. The enclosed responses adhere to the bulleting style.

- Based on review of the Grading & Drainage Plan it is not clear how the proposed drainage system relates to the post-development routing diagram included in the Stormwater Report, particularly connection of subcatchment 3S and 7S to the drainage collection system.

  Response: Subcatchment 3S represents courtyard areas located above the garage level of the building. Stormwater runoff from these courtyards will be collected in area drains and routed through the building's internal plumbing to the underground infiltration area west of the building. The detailed design of the courtyards, area drains, and building plumbing will be provided as the architectural and plumbing construction plans are developed. Subcatchment 7S represents the narrow area of land between the building/garage footprint and the project's property line. Runoff from this subcatchment will not be collected by the on-site stormwater management system, but will bypass to Dorothy Road. This subcatchment is predominantly lawn area and, as shown in the Stormwater Report, will not increase peak flow rates to Dorothy Road over existing conditions.

- There are no details provided to review the stormwater runoff system on the building roof which is indicated to detain roof runoff.

  Response: Runoff calculations have been revised to include discharge from the roof detention system in all storms analyzed. This overflow will be at a controlled rate and will flow into the underground infiltration system in the parking lot west of the building. The detailed design of the rooftop detention will be provided as the architectural and plumbing construction plans are developed. In addition, approximately 9,000 square feet of the southeast corner of the building roof will discharge directly to the surface through a roof drain. Please see the enclosed, revised Stormwater Report for additional information and calculations.

- Plan should indicate all drainage and stormwater collection pipes or infrastructure, including downspouts or perimeter drains.

  Response: All on-site stormwater management systems are depicted on the attached Grading & Drainage Plan (Sheet C-105). While a drainage connection from the building to the underground infiltration system west of the building is shown on the plans, the detailed design of the courtyard area drains, the roof detention system, roof drains, and building plumbing will be provided as the architectural and plumbing construction plans are developed. This final design will conform to the runoff calculations provided with the courtyard areas and majority of the roof routed to the underground infiltration system and approximately 9,000 square feet of roof area in the southeast corner discharging directly to the surface through a roof drain as shown on the Plans.

- Suitable documentation of groundwater conditions have not been provided. Deep observation test holes should be performed to identify soil conditions and observable groundwater indicators. Additionally, and due to the disturbed nature of the site, full depth monitor wells should be installed to a depth of 10 feet to document the probable seasonal high groundwater level. The Frimpter Method shall be utilized with the observed ground water readings and in conjunction with the USGS Groundwater Well Network. At a minimum, these test pits should be installed in the proposed foot print of the building and in the areas of the proposed stormwater infiltration systems.

Response: In November 2020, BSC performed three soil test pits on site. The results of these test pits confirmed the soils mapping and previously performed borings with regard to seasonal high groundwater. Locations of the test pits are shown on the enclosed Grading & Drainage Plan. Test pit logs are included in Appendix D and more detailed information is provided in Section 1.02 of the revised Stormwater Report. Due to the nature of the existing soils, redox features were not visible. The Massachusetts Stormwater Handbook states that when redox features are not available, installation of temporary push point wells or piezometers should be considered. The Stormwater Handbook does not require the use of the Frimpter method for estimating seasonal high groundwater. Wells should be monitored in the spring when groundwater is highest and results compared to nearby groundwater wells monitored by the USGS to estimate whether regional groundwater is below normal, normal or above normal The applicant proposes performing further on-site testing for groundwater levels during March and/or April 2021 during the expected seasonal high groundwater period. Per the Stormwater Handbook, these observations will be compared to nearby USGS wells to determine if the observed levels are below normal, normal or above normal. Based on the timing of the expected seasonal high groundwater, the Applicant is amenable to including this requirement as a condition of the Comprehensive Permit and modifying the stormwater design, if necessary, for review by the Town Engineer prior to issuance of building permit.

- Stormwater infiltration is not recommended over the existing sewer line/easement without upgrading or renewing the existing 14"/18" sewer main. Groundwater mounding calculations shall be provided and the infiltration system shall be placed a minimum of 2ft above the calculated ground water mound elevation as well as in a location such that the infiltrated water does not impact the sewer main.

  Response: The infiltration system in question has been relocated south of the sewer line to allow Town access should it be needed. Per the Massachusetts Stormwater Handbook, a mounding analysis is required when the vertical separation from the bottom of an exfiltration system to seasonal high groundwater is less than four (4) feet and the recharge system is proposed to attenuate the peak discharge from a 10-year or higher 24-hour storm (e.g., 10-year, 25-year, 50-year, or 100-year 24-hour storm). In such cases, the mounding analysis must demonstrate that the Required Recharge Volume (e.g., infiltration basin storage) is fully dewatered within 72 hours (so the next storm can be stored for exfiltration). The mounding analysis must show that the groundwater mound will not reach the base of the recharge system and will not break out above the land or water surface of a wetland. It is not a requirement for an infiltration BMP to be located a minimum of 2 feet above the calculated groundwater mound elevation.

We look forward to discussing these revisions with you at the next public hearing on the project. Should you have any questions on this information, please do not hesitate to reach out to me at (617) 896-4321 or jhession@bscgroup.com.

Sincerely,

BSC Group, Inc.

John Hession, P.E.
Vice President

cc: zba@town.arlington.ma.us
Marta Nover and Todd Undzis, BETA
Stephanie Kiefer, Smolak & Vaughan
Gwen Noyes and Arthur Klipfel, Arlington Land Realty

Fiscal Impact Analysis

Thorndike Place

Dorothy Road, Arlington, MA

Prepared for: Arlington Land Realty, LLC

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FISCAL IMPACT ANALYSIS
Thorndike Place

January 8, 2021

I. Introduction

Fougere Planning and Development has been engaged by Arlington Land Realty, LLC to undertake a Fiscal Impact Analysis to estimate new revenue the Town of Arlington may realize, as well as to evaluate the potential increased service demand costs that might occur, from the development of a 176-unit apartment community proposed on Dorothy Road. As a 40B development, 25% percent of the residences will be designated as Affordable and restricted to households earning up to 80% of the Area Median Income. A majority of the units, 55.6%, will be studio and one-bedroom units which generate few school age children. The 17.6 acre site is currently vacant. A parking garage will be incorporated into the design and the site will accommodate 239 parking spaces. The housing development will be serviced by public utilities. All on-site parking areas and trash pickup will be privately managed and maintained. Table One outlines the proposed apartment unit mix.

Table One
Residential Unit Types

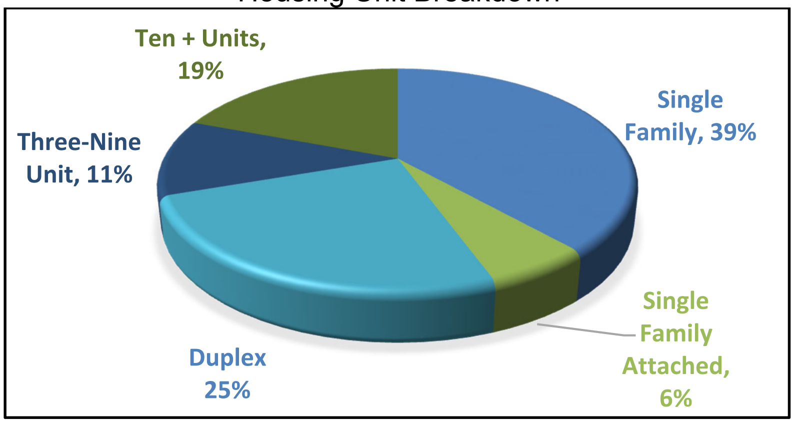
Studio - Market	8
Studio - Affordable	3
One Bed - Market	65
One Bed - Affordable	22
Two Bed - Market	43
Two Bed - Affordable	15
Three Bed - Market	15
Three Bed - Affordable	5
Totals	**176**

II. Local Trends

Census figures report that from 2000 to 2010 Arlington's population rose from 42,410 to 42,844, representing a 1.1% increase over the 10-year period. The Census Bureau estimates the 2019 population to be 45,531.

A majority of Arlington's housing stock consists of single family homes. The most recent Census data (2018) reports indicate that out of a total of 18,780 housing units in the community, 7,136 are single family as outlined in Figure One.

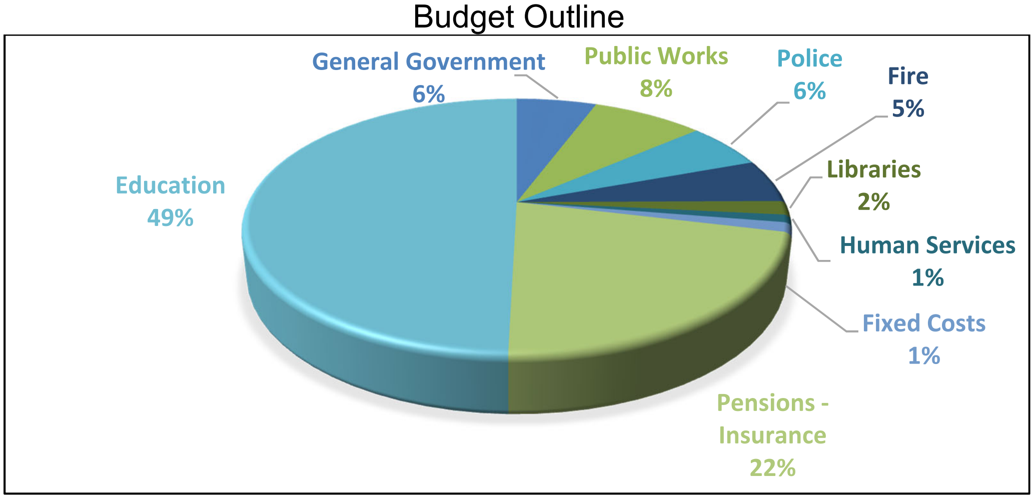
Figure One
Housing Unit Breakdown



Budget

Schools, along with the fire and police departments will realize the most direct and measurable increase in service demands from the proposed project. These departments, as detailed in Figure Two, show some of the largest cost centers in the community and therefore will be the focus of this analysis.

Figure Two
Budget Outline



III. Per Capita Methodology & Marginal Cost Approach

There are a number of methodologies that are used to estimate fiscal impacts of proposed development projects. The Per Capita Multiplier Method is the most often used analysis to determine municipal cost allocation. This method is the classic "average" costing method for projecting the impact of population growth on local spending patterns and is used to establish the costs of existing services for a new development. The basic premise of this method is that current revenue/cost ratios per person and per unit is a potential indicator of future revenue/cost impacts occasioned by growth. New capital expenditures required for provision of services to a development are not added to current costs; instead, the present debt service for previous improvements is included to represent ongoing capital projects. The advantage of this approach is its simplicity of implementation and its wide acceptance by both consultants and local officials. The downside of this approach is that the methodology calculates the "average" cost as being the expected cost, which is often not the case and costs can be understated or exaggerated; significantly in some instances. If one student is added to a school system, limited cost impacts will occur; however, based on an "average" cost to educate one student the cost would be noted as $18,000/year which includes such costs as existing debt, building maintenance, administrative and other factors, all of which will be minimally impacted by the addition of one student. The "true cost" could be significantly less, especially in those communities with declining enrollment.

The Marginal Cost Approach is a more realistic methodology that can be used to estimate and measure developmental impacts based on actual costs that occur in the community. At this time, a "level of service" exists in Arlington to serve the community. This existing service level, for the most part, addresses the needs of the community through existing tax collections. As new development occurs, pressures are placed on some departments to address increased demands, while other departments see negligible, if any impacts. In reviewing the potentially impacted town departments specifically, a truer picture of anticipated cost impacts can be determined. The Report will use this methodology unless discussions with Department heads lead to no definitive cost conclusion, in which case the Average Costing Method will be applied.

Given the nature of the proposed development project, as will be shown by the analysis below, few significant impacts will be felt by Town departments. Any required off-site road improvements will be addressed during the approval process. Solid waste generated by this project will be removed by a private hauler. Any construction related or operating utility expenses will be offset through user fees. All on-site improvements will be private and all maintenance expenses will be paid for by this project owner. This report does not intend to infer that few costs will be incurred as a result of this project. Measurable impacts will certainly be felt by a few Town departments, most notably the School Department along with the Police and Fire Departments. Other town agencies will see little or no measurable impacts.

IV. Local Revenues From Development

1) Property Taxes

Local property taxes provide the bulk of General Fund Revenue for the Town, with FY2021 figures showing that 77.6% will be generated from this revenue source, with the remaining income being received from State Aid, Local Receipts and other sources. The Fiscal Year 2021 Tax Rate is $11.34.

Based on a review of area market conditions and preliminary rent levels, it is estimated that the proposed apartment development will have an estimated assessed value of $63,360,000. As outlined in Table Two, property tax revenues are anticipated to equal $718,502 annually.

Table Two
Anticipated Property Tax Revenue

Estimated Assessment	Tax Rate	Property Taxes
$63,360,000	$11.34	$718,502

2) Excise Tax Revenue

Another major revenue source for the community is from motor vehicle excise taxes. In fiscal year 2019, the Town received a total of $5,332,866[1] from this revenue source. Table Three outlines the projected excise tax revenue stream for the proposed project, which is estimated to be $99,000 annually.

[1] FY2021 Budget document Local Receipts, 2019 actual revenue, page 34.

Table Three
Motor Vehicle Excise Taxes

Avg. Car Value	$20,000
Total Cars[2]	198
Total Value	$3,960,000
Excise Rate	$25/$1,000
Est. Excise Taxes	**$99,000**

3) Community Preservation Surcharge Revenues

The Town of Arlington participates in the Massachusetts Community Preservation Act (CPA) with a surcharge to 1.5% on the total property taxes paid. Based on the estimated property taxes from the proposed development, CPA surcharge revenue is estimated to be $10,777 annually as outlined in Table Four.

Table Four
Estimated CPA Revenue

CPA	Property Taxes	Estimated CPA Revenue
1.5%	$718,502	$10,777

4) Total Project Revenues

The proposed development is expected to generate $828,279 in annual revenue from both property tax and vehicle excise taxes detailed in Table Five.

Table Five
Estimated Gross Revenue

Estimated Property Taxes	$718,502
Estimated Excise Taxes	$99,000
CPA Surcharge	$10,777
Total Est. Revenue	**$828,279**

Other income sources were reviewed for this analysis but were not included in the revenue figures. The Town receives state aid from a number of sources based upon each town's population and school enrollments. The anticipated new residents will create demand for local retail and other services, thereby creating a positive impact on the local economy. In addition, one- time building permit fees[3] are estimated to be tens of thousands of dollars, and the construction economy will be enhanced from this new development project.

[2] Professional opinion estimate: .75 vehicle per studio unit, 1 per one bed, 1.25 per two bed and 1.5 per three bed.

[3] $20/$1,000 for first $15,000,000 and $5/$1,000 for remaining.

V. Department Impacts

As noted above, the Police, Fire and School Departments account for a significant percentage of the Town's operating expenses. These Departments employ the largest number of personnel and have the most dramatic impact on the Town's budget. Given the large budgetary impact these Departments have on the Town, they are closely analyzed in this Report.

Police & Fire

Both the Police and Fire Departments will see an upturn in activity from the proposed residential community, with increased demand for services being attributed to the new project. To gain a firm understanding of the degree of impact this project may have on these departments, over 2,900 40B apartment units were analyzed as to the emergency call volume generated by these land uses; two Arlington[4] apartment complexes were also reviewed. The data was calculated to arrive at an average emergency call ratio per unit, which was then used to generate projected emergency calls for each department. Extrapolating from the comparable call data, slight increases are projected in the Town's Police and Fire Departments call volume. Table Six outlines the findings from this research.

Table Six
Estimated Annual Police-Fire-Ambulance Emergency Calls[5]

Agency	Avg. Call Per Unit	Proposed Apartments	Estimated Calls
Police	0.377	176	66
Fire	0.068	176	12
Ambulance	0.105	176	18

Police Department

Police Department calls are estimated to increase by 66 calls annually or slightly more than 1 call per week. To put the call volume into perspective, the Department received approximately 27,649 calls[6] in 2019 (531 per week). The Police Department's Fiscal Year 2021 Budget was $8,451,748.

[4] Both Arlington apartment complexes have less than 25% affordable units, Arlington 360: 10% & Brigham Square 14%.
[5] Complete list of emergency call data to apartment complexes is provided in Appendix.
[6] 2019 Town Report, Calls for Service. In 2018 there were 29,880 calls for service.

To gain an understanding of the impact of this project on the Police Department, we reached out to Police Captain Jim Curran. The Captain believed the estimated calls were reasonable along with the estimated costs applied to the project.

In order to account for some costs related to the new use, a number of options were reviewed including department cost per capita and per housing unit. As emergency calls are a reliable metric that provides a more realistic measure of demand for service, we will use this average costing method to allocate costs to the apartment use. Dividing the Police Budget by annual calls generates a cost per call. This cost is then multiplied by the estimated calls from the apartment neighborhood, resulting in an estimated cost of $20,196 as outlined in Table Seven.

Table Seven
Estimated Police Department Costs

Budget	Police Calls	Cost Per Call	Est. Calls	Est. Cost
$8,451,748	27,649	$306	66	$20,196

Fire Department

A much more modest call volume increase is anticipated for the Fire Department, with 12 fire calls and 18 ambulance calls projected, for a total of 30 calls annually (.57 calls per week). In 2019 the Department responded to 5,046 incidents[7] (97 calls per week), with 3,183 being noted as EMS. The Departments 2021 operating Budget was $7,754,729.

We discussed the project with Fire Prevention Deputy Ryan Melly. The Deputy thought the estimated calls were reasonable and relate to existing projects found in the community. The Deputy did not see any issues related to the ability to properly respond to incidents at the proposed complex. A full review of the project will be undertaken once the site plan is submitted to the Town. Staffing levels have remained stable.

As with the Police Department, in order to account for some cost impacts, we calculated the cost per Fire Department call to arrive at a gross operational cost as outlined in Table Eight.

Table Eight
Estimated Gross Fire Department Costs

Budget	Fire Calls	Cost Per Call	Est. Calls	Est. Cost
$7,754,729	5,046	$1,537	30	$46,110

[7] 2019 Town Report, in 2018 5,553 calls were reported (3,177 EMS).

Ambulance income is a source of revenue generating $538,195 in 2019[8], or $169 per call[9]. As outlined above, the new apartment complex is estimated to generate 18 annual EMS calls, resulting in $3,042 in revenue. Deducting these funds from the gross estimated cost, results in a net Fire Department expense of **$43,068.**

Other Town Departments

Given the minimal impacts associated with the proposed apartment complex on other Town Departments, few additional financial impacts are anticipated. All trash and snow removal will be privately maintained. Building permit fees are estimated to be tens of thousands of dollars[10] ($20 per $1,000 up to $15,000,000 the $5 per $1,000) which will more than offset cost impacts to the Building Department. To assign some costs to miscellaneous expenses that may incur to the Town, we have allocated a general government impact[11] of $13,200 for this project.

School Department

The School Department's budget is the largest in the Town, with a Fiscal 2021 budget of $75,570,531, representing 51.7% of the Town's total budget. As previously outlined, the proposed apartment complex will total 176 units, with 55.6% consisting of studios and one bedroom units as detailed in Table Nine.

Table Nine
Residential Unit Types

Studio - Market	8
Studio - Affordable	3
One Bed - Market	65
One Bed - Affordable	22
Two Bed - Market	43
Two Bed - Affordable	15
Three Bed - Market	15
Three Bed - Affordable	5
Totals	**176**

[8] FY2021 Budget Local Receipts, page 31.
[9] 2019 EMS calls 3,183.
[10] Building permit fees for Arlington 360 totaled $54,000.
[11] $75 per unit.

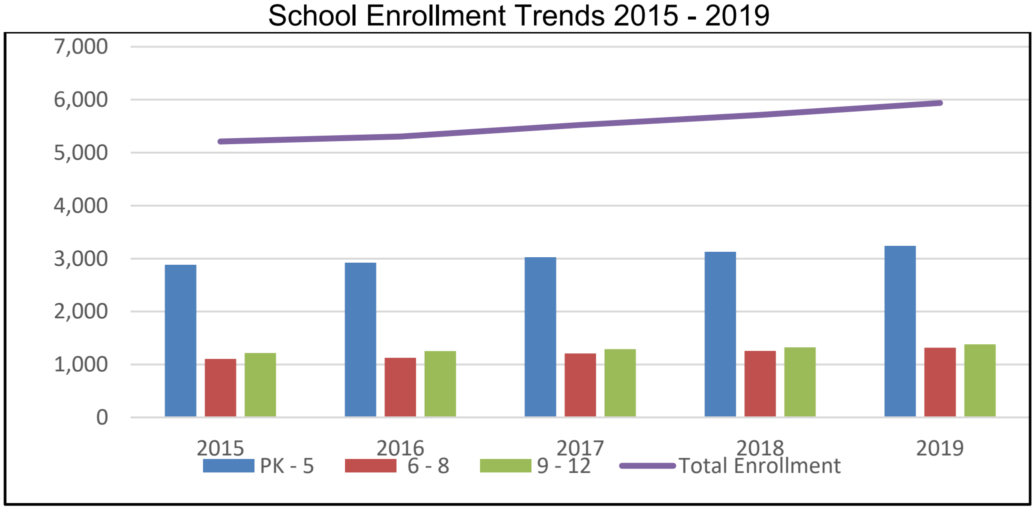
Schools and Enrollment

Arlington's school enrollments have been growing over the last five years and as outlined in Table Ten and Figure Three, all grade level groupings have seen increases. The middle school has experienced the largest percentage increase over this time period. A new high school is presently under construction and is expected to be completed in 2024. The new building will have a capacity of 1,755 students.

Table Ten
School Enrollments 2015 - 2019

	2015	2016	2017	2018	2019	% Change
PK - 5	2,884	2,924	3,026	3,128	3,241	12.38%
6 - 8	1,107	1,127	1,208	1,258	1,318	19.06%
9 - 12	1,217	1,253	1,290	1,325	1,380	13.39%
	5,208	**5,304**	**5,524**	**5,711**	**5,939**	**14.04%**

Figure Three
School Enrollment Trends 2015 - 2019



The proposed development includes a mix of studio, one, two and three bedroom apartment units, with 25% set aside as affordable (as required by 40B provisions). Based on our database of over 3,700 40B apartment units in the region as detailed in Table Eleven, we are estimating that the proposed development will generate an average of 35 school age children (SAC) annually. As noted above, 51.7% of the units will be studio and one-bedroom units that generate few school age children. Two local apartment developments were also reviewed, but they do not contain 25% affordable units (Arlington 360: 10% and Brigham Square: 14%). Based on these two Arlington apartment enrollment profiles[12], it is anticipated that approximately 67% of the students will be of elementary school age as outlined in Table Twelve.

Table Eleven
Estimated School Age Children

Complex	Total Units	SAC	SAC/ Unit
Arlington 360 - Garden	256	26	0.102
Brigham Square	119	32	0.269
	375	58	0.155
Pembroke - Woods	240	49	0.204
Bedford Village at Taylor Pond	200	39	0.195
Avalon at Bedford Center	139	52	0.374
North Andover - Berry Farms	196	49	0.250
Heritage at Bedford Springs	164	63	0.384
Hingham Avalon Shipyard - Garden	86	12	0.140
Newton (Three Complexes)	678	239	0.353
Charles River Landing (Needham)	350	28	0.080
Cirrus Apartments Ashland	398	40	0.101
Westwood Gables	350	43	0.123
Lincoln Woods	125	34	0.272
Quinn 35 Shrewsbury	250	16	0.064
Cloverleaf Natick	183	32	0.175
Avalon Natick	406	46	0.113
Total Averages	3,765	742	**0.197**
Thorndike Place	**176**	**35**	

Table Twelve
Estimated Enrollment Profile

PK - 5	67.16%	23
6 - 8	16.42%	6
9 - 12	16.42%	6

Based upon past discussions[13] with the School Department's Chief Financial Officer Michael Mason, Mr. Mason believed carrying an expense of $10,463 per pupils was reasonable. This cost is based on the Town's current 5-year plan and formula to fund the school department; 25% of fixed costs such as administration, facilities and other indirect

[12] Arlington 360 & Brigham Square
[13] Summer 2020, relative to a proposed 40B apartment complex

costs were removed to arrive at the per student expense. Given these costs considerations, total school expenses are estimated to be $366,205, as outlined in Table Twelve.

Table Thirteen
Average Estimated School Costs

35 Students x $10,463 per = $366,205

SUMMARY

As outlined below in Table Fourteen, this fiscal impact analysis indicates that there will be a net positive revenue impact related to construction of the proposed development.

Table Fourteen
Fiscal Summary

Gross Projected Revenues	$828,279
Total Municipal Costs	
Police	-$20,196
Fire	-$43,068
Other General Fund Impacts	-$13,200
Schools	-$366,205
Total Costs	-$442,669
Net Positive Fiscal Impact Range	**+$385,610**

Key findings supporting this development include:

- The proposed apartment complex will generate approximately $828,279 in gross revenues per year. Taking into consideration estimated municipal costs, the proposed project will yield a positive net revenue of $385,610 annually.
- The site's estimated assessed value will increase substantially from $7,533,400 to $63,360,000, 1 741% increase in property value.
- Property taxes will increase 708%; rising from $88,828 to $718,502.
- Twenty-five percent, 44 units, of the 176 apartments will be set aside as affordable units in perpetuity.
- All on-site maintenance and trash collection will be private.
- Calls to the Police Department are projected to increase by 66, compared with an annual Town wide call volume of 27,649.
- The Fire Department is expected to receive approximately 30 calls a year from the proposed apartment complex, adding to the 5,046 calls a year that are presently received by the Department.
- It is estimated that 35 school age children will live at the apartment complex.
- Both short-term and long-term positive economic benefits are anticipated to occur, with construction related jobs being created and local business activity enhanced with new residents living in the community.
- Building permit fees will generate tens of thousands of dollars in one-time revenues.

Appendix

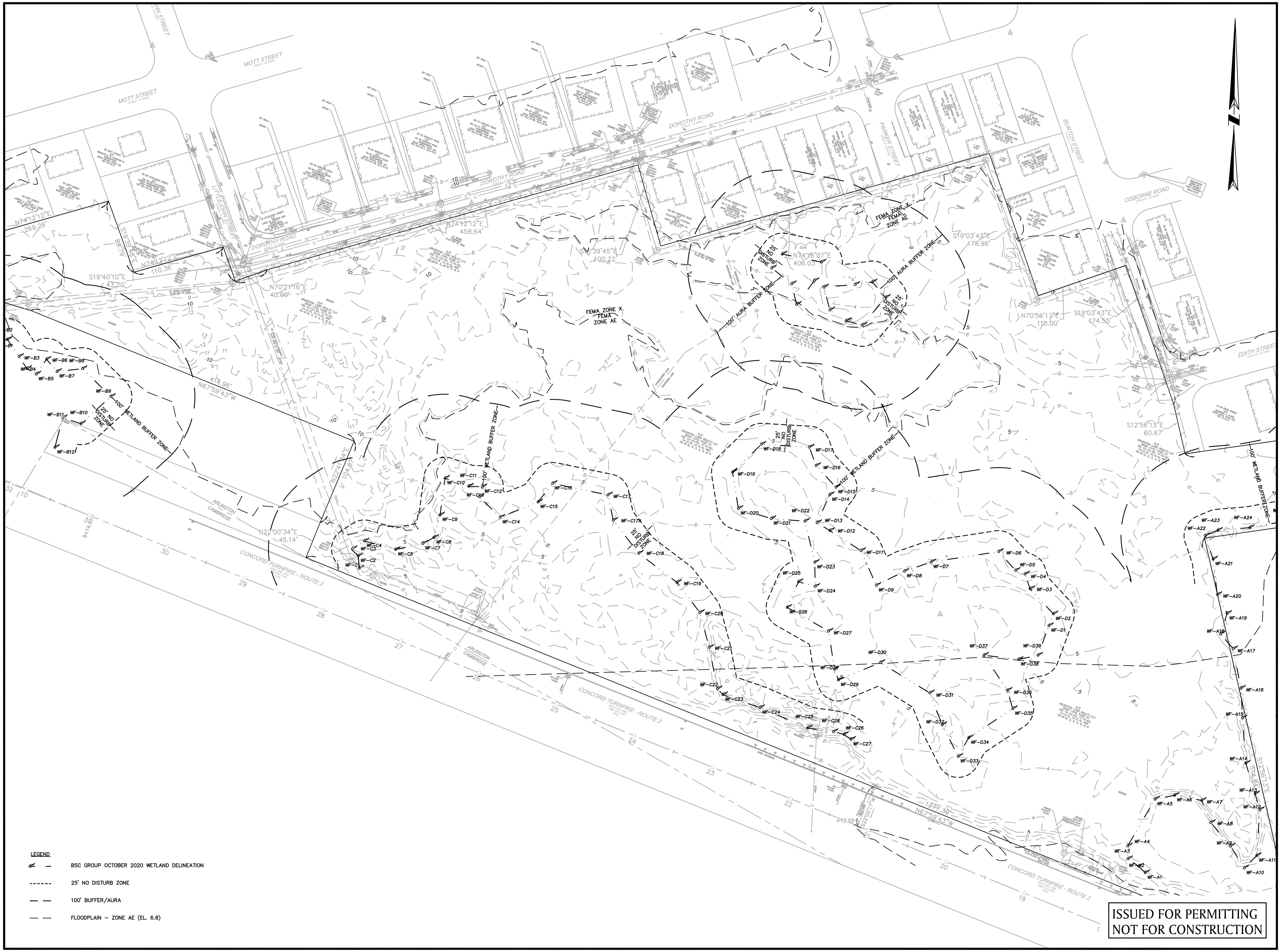
Estimated Annual Police Calls

Project	Town	Units	Avg. Police Calls Per Year	Avg. Call Per Unit	Projected Yearly Calls
Arlington 360	Arlington	274	62	0.226	
Brigham Square	Arlington	119	24	0.202	
Lynnfield Commons	Lynnfield	200	73	0.365	
The Lodge	Foxborough	250	74	0.296	
Union Place	Franklin	297	73	0.247	
Fairfield Green	Mansfield	200	146	0.728	
Pembroke Woods	Pembroke	240	92	0.385	
Blue Hills	Randolph	274	148	0.540	
Avalon Newton Highlands	Newton	294	153	0.520	
Avalon Chestnut Hill	Newton	204	67	0.328	
Arborpoint Woodland	Newton	180	22	0.120	
Cloverleaf	Natick	183	82	0.448	
The Gables	Westwood	350	155	0.442	
Hastings Village	Wellesley	52	3	0.058	
Totals		3,117	1,174	**0.377**	
Thorndike Place		176			**66**

Estimated Annual Fire/EMS Calls

Project	Town	Units	Avg. Fire Calls Per Year	Avg. Call Per Unit	Projected Yearly Calls
Arlington 360	Arlington	274	12	0.044	
Brigham Square	Arlington	119	6	0.050	
The Lodge	Foxborough	250	26	0.105	
Union Place	Franklin	297	19	0.063	
Fairfield Green	Mansfield	200	43	0.213	
Pembroke Woods	Pembroke	240	9	0.036	
Blue Hills	Randolph	274	10	0.035	
Avalon Newton Highlands	Newton	294	26	0.088	
Avalon Chestnut Hill	Newton	204	11	0.053	
Arborpoint Woodland	Newton	180	12	0.064	
Cloverleaf	Natick	183	7	0.038	
The Gables	Westwood	350	17	0.049	
Hastings Village	Wellesley	52	2	0.031	
Totals		2,917	198	**0.068**	
Thorndike Place		176			**12**

Project	Town	Units	Avg. EMS Calls Per Year	Avg. Call Per Unit	Projected Yearly Calls
Arlington 360	Arlington	274	14	0.051	
Brigham Square	Arlington	119	8	0.067	
The Lodge	Foxborough	250	24	0.096	
Union Place	Franklin	297	44	0.148	
Fairfield Green	Mansfield	200	25	0.123	
Pembroke Woods	Pembroke	240	70	0.293	
Blue Hills	Randolph	274	28	0.101	
Avalon Newton Highlands	Newton	294	26	0.088	
Avalon Chestnut Hill	Newton	204	9	0.044	
Arborpoint Woodland	Newton	180	7	0.036	
Cloverleaf	Natick	183	24	0.131	
The Gables	Westwood	350	26	0.074	
Hastings Village	Wellesley	52	2	0.038	
Totals		2,917	306	**0.105**	
Thorndike Place		176			**18**



PROFESSIONAL ENGINEER

DATE

THORNDIKE PLACE

DOROTHY ROAD

IN

ARLINGTON
MASSACHUSETTS
(MIDDLESEX COUNTY)

EXISTING ENVIRONMENTAL RESOURCES PLAN

MARCH 13, 2020

REVISIONS:

NO.	DATE	DESC.
1	10/22/20	WETLAND DELINEATION
2	1/21/21	IVW DELINEATION

PREPARED FOR:

ARLINGTON LAND REALTY, LLC
84 SHERMAN STREET, 2ND FLOOR
CAMBRIDGE, MA 02140

BSC GROUP
803 Summer Street
Boston, Massachusetts
02127
617 896 4300

SCALE: 1" = 50'

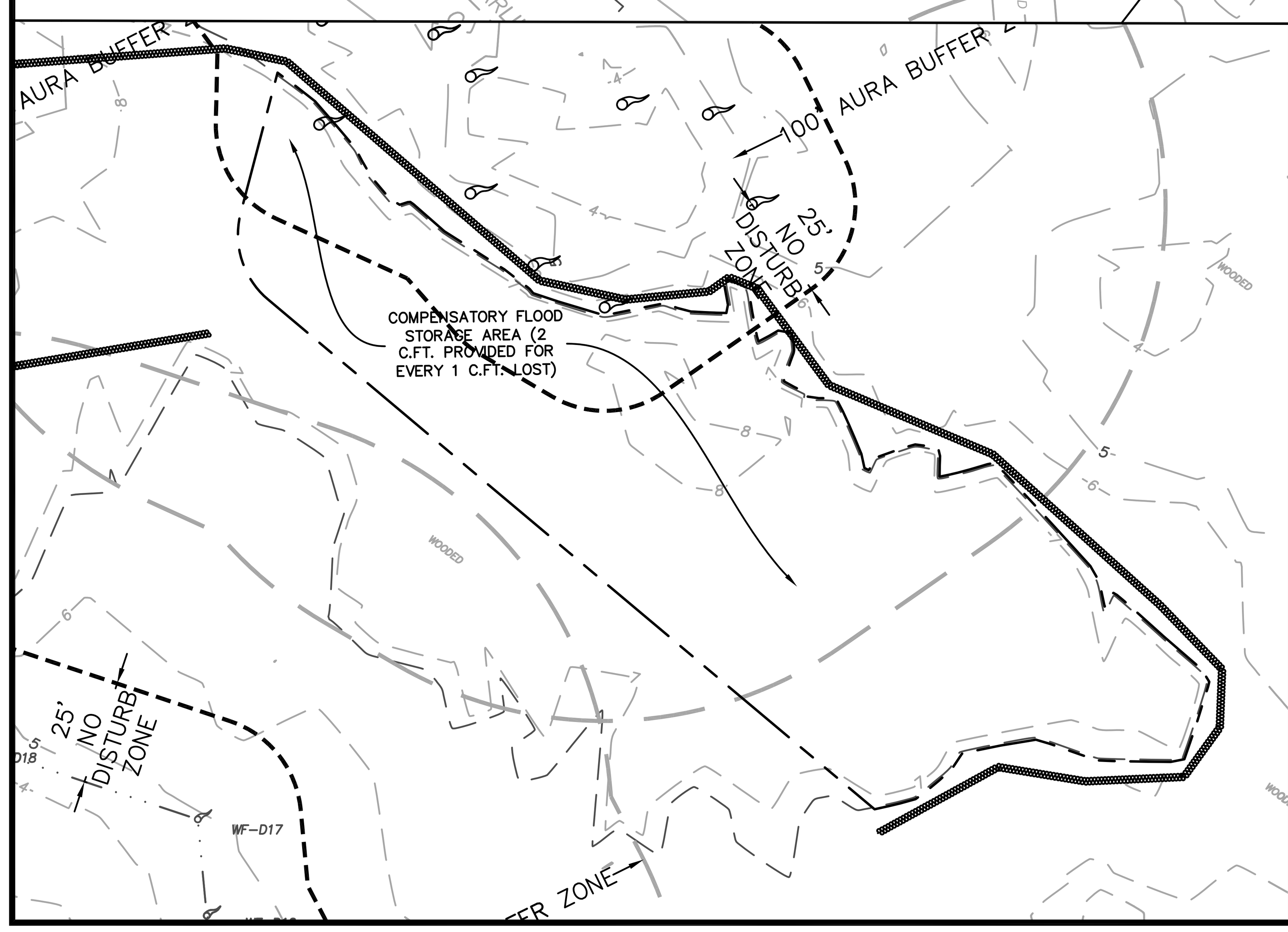
0 25 50 100 FEET

FILE: \Civil_Drwgs\2340700-CONSTRAINTS

DWG.:

JOB. NO: 23407.00

SHEET C-100



ERROSION AND SEDIMENT CONTROL NOTES

1. THE PROJECT WORK SHALL COMPLY WITH THE 2017 NPDES CONSTRUCTION GENERAL PERMIT FOR MASSACHUSETTS (CGP). A STORMWATER POLLUTION PREVENTION PLAN (SWPPP) SHALL BE PREPARED AND THE CONTRACTOR SHALL COMPLY WITH ALL REQUIREMENTS OF THE SWPPP. THE CONTRACTOR SHALL PROVIDE EVIDENCE THAT A NOTICE OF INTENT (NOI) HAS BEEN FILED FOR COVERAGE UNDER THE CGP AT LEAST 14 DAYS PRIOR TO THE START OF ANY EARTH DISTURBING ACTIVITES. NO EARTH DISTURBING ACTIVITIES SHALL OCCUR UNTIL THE CONTRACTOR HAS OBTAINED COVERAGE UNDER THE CGP.
2. APPROPRIATE EROSION AND SEDIMENT CONTROL MEASURES SHALL BE INSTALLED PRIOR TO SOIL DISTURBANCE. MEASURES SHALL BE TAKEN TO CONTROL EROSION WITHIN THE PROJECT AREA. SEDIMENT IN RUNOFF WATER SHALL BE TRAPPED AND RETAINED WITHIN THE PROJECT AREA.
3. MINIMIZE TOTAL AREA OF DISTURBANCE AND PROTECT NATURAL FEATURES AND SOIL.
4. THE CONTRACTOR SHALL SEQUENCE ALL ACTIVITIES TO MINIMIZE SIMULTANEOUS AREAS OF DISTURBANCE. MASS CLEARING AND GRADING OF THE ENTIRE SITE SHALL BE AVOIDED.
5. MINIMIZE SOIL EROSION AND CONTROL SEDIMENTATION DURING CONSTRUCTION.
6. DIVERT UNCONTAMINATED WATER AROUND DISTURBED AREAS.
7. INSTALL AND MAINTAIN ALL EROSION AND SEDIMENT CONTROL MEASURES IN ACCORDANCE WITH THE MANUFACTURER'S SPECIFICATIONS AND GOOD ENGINEERING PRACTICES AND IN ACCORDANCE WITH THE 2017 EPA CONSTRUCTION GENERAL PERMIT FOR MASSACHUSETTS.
8. PROTECT AND MANAGE ON AND OFF-SITE MATERIAL STORAGE AREAS (OVERBURDEN AND STOCKPILES OF DIRT, BORROW AREAS, OR OTHER AREAS USED SOLELY BY THE PERMITTED PROJECT SHALL BE CONSIDERED A PART OF THE PROJECT).
9. COMPLY WITH APPLICABLE FEDERAL, STATE AND LOCAL LAWS AND REGULATIONS INCLUDING WASTE DISPOSAL, SANITARY OR SEWER REGULATIONS, AND AIR QUALITY REQUIREMENTS, INCLUDING DUST CONTROL.
10. SEDIMENT SHALL BE REMOVED ONCE THE VOLUME REACHES HALF THE HEIGHT OF THE EROSION CONTROL DEVICE. SEDIMENT SHALL BE REMOVED PRIOR TO REACHING THE LOAD-BEARING CAPACITY OF THE SILT FENCE WHICH MAY BE LOWER THAN HALF THE HEIGHT.

EROSION AND SEDIMENT CONTROL NOTES (CONT.)

11. BMPS TO BE USED FOR INFILTRATION AFTER CONSTRUCTION SHALL NOT BE USED AS BMPS DURING CONSTRUCTION UNLESS OTHERWISE APPROVED BY THE ENGINEER. MANY INFILTRATION TECHNOLOGIES ARE NOT DESIGNED TO HANDLE THE HIGH CONCENTRATIONS OF SEDIMENTS TYPICALLY FOUND IN CONSTRUCTION RUNOFF, AND THUS SHALL BE PROTECTED FROM CONSTRUCTION RELATED SEDIMENT LOADINGS.
12. SOIL STOCKPILE SIDE SLOPES SHALL NOT BE GREATER THAN 2H:IV. ALL STOCKPILES SHALL BE SURROUNDED BY SEDIMENT CONTROLS.
13. A TRACKING PAD OR OTHER APPROVED STABILIZATION METHOD SHALL BE CONSTRUCTED AT ALL CONSTRUCTION ENTRANCE/EXIT POINTS OF THE SITE TO REDUCE THE AMOUNT OF SOIL CARRIED ONTO ROADWAYS AND OFF THE SITE.
14. PERMANENT SEEDING SHALL BE UNDERTAKEN IN THE SPRING FROM MARCH THROUGH MAY, AND IN LATE SUMMER AND EARLY FALL FROM AUGUST TO OCTOBER 15. DURING THE PEAK SUMMER MONTHS AND IN THE FALL AFTER OCTOBER 15, WHEN SEEDING IS FOUND TO BE IMPRACTICAL, APPROPRIATE TEMPORARY STABILIZATION SHALL BE APPLIED. PERMANENT SEEDING MAY BE UNDERTAKEN DURING THE SUMMER IF PLANS PROVIDE FOR ADEQUATE MULCHING AND WATERING.
15. TEMPORARY SEDIMENT TRAPPING DEVICES SHALL NOT BE REMOVED UNTIL PERMANENT STABILIZATION IS ESTABLISHED IN ALL CONTRIBUTORY DRAINAGE AREAS.
16. ALL TEMPORARY EROSION AND SEDIMENT CONTROL MEASURES SHALL BE REMOVED AFTER FINAL SITE STABILIZATION DISTURBED SOIL AREAS RESULTING FROM THE REMOVAL OF TEMPORARY MEASURES SHALL BE PERMANENTLY STABILIZED WITHIN 30 DAYS OF REMOVAL.
17. DUST SHALL BE CONTROLLED AT THE SITE.
18. ALL PREVIOUSLY DISTURBED LAND SHALL BE STABILIZED BY APPROVED METHODS AFTER 14 DAYS IF LEFT UNDISTURBED, THIS INCLUDES STOCKPILES, CONSTRUCTION ENTRANCES, GRADED AREAS AND OTHER CONSTRUCTION ACTIVITY RELATED CLEARING.
19. IF WORK IS HALTED OVER WINTER MONTHS THE CONTRACTOR SHALL BE RESPONSIBLE FOR STABILIZING THE AREA THROUGH GROUND COVER PRACTICES.

GENERAL NOTES:

1. ALL EXISTING UTILITY STRUCTURES, CONDUITS, AND APPURTENANCES OF ANY KIND SHALL BE COMPLETELY REMOVED WITHIN THE LIMITS OF EXCAVATION FOR NEW BUILDINGS, UNLESS NOTED OTHERWISE ON THE DRAWINGS. OUTSIDE THE LIMITS OF EXCAVATION FOR NEW BUILDINGS, ALL ABANDONED AND TO-BE-ABANDONED UTILITIES GREATER THAN 8 INCHES IN DIAMETER SHALL BE SEALED BY FILLING WITH HIGH SLUMP CONCRETE (FLOWABLE FILL) AT THE LIMIT OF EXCAVATION. ALL UTILITY STRUCTURES TO BE REMOVED SHALL HAVE THE ASSOCIATED PIPES REMOVED TO A DISTANCE OF 15 FEET FROM THE STRUCTURE AND SEALED.
2. CONSTRUCTION SETUP IS SHOWN FOR REFERENCE ONLY. EROSION AND SEDIMENTATION CONTROLS TO BE APPROPRIATELY SIZED AND LOCATED/RELOCATED BY THE CONTRACTOR DURING EARTHWORK OPERATIONS.
3. CONTRACTOR SHALL WORK WITH LANDSCAPE ARCHITECT TO DETERMINE SCOPE OF TREE WORK.
4. ALL CONSTRUCTION FENCING AND WARNING SIGNS SHALL BE INSTALLED PRIOR TO ANY CONSTRUCTION. INSTALL CONSTRUCTION FENCING AT THE LIMIT OF WORK.
5. PRIOR TO THE TERMINATION, ABANDONMENT, OR REMOVAL OF ANY UTILITY, VERIFY THAT APPLICABLE NOTIFICATIONS HAVE BEEN MADE TO THE UTILITY OWNER/OPERATOR AND THAT THE UTILITY HAS BEEN PROPERLY TERMINATED, CAPPED, OR PLUGGED AS REQUIRED.
6. PROTECT ALL IMPROVEMENTS NOT INCLUDED IN THE SCOPE OF SITE DEMOLITION. ANY IMPROVEMENT WHICH IS DAMAGED SHALL BE REPAIRED OR REPLACED IN-KIND TO THE OWNER'S SATISFACTION AT NO ADDITIONAL COST.
7. UNLESS OTHERWISE INDICATED, ALL DISTURBED AREAS SHALL BE RESTORED WITH SIX (6) INCHES OF LOAM, SEEDED, FERTILIZED, AND MULCHED. PROVIDE ADDITIONAL EROSION CONTROLS AS REQUIRED.

ISSUED FOR PERMITTING
NOT FOR CONSTRUCTION

JOHN M. HESSION CIVIL No. 42747

PROFESSIONAL ENGINEER | DATE

THORNDIKE PLACE

DOROTHY ROAD
IN
ARLINGTON
MASSACHUSETTS
(MIDDLESEX COUNTY)

SITE PREPARATION PLAN

MARCH 13, 2020

REVISIONS:

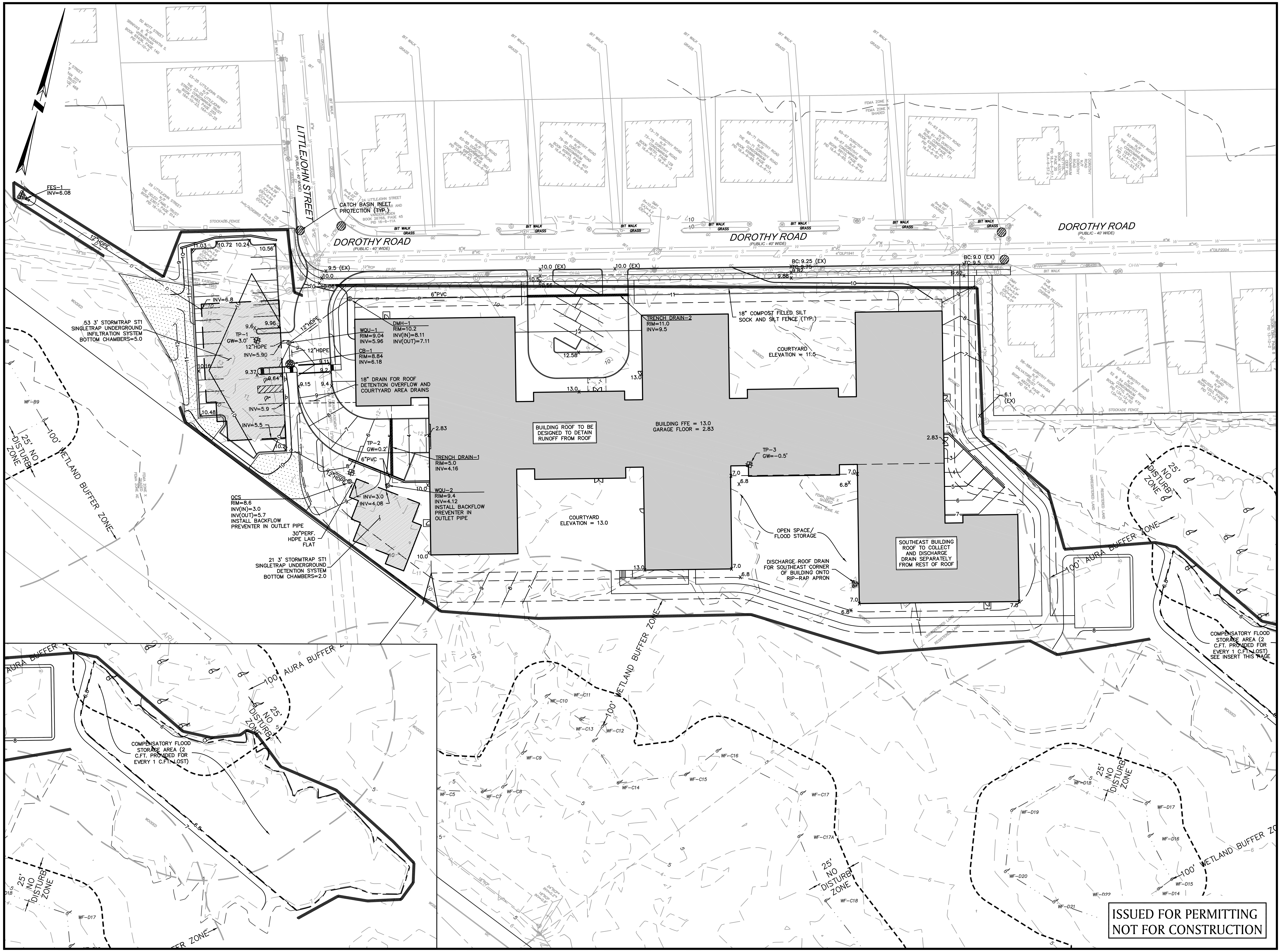
NO.	DATE	DESC.
1	11/03/20	REVISED BUILDING
2	1/21/21	RESPONSE TO PEER REVIEW

PREPARED FOR:
ARLINGTON LAND REALTY, LLC
84 SHERMAN STREET, 2ND FLOOR
CAMBRIDGE, MA 02140

BSC GROUP
803 Summer Street
Boston, Massachusetts
02127
617 896 4300

SCALE: 1" = 30'
0 15 30 60 FEET

FILE: \Civil_Drawings\2340700-DEM
DWG.:
JOB. NO: 23407.00
SHEET C-101



ISSUED FOR PERMITTING
NOT FOR CONSTRUCTION

PROFESSIONAL ENGINEER — DATE

THORNDIKE PLACE

DOROTHY ROAD

IN

ARLINGTON
MASSACHUSETTS
(MIDDLESEX COUNTY)

GRADING & DRAINAGE PLAN

MARCH 13, 2020

REVISIONS:

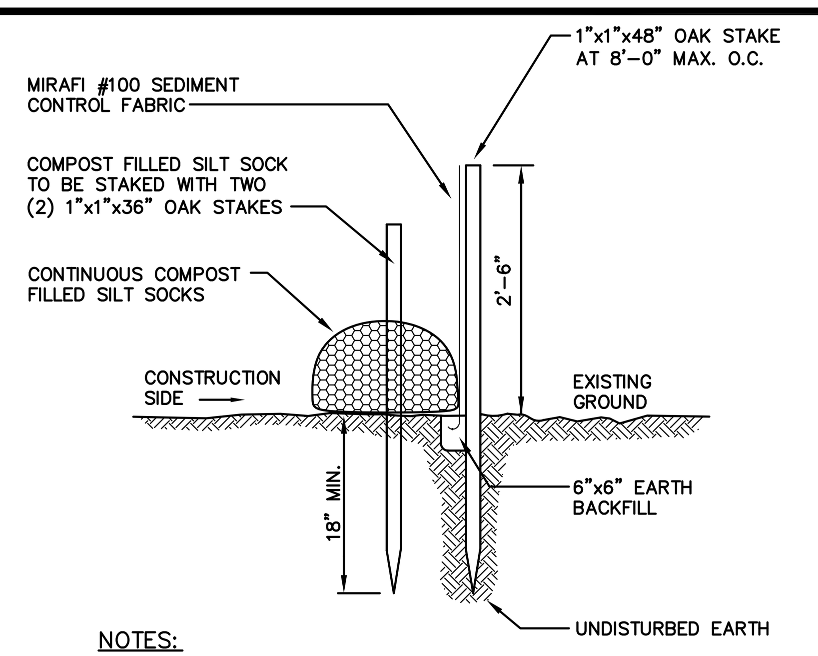
NO.	DATE	DESC.
1	9/18/20	NEW BUILDING FOOTPRINT
2	10/22/20	WETLAND DELINEATION
3	11/03/20	REVISED BUILDING
4	01/21/21	RESPONSE TO PEER REVIEW

PREPARED FOR:
ARLINGTON LAND REALTY, LLC
84 SHERMAN STREET, 2ND FLOOR
CAMBRIDGE, MA 02140

BSC GROUP
803 Summer Street
Boston, Massachusetts
02127
617 896 4300

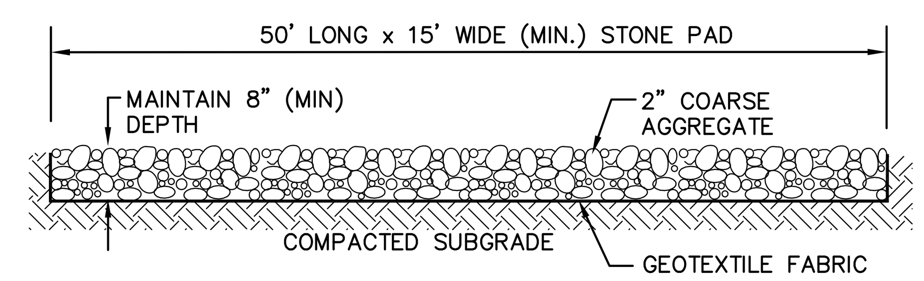
SCALE: 1" = 30'

FILE: \Civil_Drawings\2340700-GR
DWG.:
JOB. NO: 23407.00
SHEET C-105

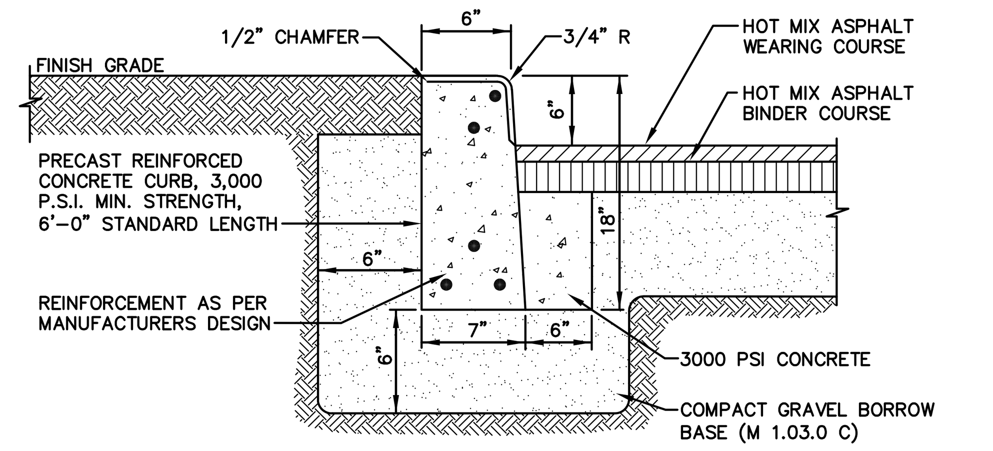


NOTES:
1. SILT SOCKS SHALL BE PLACED IN A ROW WITH THE ENDS TIGHTLY ABUTTING THE ADJACENT SILT SOCKS.
2. SILT SOCKS SHALL BE SECURELY ANCHORED IN PLACE BY TWO (2) 1"X1"X36" OAK STAKES DRIVEN THROUGH THE SILT SOCKS. THE FIRST STAKE IN EACH SILT SOCK SHALL BE ANGLED TOWARD PREVIOUSLY LAID SILT SOCK TO FORCE SILT SOCKS TOGETHER.
3. INSPECTION SHALL BE FREQUENT AND REPAIR OR REPLACEMENT SHALL BE MADE PROMPTLY AS NEEDED.
4. SILT SOCKS SHALL BE REMOVED AND REPLACED WHEN THEY BECOME FILLED WITH SEDIMENT AND BLOCK OR IMPEDE STORM FLOW OR DRAINAGE.
5. SILT SOCKS SHALL BE REMOVED WHEN THE EMBANKMENTS STABILIZE.

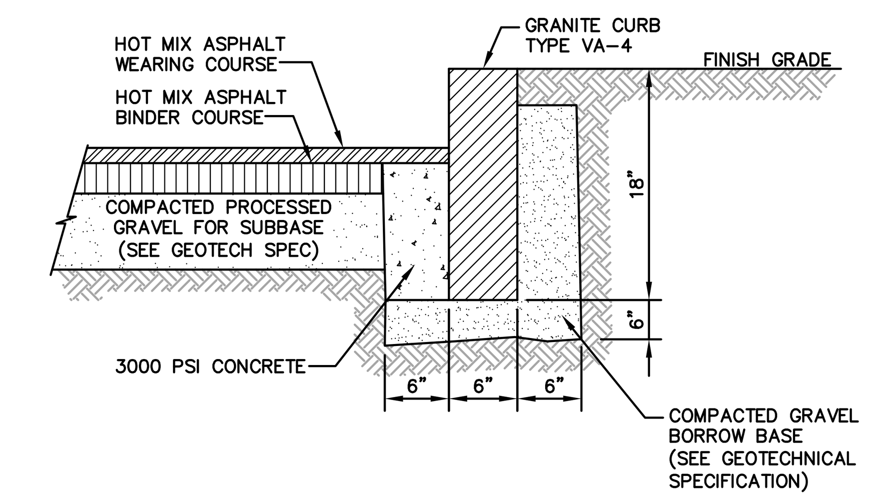
SILT FENCE WITH COMPOST FILLED SILT SOCK
SCALE: NONE



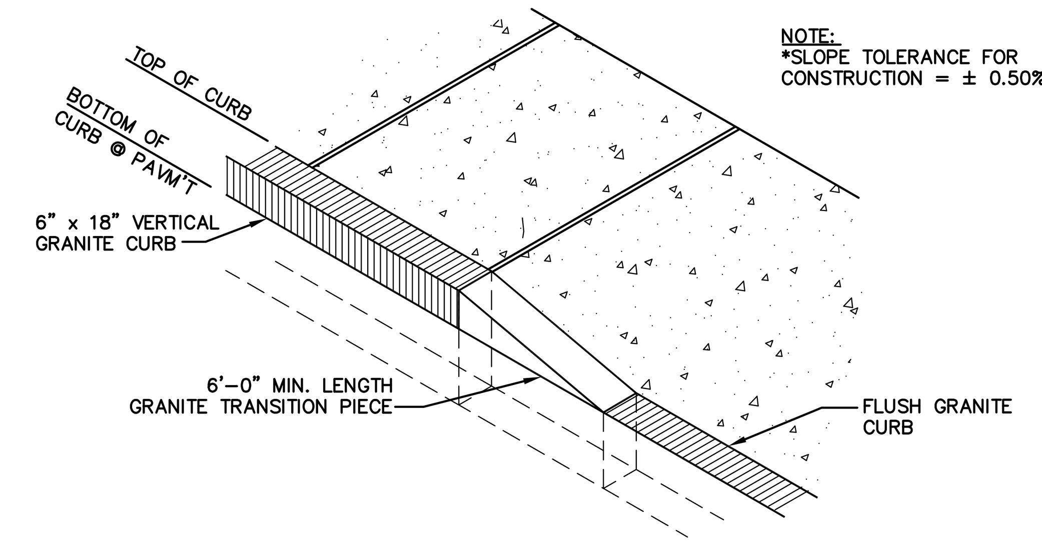
TEMPORARY CONSTRUCTION ENTRANCE
SCALE: NONE



PRECAST CONCRETE CURB
SCALE: NONE

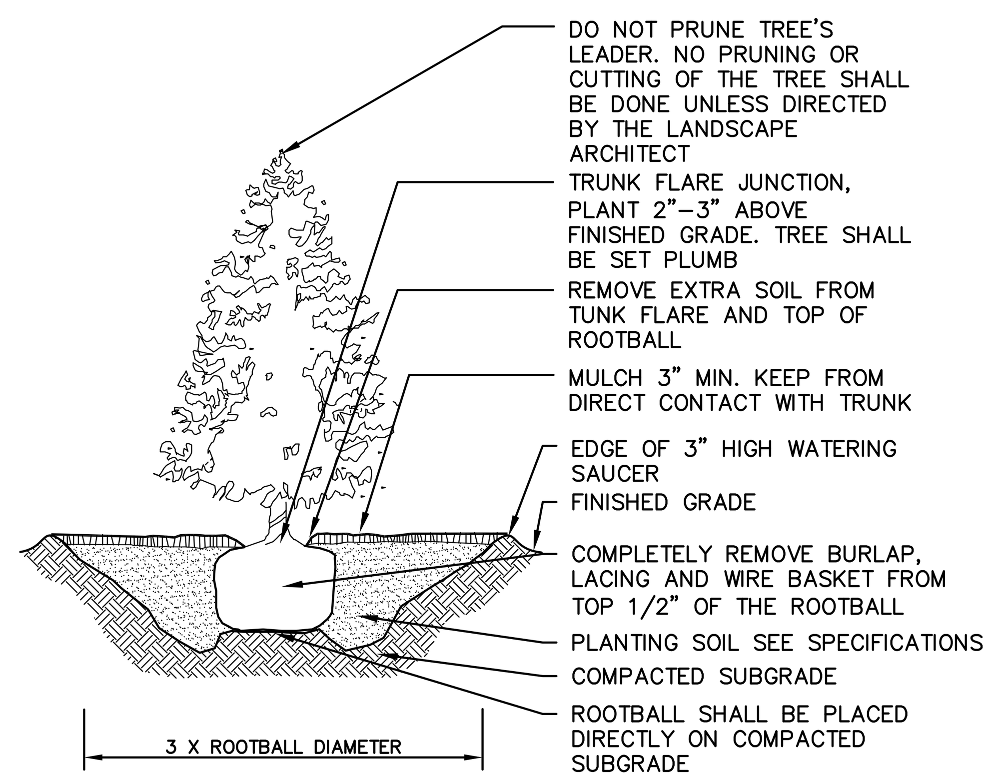


VERTICAL GRANITE CURB
SCALE: NONE



NOTE:
*SLOPE TOLERANCE FOR CONSTRUCTION = ± 0.50%

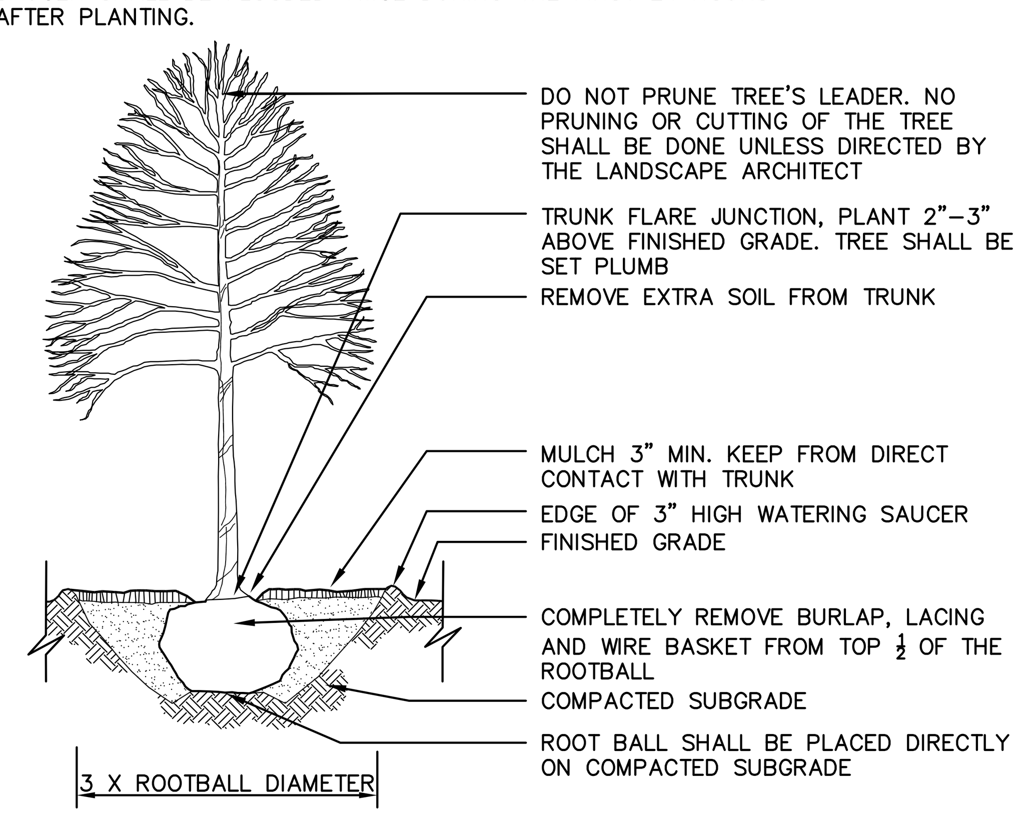
GRANITE CURB TRANSITION
SCALE: NONE



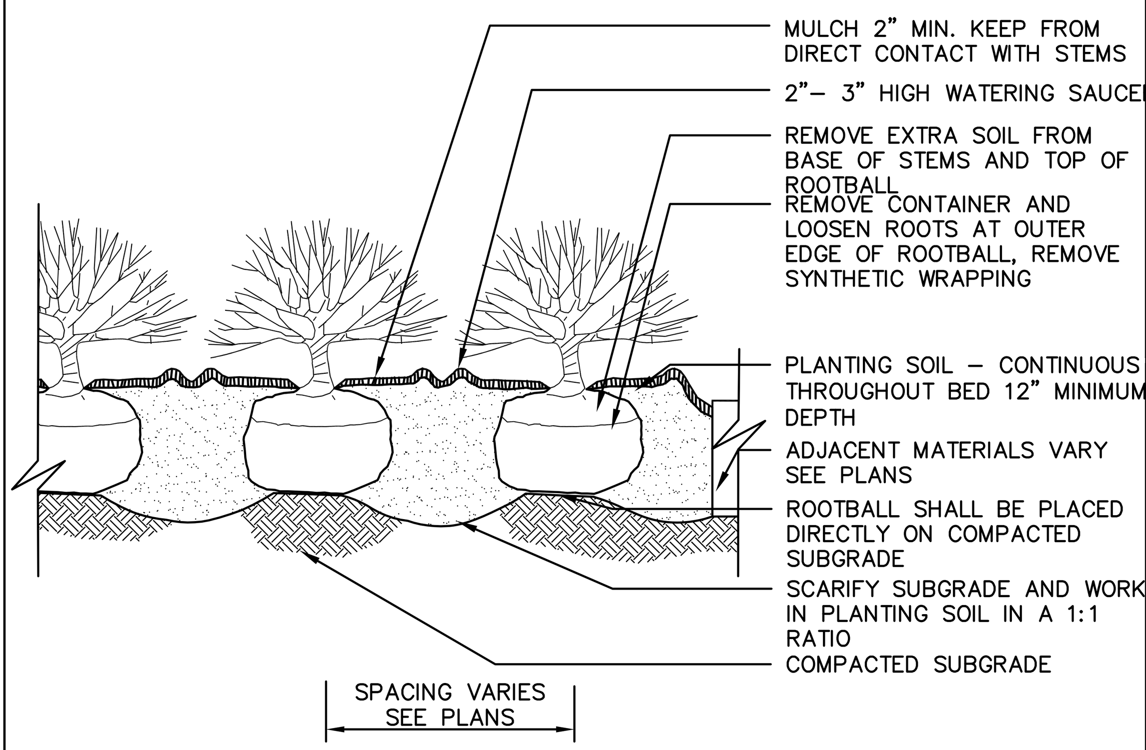
NOTE:
1. SEE SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS.
2. SAUCER SHALL BE FLOODED TWICE DURING THE FIRST 24 HOURS AFTER PLANTING.

EVERGREEN TREE PLANTING DETAIL
SCALE: NONE

NOTES:
1. SEE SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS.
2. CONTRACTOR RESPONSIBLE FOR MAINTAINING TREES IN A PLUMB CONDITION.
3. SAUCER SHALL BE FLOODED TWICE DURING THE FIRST 24 HOURS AFTER PLANTING.

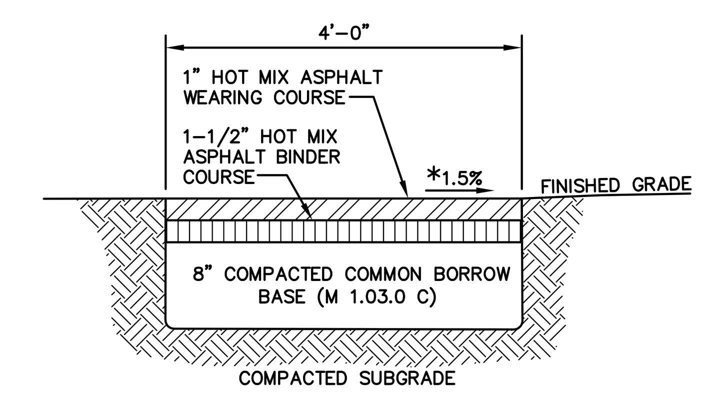


DECIDUOUS TREE PLANTING DETAIL
SCALE: NONE



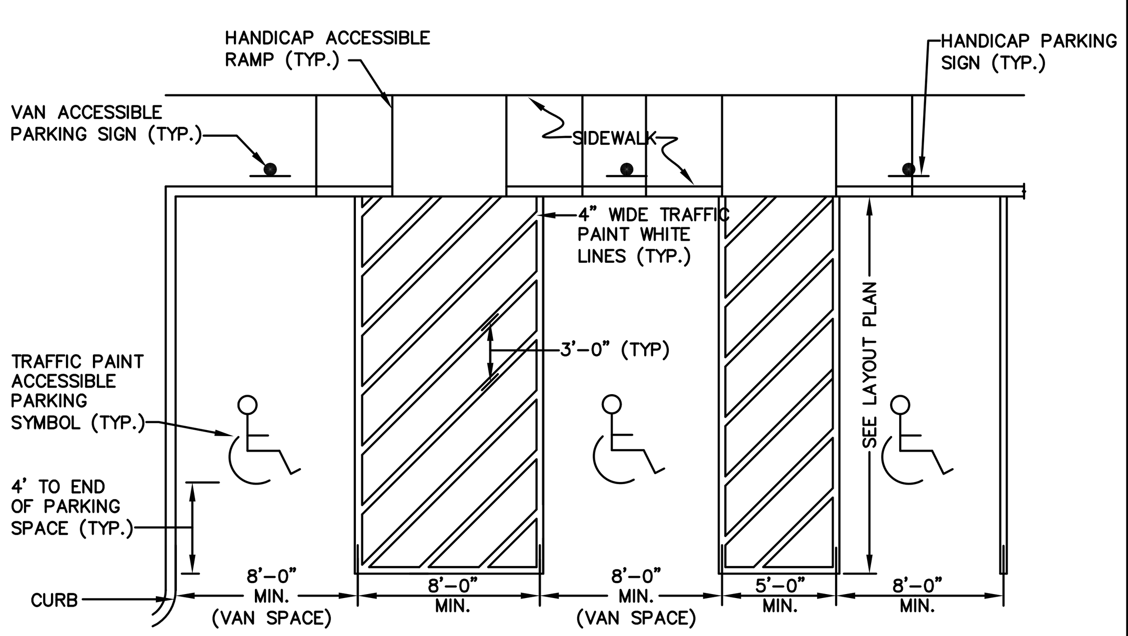
NOTES:
1. SEE SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS.
2. NO PRUNING OR CUTTING UNLESS DIRECTED BY THE LANDSCAPE ARCHITECT.
3. SAUCER SHALL BE FLOODED TWICE DURING THE FIRST 24 HOURS AFTER PLANTING.
4. SHRUBS SHALL BE SET PLUMB AND PLANTED SO THAT THE TOP OF THE ROOTBALL IS 1"-2" ABOVE FINISHED GRADE.

SHRUB PLANTING BED
SCALE: NONE



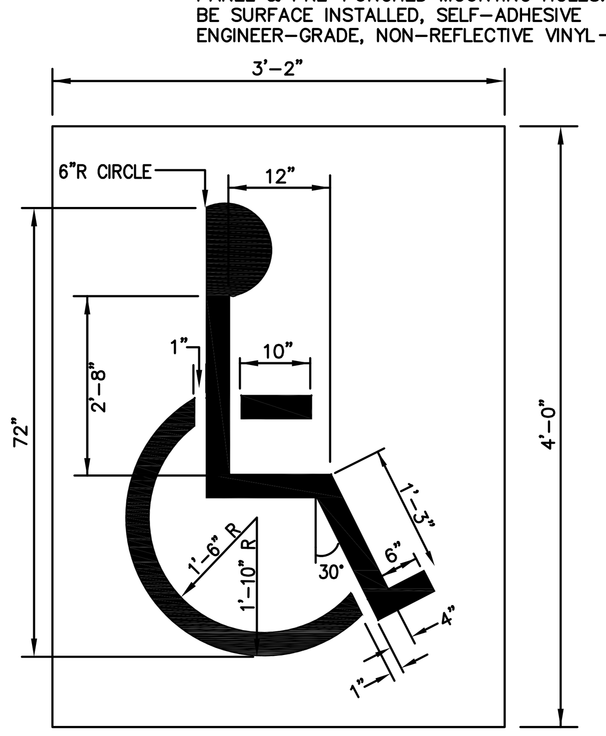
*CONSTRUCTION TOLERANCE = 0.5%

HOT MIX ASPHALT WALKWAY
SCALE: NONE



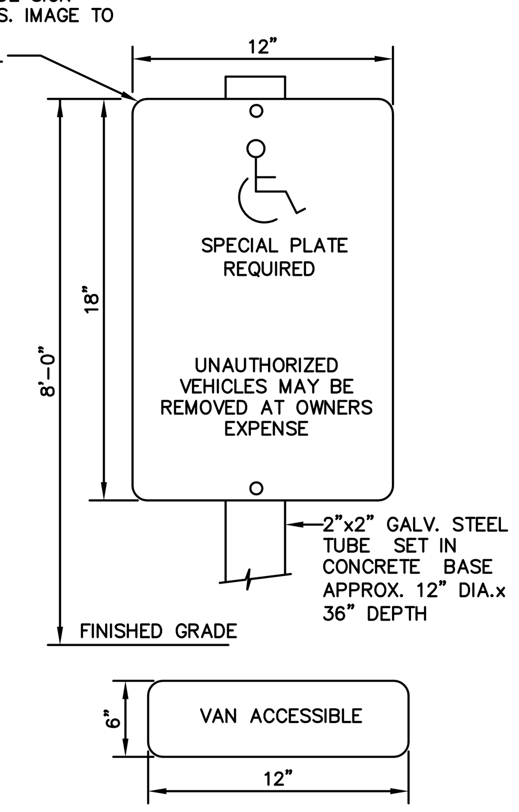
PAINTED PAVEMENT MARKINGS ACCESSIBLE PARKING SPACE
SCALE: NONE

GALVANIZED ALUMINUM REFLECTIVE SIGN PANEL WITH SELF ADHESIVE, ENGINEER-GRADE, REFLECTIVE VINYL SHEETING. EDGES TO BE DRESSED. PROVIDE SIGN PANEL & PRE-PUNCHED MOUNTING HOLES. IMAGE TO BE SURFACE INSTALLED, SELF-ADHESIVE ENGINEER-GRADE, NON-REFLECTIVE VINYL.



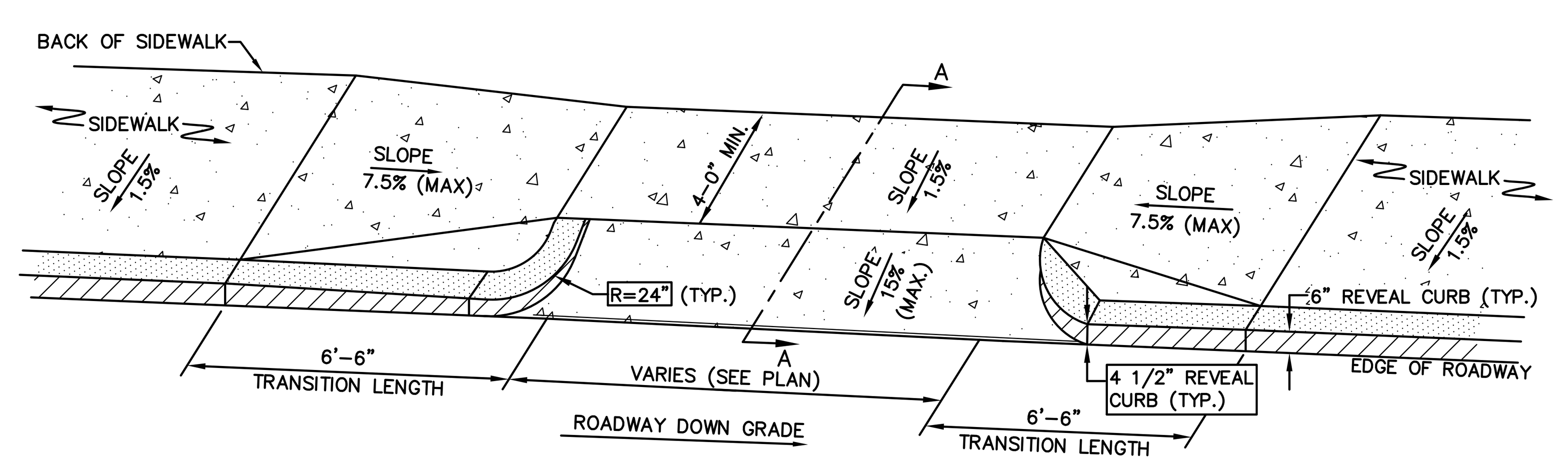
ACCESSIBLE PARKING PAVEMENT MARKING SYMBOL

NOTE:
ACCESSIBLE SYMBOL SHALL BE TRAFFIC PAINT AND CENTERED IN STALL.

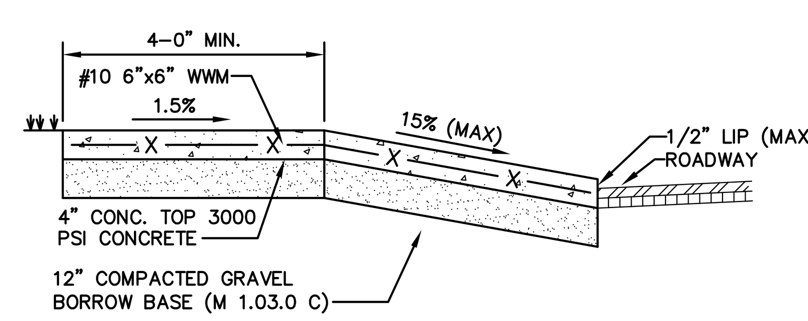


ACCESSIBLE SIGN & POST (VISITOR SIGN & POST TYP.)

PAINTED PAVEMENT MARKINGS ACCESSIBLE PARKING SYMBOL & ACCESSIBLE PARKING SIGN
SCALE: NONE



PLAN



SECTION A-A

CURB TRANSITION LENGTH FOR WHEELCHAIR RAMPS	
ROADWAY PROFILE GRADE (%)	HIGH SIDE TRANSITION LENGTH ROUNDED TO THE NEAREST 4"
0 OR LOW SIDE	6'-6"
>0 - 1	7'-8"
>1 - 2	9'-0"
>2 - 3	11'-0"
>3 - 4	14'-0"
>4	15'-0" (MAX)

NOTES:
1. BASED ON A DESIGN SLOPE OF 7.5% & A REVEAL OF 6".
2. SLOPE TOLERANCE FOR CONSTRUCTION = ± 0.50%
3. THE MAX. ALLOWABLE SLOPE OF ACCESSIBLE ROUTE EXCLUDING CURB RAMPS SHALL BE 5%.
4. THE MAX. ALLOWABLE SLOPE OF ACCESSIBLE ROUTE CURB RAMPS SHALL BE 7.5%.
5. A MINIMUM OF 3 FEET CLEAR SHALL BE MAINTAINED AT ANY PERMANENT OBSTACLE IN ACCESSIBLE ROUTE (I.E. HYDRANTS, UTILITY POLES, TREE WELLS, SIGNS, ETC.).
6. BASE OF RAMP SHALL BE GRADED TO PREVENT PONDING.

SIDEWALK THROUGH DRIVEWAY - TYPE 1
SCALE: NONE

ISSUED FOR PERMITTING
NOT FOR CONSTRUCTION

COMMONWEALTH OF MASSACHUSETTS JOHN M. HESSION CIVIL No. 42747 REGISTERED PROFESSIONAL ENGINEER

PROFESSIONAL ENGINEER DATE

THORNDIKE PLACE

DOROTHY ROAD
IN
ARLINGTON MASSACHUSETTS
(MIDDLESEX COUNTY)

CIVIL & LANDSCAPE DETAILS

MARCH 13, 2020

REVISIONS:

NO.	DATE	DESC.
1	9/18/20	NEW BUILDING FOOTPRINT
2	11/03/20	REVISED BUILDING
3	1/21/21	RESPONSE TO PEER REVIEW

PREPARED FOR:
ARLINGTON LAND REALTY, LLC
84 SHERMAN STREET, 2ND FLOOR
CAMBRIDGE, MA 02140

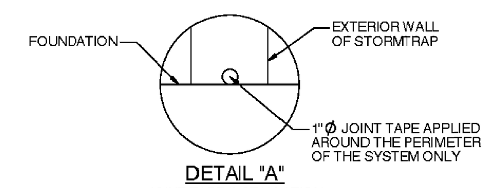
BSC GROUP
803 Summer Street
Boston, Massachusetts
02127
617 896 4300

SCALE: AS NOTED

FILE: 2340700\C\D\2340700-DET
DWG.:
JOB. NO: 23407.00
SHEET C-200

STORMTRAP INSTALLATION SPECIFICATION

1. STORMTRAP MODULES SHALL BE MANUFACTURED ACCORDING TO SHOP DRAWINGS APPROVED BY THE INSTALLING CONTRACTOR AND ENGINEER. THE SHOP DRAWINGS SHALL INDICATE SIZE AND LOCATION OF ROOF OPENINGS AND INLET/ OUTLET PIPE OPENINGS.
2. STORMTRAP SHALL BE INSTALLED IN ACCORDANCE WITH ASTM C891-09, STANDARD PRACTICE FOR INSTALLATION OF UNDERGROUND PRE-CAST CONCRETE UTILITY STRUCTURES. THE FOLLOWING ADDITIONS AND/OR EXCEPTIONS SHALL APPLY:
   - A. SPECIFICATIONS ON THE ENGINEER'S DRAWINGS SHALL TAKE PRECEDENCE.
   - B. STORMTRAP MODULES SHALL BE PLACED ON LEVEL FOUNDATION (SEE SHEET 3.1) WITH A 1'-0" OVERHANG ON ALL SIDES THAT SHALL BE POURED IN PLACE BY INSTALLING CONTRACTOR.
   - C. THE STORMTRAP MODULES SHALL BE PLACED SUCH THAT THE MAXIMUM SPACE BETWEEN ADJACENT MODULES DOES NOT EXCEED 3/4". IF THE SPACE EXCEEDS 3/4", THE MODULES SHALL BE RESET WITH APPROPRIATE ADJUSTMENT MADE TO LINE AND GRADE TO BRING THE SPACE INTO SPECIFICATION.
   - D. THE PERIMETER HORIZONTAL JOINT OF THE STORMTRAP MODULES SHALL BE SEALED TO THE FOUNDATION WITH PREFORMED MASTIC JOINT SEALER ACCORDING TO ASTM C891-09, 8.8 AND 8.12. SEE DETAIL "A".
   - E. ALL EXTERIOR JOINTS BETWEEN ADJACENT STORMTRAP MODULES SHALL BE SEALED WITH PRE-FORMED, COLD-APPLIED, SELF-ADHERING ELASTOMERIC RESIN BONDED TO A WOVEN HIGHLY PUNCTURE RESISTANT POLYMER WRAP CONFORMING TO ASTM C891-09 AND SHALL BE 0'-8" INTEGRATED PRIMER SEALANT AS APPROVED BY STORMTRAP. THE ADHESIVE EXTERIOR JOINT WRAP SHALL BE INSTALLED ACCORDING TO THE FOLLOWING INSTALLATION INSTRUCTIONS:
     1. USE A BRUSH OR WET CLOTH TO THOROUGHLY CLEAN THE OUTSIDE SURFACE AT THE POINT WHERE THE JOINT WRAP IS TO BE APPLIED.
     2. A RELEASE PAPER PROTECTS THE ADHESIVE SIDE OF THE JOINT WRAP. PLACE THE ADHESIVE TAPE (BUTYL SIDE DOWN) AROUND THE STRUCTURE, REMOVING THE RELEASE PAPER AS YOU GO. PRESS THE JOINT WRAP FIRMLY AGAINST THE STORMTRAP MODULE SURFACE WHEN APPLYING.
   - F. THE FILL PLACED AROUND THE STORMTRAP UNITS MUST BE DEPOSITED ON BOTH SIDES AT THE SAME TIME AND TO APPROXIMATELY THE SAME ELEVATION. AT NO TIME SHALL THE FILL BEHIND ONE SIDE WALL BE MORE THAN 2'-0" HIGHER THAN THE FILL ON THE OPPOSITE SIDE. BACKFILL SHALL BE COMPACTED TO 95% STANDARD PROCTOR DENSITY OR OTHERWISE SPECIFIED BY ENGINEER. CARE SHALL BE TAKEN TO PREVENT ANY WEDGING ACTION AGAINST THE STRUCTURE, AND ALL SLOPES BOUNDING OR WITHIN THE AREA TO BE BACKFILLED MUST BE STEPPED OR SERRATED TO PREVENT WEDGE ACTION. (REFERENCE ARTICLE 502.10 I.D.O.T. S.S.R.B.C.) CARE SHALL ALSO BE TAKEN AS NOT TO DISRUPT THE JOINT WRAP FROM THE JOINT DURING THE BACKFILL PROCESS. BACKFILL MATERIAL SHALL BE CLEAN, CRUSHED, ANGULAR No.5 (AASHTO M43) AGGREGATE.



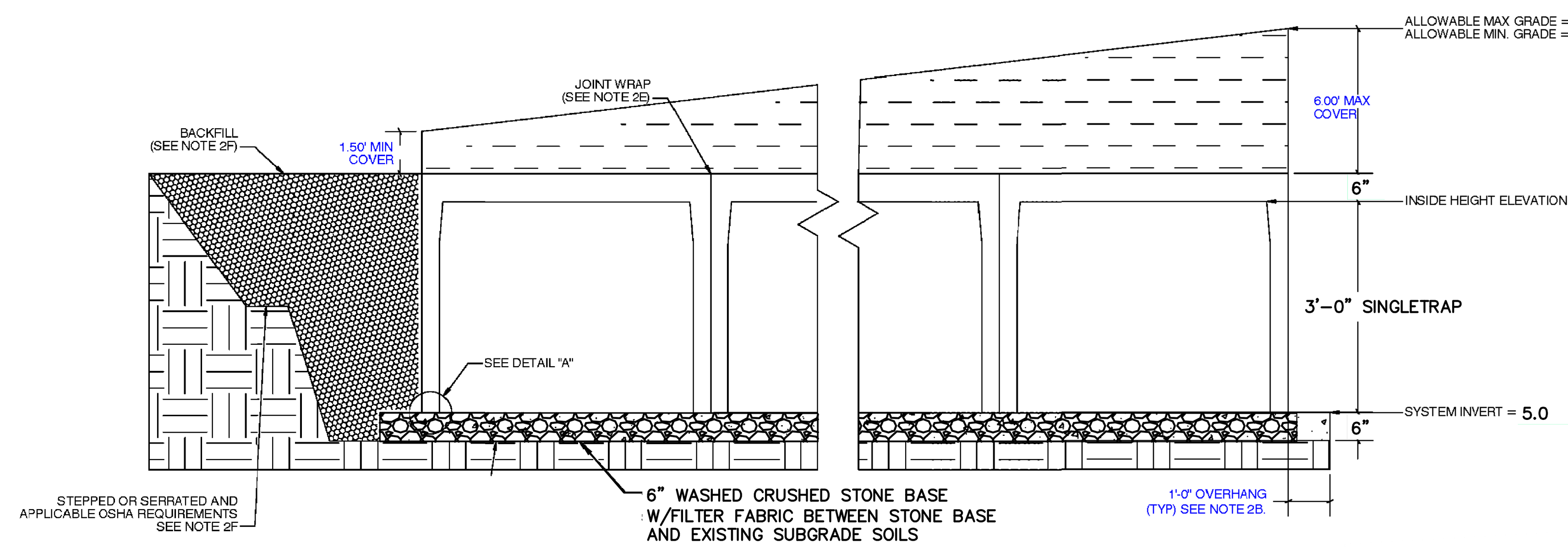
DETAIL "A"
JOINT TAPE INSTALLATION

RECOMMENDED PIPE OPENING SPECIFICATION

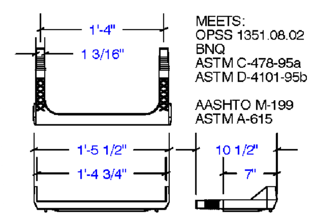
1. PIPE OPENINGS SHALL MAINTAIN A MINIMUM 1'-0" OF CLEARANCE FROM A VERTICAL EDGE OF THE STORMTRAP UNIT.
2. MAXIMUM OPENING SIZE TO BE DETERMINED BY UNIT HEIGHT. PREFERRED OPENING SIZE Ø36" OR LESS. ANY OPENING NEEDED THAT DOES NOT FIT THIS CRITERIA SHALL BE BROUGHT TO THE ATTENTION OF STORMTRAP FOR REVIEW.
3. CONNECTING PIPES SHALL BE INSTALLED WITH A 1'-0" CONCRETE COLLAR, AND A AGGREGATE CRADLE FOR AT LEAST ONE PIPE LENGTH, AS SHOWN. A STRUCTURAL GRADE CONCRETE OR GROUT WITH A MINIMUM 28 DAY COMPRESSIVE STRENGTH OF 3000 PSI SHALL BE USED.
4. THE ANNULAR SPACE BETWEEN THE PIPE AND THE HOLE SHALL BE FILLED WITH NON-SHRINK GROUT.

RECOMMENDED PIPE INSTALLATION INSTRUCTIONS

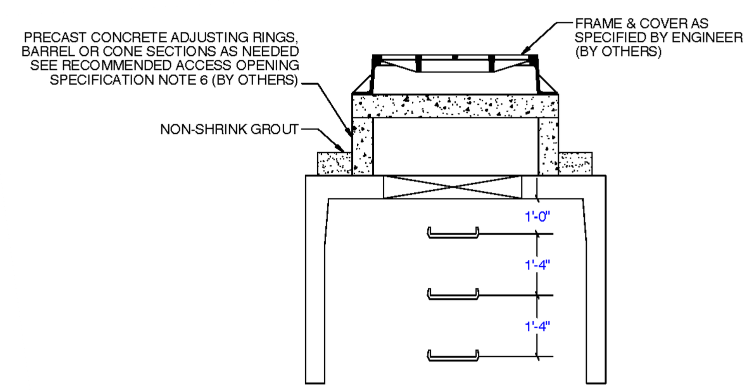
1. CLEAN AND LIGHTLY LUBRICATE ALL OF PIPE TO BE INSERTED INTO STORMTRAP.
2. IF PIPE IS CUT, CARE SHOULD BE TAKEN TO ALLOW NO SHARP EDGES. BEVEL AND LUBRICATE LEAD END OF PIPE.
3. ALIGN CENTER OF PIPE TO CORRECT ELEVATION AND INSERT INTO OPENING.



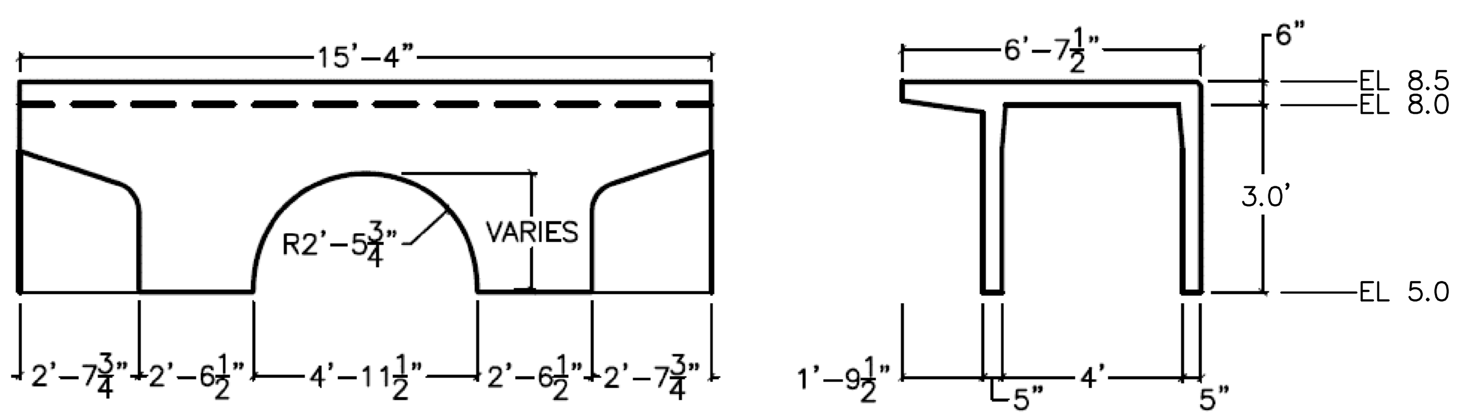
3'-0" SINGLETRAP



STEP DETAIL



RISER / STAIR DETAIL



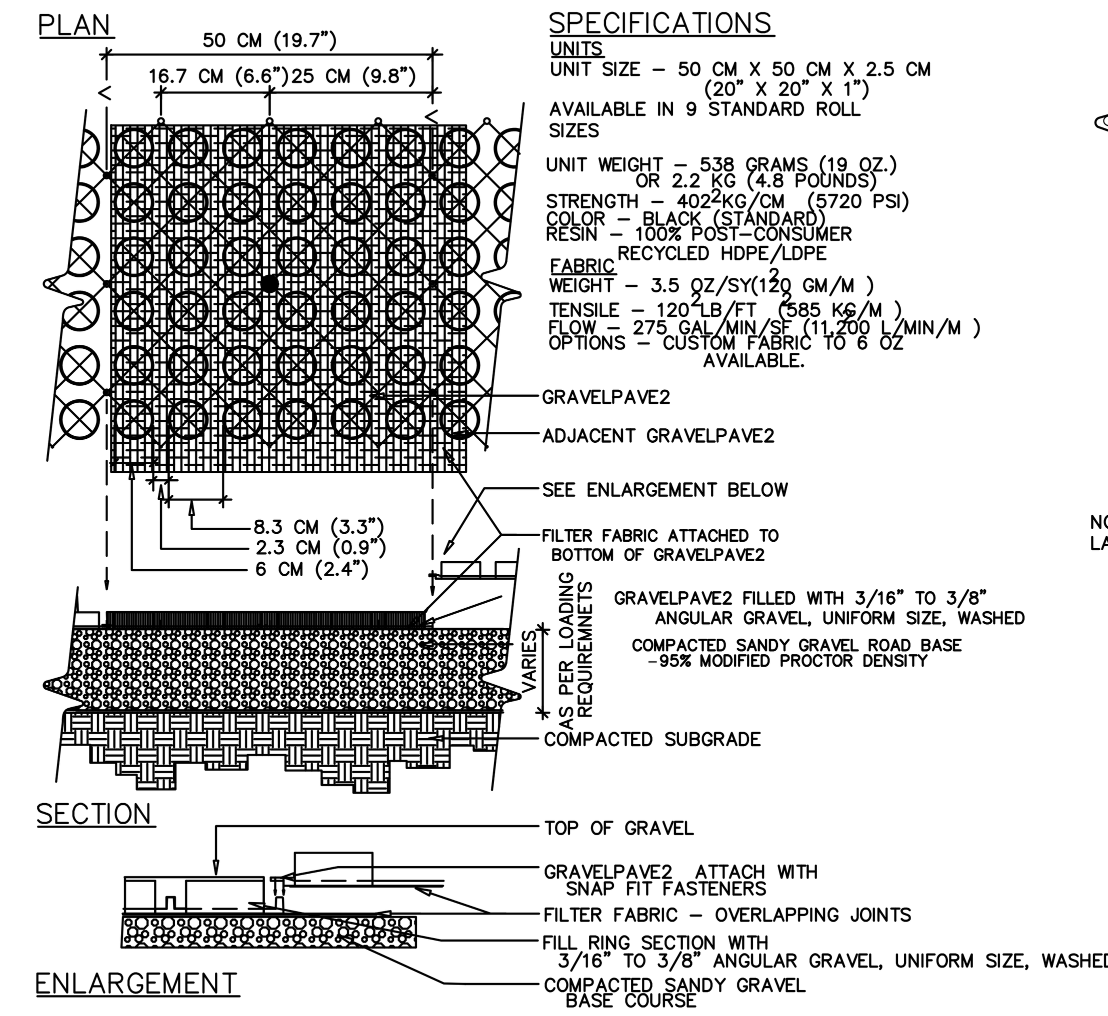
STORMTRAP SINGLE TRAP (SECTION VIEW)

RECOMMENDED ACCESS OPENING SPECIFICATION

1. TYPICAL ACCESS OPENINGS FOR THE STORMTRAP SYSTEM ARE 2'-0" IN DIAMETER. ACCESS OPENINGS LARGER THAN 2'-0" IN DIAMETER NEED TO BE APPROVED BY STORMTRAP. ALL OPENINGS MUST RETAIN AT LEAST 1'-0" OF CLEARANCE IN ALL DIRECTIONS FROM THE EDGE OF THE STORMTRAP UNITS.
2. PLASTIC COATED STEEL STEPS PRODUCED BY M.A. INDUSTRIES PART #PS3-PFC (SEE DETAIL TO THE RIGHT) ARE PROVIDED INSIDE ANY UNIT WHERE DEEMED NECESSARY. THE HIGHEST STEP IN THE UNIT IS TO BE PLACED A DISTANCE OF 1'-0" FROM THE INSIDE EDGE OF THE STORMTRAP UNITS. ALL ENSUING STEPS SHALL BE PLACED WITH A MAXIMUM DISTANCE OF 1'-4" BETWEEN THEM. STEPS MAY BE MOVED OR ALTERED TO AVOID OPENINGS OR OTHER IRREGULARITIES IN THE UNIT.
3. STORMTRAP LIFTING INSERTS MAY BE RELOCATED TO COINCIDE WITH THE ACCESS OPENING OR THE CENTER OF GRAVITY OF THE UNIT AS NEEDED.
4. STORMTRAP ACCESS OPENINGS MAY BE RELOCATED TO AVOID INTERFERENCE WITH INLET AND/OR OUTLET PIPE OPENINGS SO PLACEMENT OF STEPS IS ATTAINABLE.
5. ACCESS OPENINGS SHOULD BE LOCATED IN ORDER MEET THE APPROPRIATE MUNICIPAL REQUIREMENTS. STORMTRAP RECOMMENDS AT LEAST ONE ACCESS OPENING PER SYSTEM FOR ACCESS AND INSPECTION.
6. USE PRECAST ADJUSTING RINGS AS NEEDED TO MEET GRADE. STORMTRAP RECOMMENDS FOR COVER OVER 2' TO USE PRECAST BARREL OR CONE SECTIONS. (BY OTHERS)

UNDERGROUND INFILTRATION (STORMTRAP SINGLE TRAP OR APPROVED EQUAL)

SCALE: NONE

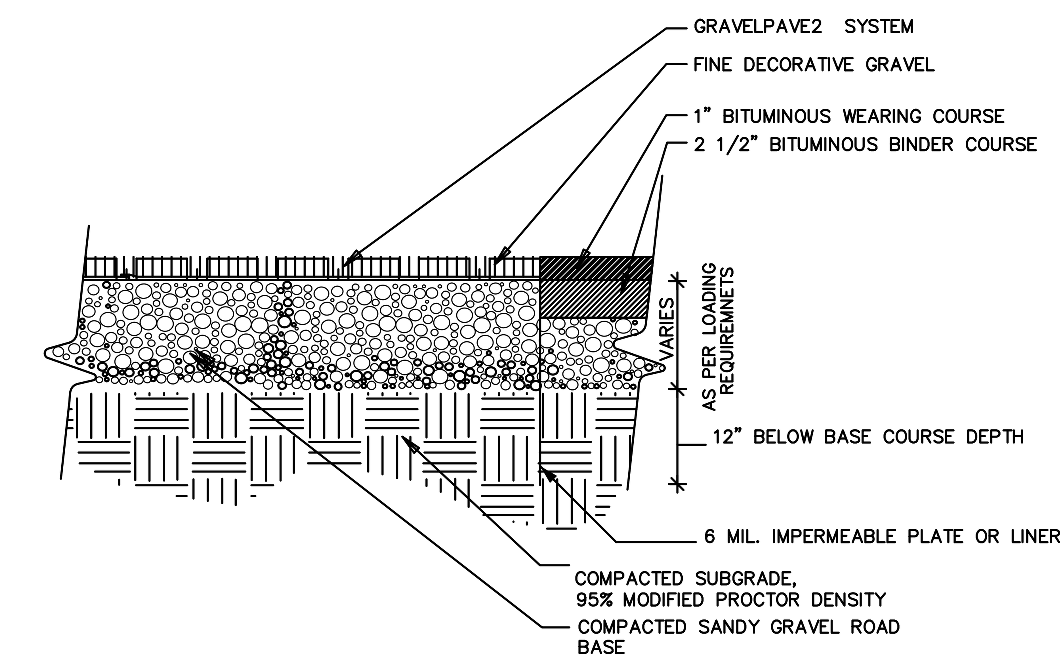


TYPICAL GRAVELPAVE2 DETAIL 1 / 1 OF 1

NOT TO SCALE CHOOSE THIS PRODUCT FOR REINFORCING GRAVEL WEARING SURFACES

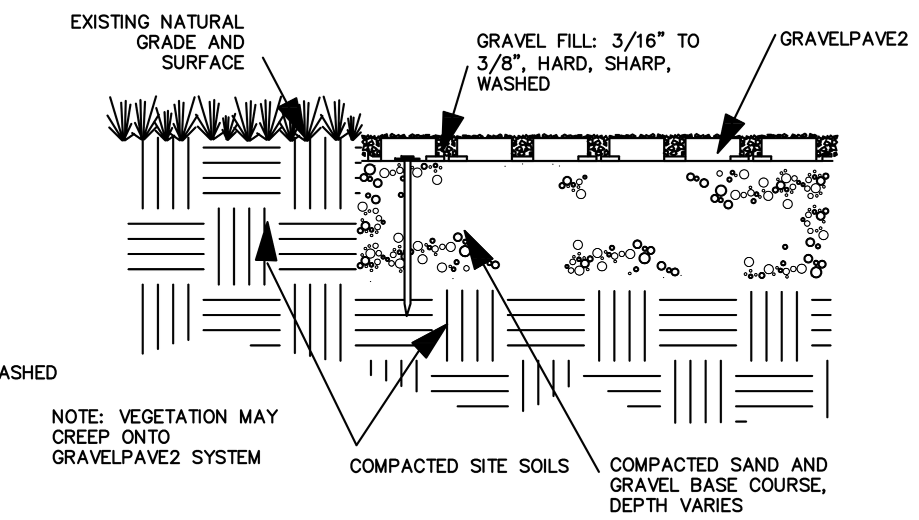
Invisible Structures, Inc.
Gvdet.dwg

1600 Jackson Street, SUITE 310
GOLDEN, COLORADO 80401

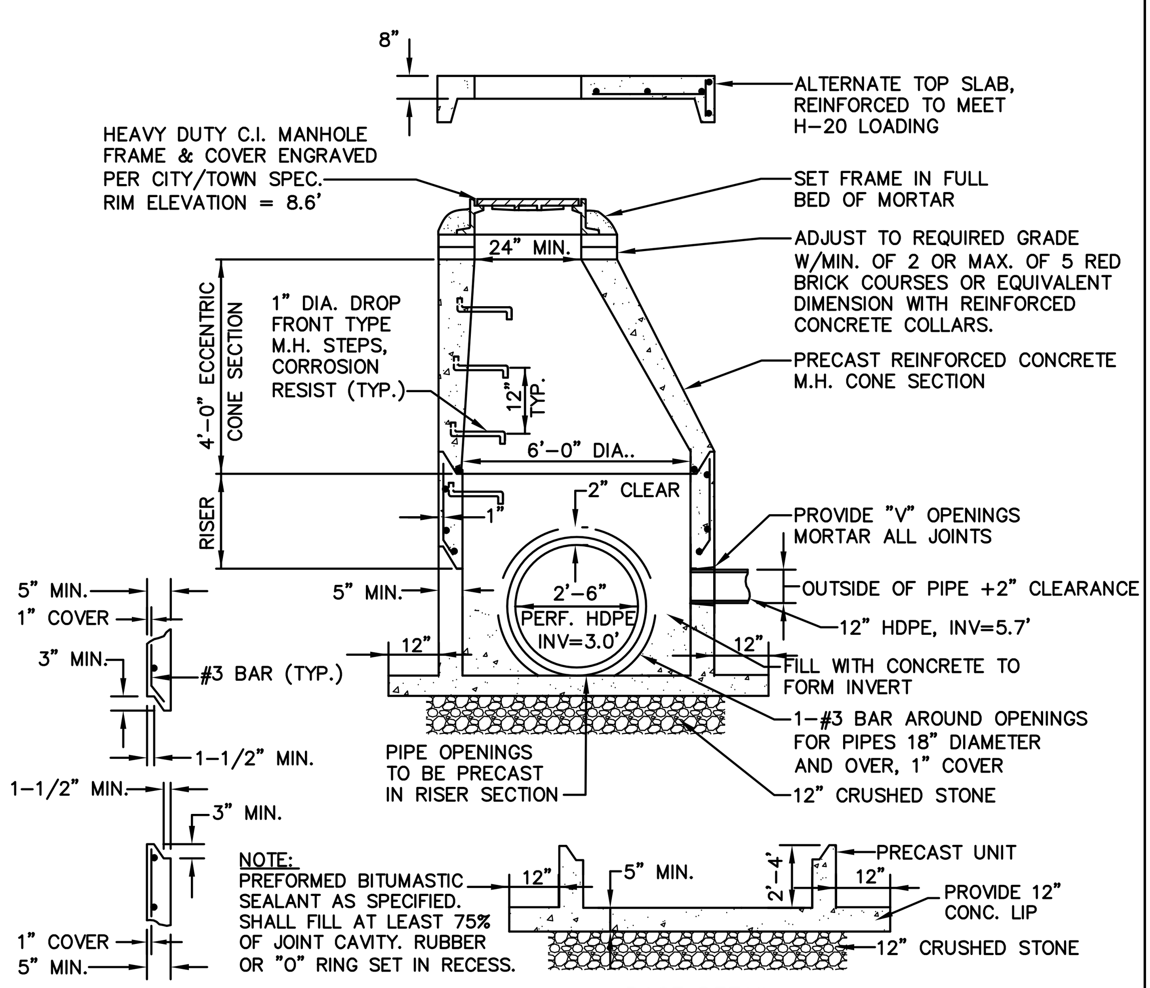


GRAVELPAVE2 AT ASPHALT EDGE

NOTE: GRASS/PLANT TYPES SHALL BE SPECIFIED BY A LANDSCAPE ARCHITECT OR LANDSCAPE DESIGNER



FLUSH, NATURAL (EXISTING) EDGING



JOINT DETAILS

BASE DETAIL

OCS
SCALE: NONE

ISSUED FOR PERMITTING
NOT FOR CONSTRUCTION

PROFESSIONAL ENGINEER DATE

THORNDIKE PLACE

DOROTHY ROAD

IN

ARLINGTON MASSACHUSETTS

(MIDDLESEX COUNTY)

CIVIL & LANDSCAPE DETAILS

MARCH 13, 2020

REVISIONS:

NO.	DATE	DESC.
1	9/18/20	NEW BUILDING FOOTPRINT
2	11/03/20	REVISED BUILDING
3	01/21/21	ADD OCS-1 DETAIL

PREPARED FOR:
ARLINGTON LAND REALTY, LLC
84 SHERMAN STREET, 2ND FLOOR
CAMBRIDGE, MA 02140

BSC GROUP
803 Summer Street
Boston, Massachusetts
02127
617 896 4300

SCALE: AS NOTED

FILE: 2340700\C\D\2340700-DET
DWG.:
JOB. NO: 23407.00
SHEET C-203

BSC GROUP
Transportation ▪ Energy ▪ Land Development

803 Summer Street
Boston, MA 02127

Tel: 617-896-4300

www.bscgroup.com

January 25, 2021

Jenny Raitt, Director
Department of Planning and Community Development
Town of Arlington
50 Pleasant Street
Arlington, Massachusetts 02476

Christian Klein, Chairperson
Zoning Board of Appeals
Town of Arlington
50 Pleasant Street
Arlington, Massachusetts 02476

RE: Response to Peer Review Comments – Traffic Impact Assessment
Thorndike Place Comprehensive Permit Application

Dear Ms. Raitt and Chairman Klein:

On behalf of the Applicant, Arlington Land Realty LLC, BSC Group, Inc. (BSC) is pleased to provide the following written responses to traffic-related peer review comments for the Thorndike Place residential project on Dorothy Road in Arlington, Massachusetts. This letter responds to comments provided by BETA Group, Inc. (BETA) in a letter to you dated December 1, 2020. This letter supplements a response to peer review comments letter prepared by Vanasse & Associates and dated January 15, 2021. For clarity, we have repeated original comments in standard text and then provided a summary of our response in italics.

SITE ACCESS, CIRCULATION, AND PARKING

T1. Include dimensioning of parking stalls and drive aisles for the parking garage.
Response: The parking space lengths and drive aisle widths were shown on the Garage Plan included in the Architectural Drawing set dated November 3, 2020. The parking spaces are proposed at 8.5 feet wide.

T2. Identify snow storage areas and verify that snow storage will not reduce parking capacity.
Response: Snow storage for the surface parking lot and primary access drive will be provided off the pavement on the west side of the parking lot. Snow storage for the courtyard entrance will be provided off pavement within landscape areas and to the east and west of the courtyard between the building and back of sidewalk. These designated snow storage areas will be depicted in the final site plans submitted for review for consistency with the Board's decision. Any excess snow will be removed and properly disposed of offsite.

Engineers

Environmental Scientists

Custom Software Developers

Landscape Architects

Planners

Surveyors

T3. Clarify whether visitor parking spaces will be designated, and the suggested number of visitor spaces and resident spaces.

Response: Visitor parking spaces will not be designated but will be located in the front courtyard area and surface parking lot, on the western side of the property. The garage spaces will be for residents only. The Arlington Zoning Bylaw does not does not differentiate visitor parking spaces when determining the required parking for multi-family development. For projects similar to this, it is estimated that there may be 1 visitor for every 10 dwelling units any time, or approximately 17 visitor spaces for this project

T4. Long term, presumed tenant, bicycle parking is designated within the garage. Recommend designating exterior bike racks for visitor/short term use near a location of public building access, such as within the proposed parking courtyard area.

Response: Bicycle parking for residents is provided in the garage and ground floor as shown on the Garage Plan and Ground Floor Plan included in the Architectural Drawing set dated November 3, 2020. Exterior bike racks will be provided for visitors/short term use in the main entrance courtyard area will be depicted in the final site plans submitted for review for consistency with the Board's decision.

T5. Include swept path analysis on Site Plans to ensure Municipal Fire vehicles can adequately maneuver the Site.

Response: A truck turning exhibit has been prepared showing the emergency vehicle route, a copy of which is enclosed herein. The turning radius specifications were provided by the Arlington Fire Department.

T6. The Site Plan should define pedestrian connections to the Minuteman Commuter Bikeway. If an on-site connection is not provided, clarify the shortest route to/from the bikeway.

Response: No on-site pedestrian connection is currently proposed to the Minuteman Commuter Bikeway. The most direct route to the Minutemen is approximately 1/3 mile by taking Dorothy Road to Margaret Street south. For people who want to travel to the north, it is a similar distance taking Dorothy Road to Margaret Street north to Lake Street east.

T7. An existing pedestrian bridge over Route 2 is located on the southern frontage of the Site. If the bridge is structurally sound, recommend providing an on-site pedestrian pathway between the bridge, the Project, and the Commuter Bikeway/Thorndike Field. This would allow direct connection between residential uses and commercial/office/medical space south of Route 2.

Response: No pedestrian access is currently proposed to the existing pedestrian bridge over Route 2. Additionally, the TAC stated that use of the pedestrian bridge was not recommended and, therefore, a pedestrian connection is not proposed.

T8. Verify locations of accessible entrances. Accessible spaces in the surface lot may be closer to an accessible entrance if they are relocated to the courtyard parking area.

Response: The accessible parking spaces will be relocated to the courtyard parking area to be closer to the main building entrance.

T9. Verify intended circulation of the courtyard parking area."

Response: The proposed courtyard circulation will be reversed to provide counter clockwise circulation.

CONSTRUCTION IMPACTS

T41. Quantify and analyze the effect of construction on the Dorothy Road neighborhood. It is expected that the earthwork required for the site will result in a significant number of trips for large dump trucks, in addition to other construction vehicles related to the grading and construction of the Site building. Verify turning path of large construction vehicles at affected intersections within the neighborhood and to/from Lake Street.

Response: Prior to construction, a Construction Traffic Management Plan will be prepared by the

General Contractor and submitted to appropriate town staff prior to issuance of building permits. It is anticipated that coordination of the construction vehicle access route and construction hours will be undertaken with input from Public Works, Building and the Police Department prior to commencement of site preparation work. It is likely that construction vehicles will access the site from Route 2 and Lake Street via Littlejohn Street and will exit back to Route 2 via Burch Street or Margaret Street to Lake Street. Temporary parking restrictions during construction hours may be necessary on the construction vehicle route.

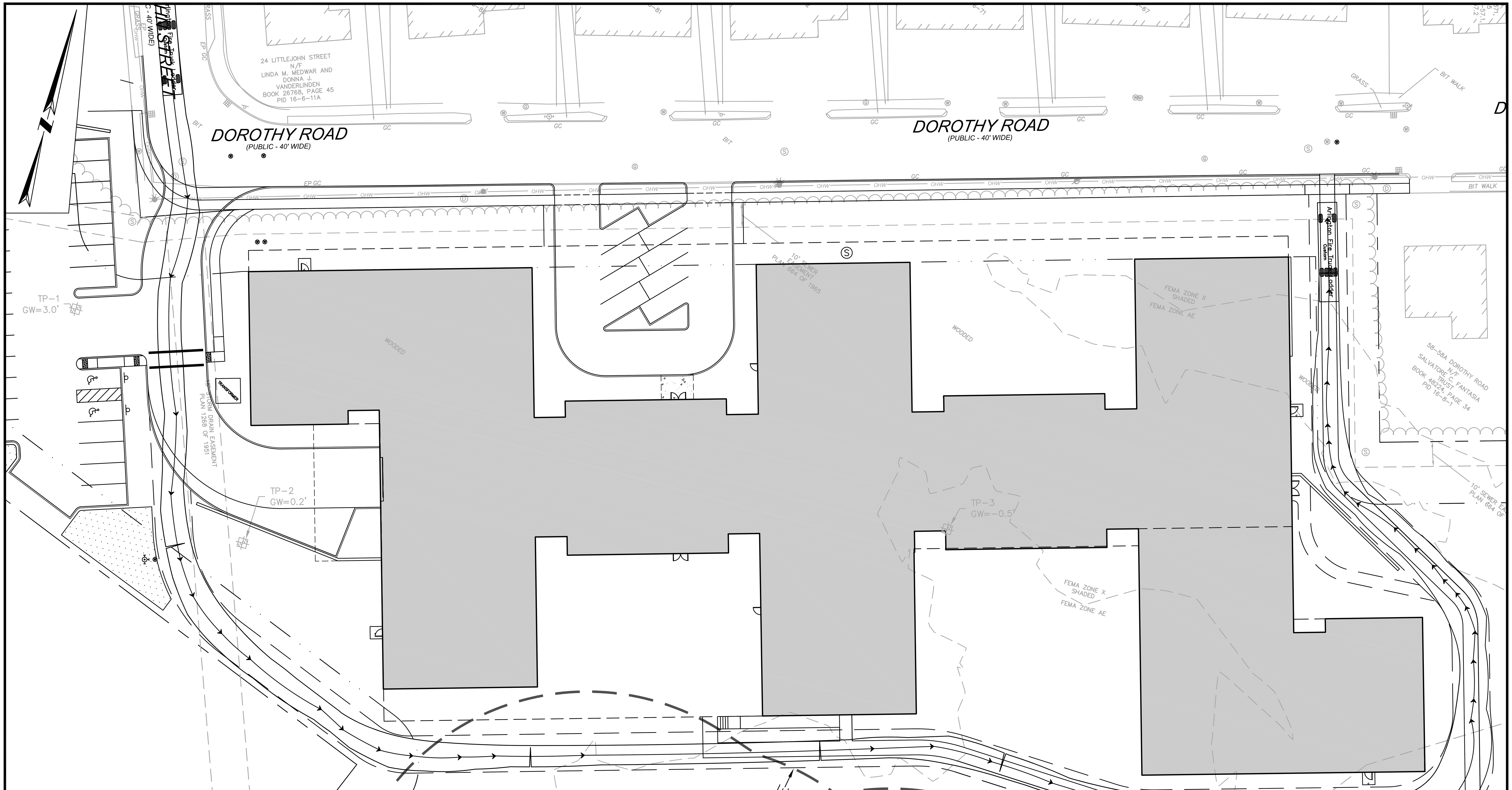
We look forward to discussing these responses with you at the next public hearing on the topic. Should you have any questions on this information, please do not hesitate to reach out to me at (617) 896-4321 or jhession@bscgroup.com.

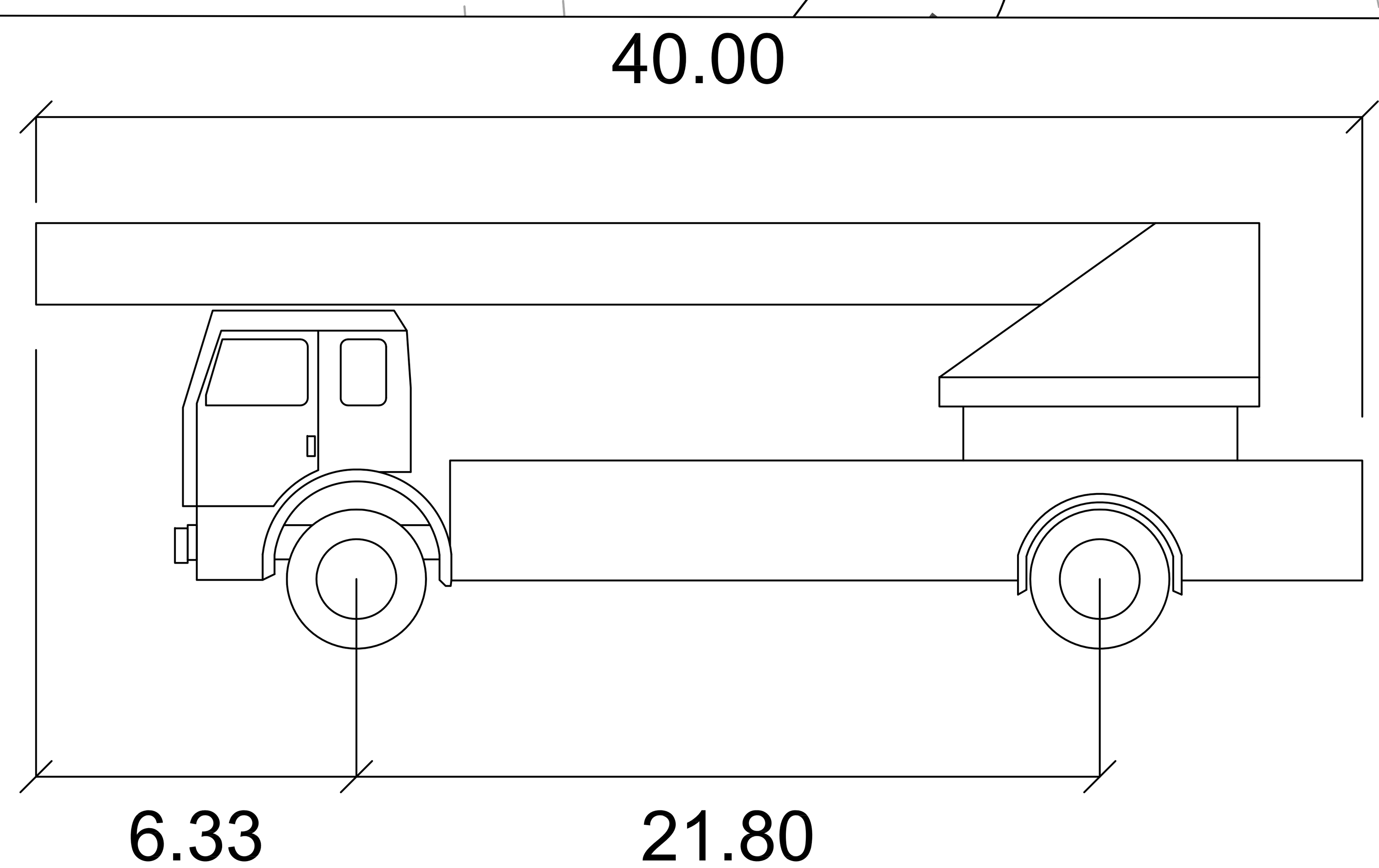
Sincerely,
BSC Group, Inc.

John Hession, P.E.
Vice President

cc: zba@town.arlington.ma.us
Marta Nover and Greg Lucas, BETA
Stephanie Kiefer, Smolak & Vaughan
Gwen Noyes and Arthur Klipfel, Arlington Land Realty
Scott Thornton, VAI

Attachment: Truck Turning Exhibit





Arlington Fire Truck

feet

Width	:	7.80
Track	:	6.91
Lock to Lock Time	:	6.0
Steering Angle	:	40.0

ISSUED FOR PERMITTING
NOT FOR CONSTRUCTION

PROFESSIONAL ENGINEER DATE

THORNDIKE PLACE

DOROTHY ROAD
IN
ARLINGTON
MASSACHUSETTS
(MIDDLESEX COUNTY)

TRUCK TURNING
FIRE TRUCK ACCESS

JANUARY 12, 2021

REVISIONS:

NO.	DATE	DESC.
1	9/18/20	NEW BUILDING FOOTPRINT
2	10/22/20	WETLAND DELINEATION
3	11/03/20	REVISED BUILDING

PREPARED FOR:
ARLINGTON LAND REALTY, LLC
84 SHERMAN STREET, 2ND FLOOR
CAMBRIDGE, MA 02140

BSC GROUP
803 Summer Street
Boston, Massachusetts
02127
617 896 4300

SCALE: 1" = 20'
0 10 20 40 FEET

FILE: \Civil_Drawings\2340700-LM
DWG.:
JOB. NO: 23407.00
SHEET SK-01

BSC GROUP

MEMORANDUM

33 WALDO STREET, WORCESTER, MA 01608 - www.bscgroup.com
TEL 508-792-4500 - 800-288-8123

To:	John Hession, BSC Group, Inc.	**Date:**	October 19, 2020 **Revised January18, 2021**
From:	Gillian Davies and Susan McArthur, BSC Group, Inc.	**Proj. No.**	23407.00
Re:	Wetland Delineation, Thorndike Place, Arlington, MA		

INTRODUCTION

On January 15, October 15, December 22 of 2020, and January 5, 2021 BSC Group, Inc. (BSC) conducted field delineations of wetland resource areas regulated under the *Massachusetts Wetlands Protection Act* (*WPA*) and associated *regulations* (*310 CMR 10.00 et al*) and the Town of Arlington *Wetlands Protection Bylaw (Article 8)* (*Bylaw*) and associated *regulations* (*Sections 1 through 34*) dated June 4, 2015, at the Thorndike Place/Mugar Property located off of Dorothy and Parker Roads. This primarily forested property is located between Route 2, a single-family residential neighborhood, and a local park. Site topography is relatively flat. Trash piles and debris, as well as a homeless encampment occur on the property.

ENVIRONMENTAL RESOURCE AREA MAPPING

BSC reviewed existing mapping of environmental resources for the project site. The majority of the property is located within the FEMA 100-year floodplain and part of the site appears to be located within the floodway associated with the Little River (a Letter of Map Revision (LOMR) may be needed), as indicated on the attached Environmental Resources Map. NRCS soils maps (Web Soil Survey) indicate that Udorthents, wet substratum, Urban land, wet substratum, and Swansea muck occur on the site. According to the Massachusetts Natural Heritage and Endangered Species Program (NHESP) and the MassGIS data layer for the Massachusetts Natural Heritage Atlas, no areas of Estimated or Priority Habitat for Rare Wildlife or Certified or Potential Vernal Pools exist on the project site. BSC also reviewed the USGS topographic map.

WETLAND RESOURCE AREA FIELD DELINEATION

In addition to reviewing relevant resource area mapping for the project site, BSC conducted an initial wetland field delineation on January 15, 2020. This wetland delineation was conducted in accordance with the MA *WPA regulations*, the Massachusetts Department of Environmental Protection handbook on *Delineating Bordering Vegetated Wetlands Under the Massachusetts Wetlands Protection Act* (March 1995), the *Bylaw regulations,* the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Region (Version 2.0)* (January 2012), and the *Field Indicators for Identifying Hydric Soils in New England* (May, 2018). BSC evaluated onsite vegetation to determine areas where 50% or more of the vegetation qualify as wetland species according to the above-mentioned regulatory documents and according to wetland indicator status as described in the *State of Massachusetts 2016 Wetland Plant List* (http://wetland-plants.usace.army.mil/nwpl_static/data/DOC/lists_2016/States/pdf/MA_2016v1.pdf). In accordance with the above-mentioned soils guidance documents, BSC examined soils to determine where hydric soils occur, by auguring or digging a soil pit to evaluate the top 20 inches of soil for soil texture, color, horizon thickness and depth, and presence/absence of redoximorphic features. BSC also observed the site for evidence of wetland hydrology. Due to winter conditions (lack of growing season hydrology, lack of full suite of vegetation) a decision was made to re-evaluate the wetlands at the site during the growing season. Following the same methodology, the wetland delineation was re-evaluated on October 15, 2020 and a few of the wetland flags were adjusted to accommodate growing season conditions. Wetland flags C-10, C-15 through C-17, C-17A, were moved upgradient to include a pocket of spotted touch-me-not (*Impatiens capensis*), silver maple (*Acer saccharinum*), and green ash (*Fraxinus pennsylvanica*). In addition, wetland flag D-10 was removed and the wetland line was revised to connect D-9 to D-11 based on the presence of cinnamon fern and hydric soils.

BSC marked the boundaries of four Bordering Vegetated Wetland (BVW) areas (Series A, B, C and D) with sequentially numbered pink surveyor's tape. Additionally, BSC reviewed conditions at two potential Isolated Vegetated Wetlands (IVW) (H and I Series) that had been identified and flagged during a previous delineation at the site. Two other IVWs (F and G Series) had also been identified during the previous wetland delineation. Data plots performed on January 15th, 2020 and on October 15, 2020 did not meet criteria as wetlands (i.e. lacked either a predominance of wetland vegetation or lacked hydric soils and indicators of hydrology). Wetland data sheets for Transects #1, #2, and #3 have been prepared (attached).

After discussions with the Arlington Conservation Commission and the town engineer, BSC wetland scientists performed two additional site investigations on December 22, 2020 and January 5, 2021 to reevaluate the soils in and adjacent to the potential IVWs located in close proximity to Dorothy Road. BSC soil scientists performed extensive exploration of the soils just east of the original plot location, including soil excavation using a mattock due to stony conditions. Based on a review of historic aerial photographs, the soils in this area are comprised of fill from farming operations and disturbance when the adjacent residential neighborhood was constructed in the mid -1940s. BSC confirmed from data taken on these subsequent visits that two isolated vegetated wetlands are present in this location. These small depressional areas have herbaceous layers dominated by FACU species garlic mustard (*Alliaria petiolate*)) and a thick stand of Japanese knotweed (*Polygonum cuspidatum*), which obscured their depressional topography during previous visits. However, the FACU herbaceous layer was determined not to be dominant given the tree strata consisting of FAC species: American elm (*Ulmus Americana*)), eastern cottonwood (*Populus deltoides*), and box elder (*Acer negundo*). Hydric soils were identified at both of these areas. Two new transects were established to characterize these wetlands. Transect 4 was taken along the eastern boundary of the larger depression. Soils within this wetland consists of a dark surface horizon (10YR2/1) with a depleted subsoil (2.5Y 5/2 with 5% prominent redoximorphic features). Transect 5 was taken along the western boundary of the smaller depression. Soils within this depressional area consist of a thick dark upper 20" of soil (10YR2/1) with prominent redoximorphic features present as soft masses (4% 10YR 5/6). Wetland data sheets for Transects 4 and 5 have been prepared (attached).

Soils in these depressional areas consist of variable and interlayered Human Transported Material (HTM), commonly referred to as fill, including sandy topsoil material and gravel. In addition to HTM layers, mounds of fill material are also present. Given the mature age of tree species on the site, road base material and asphalt piles may represent historical filling from the multiple development phases the area has undergone with much of the adjacent residential neighborhood constructed in the mid-1940s. From investigations, the area appears to have been used more recently by neighborhood people as a dumping ground for yard waste material and trash and it now includes a homeless encampment with used medical needles, bags, clothing, bikes, old camping equipment etc. These materials can all be found inside or within close proximity to the wetlands. These impacted wetlands represent an opportunity for improving the existing site conditions. Improvements could be completed as part of the creation of compensatory flood storage during project construction. Improvements to the IVW areas could include the removal of invasive species as well as the plantings of native wetland species to create additional ecosystem functions and values. Additionally, trash and rubble removal from the wetland resource areas, buffer zones, and uplands could help improve their quality for wildlife species who use the wetlands as habitat.

BVW Series A and D are predominantly forested areas. BVW Series B is primarily forested with an area of herbaceous cover (predominantly common reed [*Phragmites australis*]), and BVW Series C is largely herbaceous common reed, with some forested area. Throughout the site, wetlands include the following tree species: red maple (*Acer rubrum*), box elder (*Acer negundo*), American elm (*Ulmus Americana*), white pine (*Pinus strobus*), ash (*Fraxinus sp.*), American Sycamore (*Plantanus occidentalis*), and black willow (*Salix* *nigra*). Shrub and sapling species include silky dogwood (*Swida amomum*), and box elder saplings. Herbaceous species include common reed, cinnamon fern (*Osmundastrum cinnamomeum*), sensitive fern (*Onoclea sensibilis*), and goldenrod (*Solidago sp*.), and vines include poison ivy (*Toxicodendron radicans*), bittersweet (*Celastrus sp*.), greenbriar (*Smilax sp*.) and wild grape (*Vitis sp*.). In upland locations, tree species include red oak (*Quercus rubra*), white pine, cottonwood (*Populus deltoides*), box elder, and red maple. Shrubs and saplings include white pine, barberry (*Berberis sp*.), brambles (*Rubus sp*.), and multiflora rose. Herbaceous species include upland grasses and goldenrod (*Solidago sp*.), and vines include bittersweet, wild grape, greenbriar, and poison ivy.

Overall, BVW boundaries flagged on January 15, 2020, adjusted on October 15 and December 22, 2020 and IVW boundaries flagged on January 5, 2021 are similar to the boundaries flagged when wetlands were delineated previously in 2009. In some areas, the 2009 delineation extends upgradient of the BSC delineation, and in some areas the BSC delineation extends upgradient of the 2009 delineation. As the BSC delineation is the most recent, and wetland conditions can shift over time, BSC is of the opinion that this most recent delineation most accurately reflects conditions as they exist in the present.

REGULATORY REVIEW

The project site contains state and locally regulated BVW and associated 100-foot buffer zones. In addition, two locally regulated IVWs are located at the site near Dorothy Road. BSC notes that the local *Bylaw regulations* identify the 100-foot buffer zone as a regulated resource area, the Adjacent Upland Resource Area (AURA). Further, the *Bylaw regulations* establish a 25-foot "No-Disturbance Zone" where no activities or work is permitted. The *Bylaw regulations* also establish a 75-foot "Restricted Zone" where impacts should be avoided and reasonable alternatives pursued.

The Bylaw regulations define Land Subject to Flooding (LSTF), as noted in *Bylaw Section 4.B. Definition number 35* and *Section 23*. Section 23 specifies that, "Compensatory flood storage shall be at a 2:1 ratio, minimum, for each unit volume of flood storage lost at each elevation.

SUMMARY

BSC has conducted a wetland delineation at the Thorndike Place/Mugar Property that is similar in extent to the previous delineation conducted in 2009. BSC notes that the site is largely within floodplain or floodway. Additional soil investigations revealed that the two isolated depressional areas near Dorothy Road are considered IVW and as such, now have a 25-foot No Disturb Zone and a 100-foot Adjacent Upland Resource Areas as shown on the site plan.

cc: Marleigh Sullivan, BSC Group, Inc.
Ethan Sneesby, BSC Group, Inc.

MassDEP Bordering Vegetated Wetland (310 CMR 10.55) Delineation Field Data Form

Applicant: Thorndike Place Prepared by: BSC Group, Inc. (SMM & EPS) Project location: Isolated Area, behind houses DEP File #:_______________

Check all that apply:

- ❑ Vegetation alone presumed adequate to delineate BVW boundary: fill out Section I only
- ❑ Vegetation and other indicators of hydrology used to delineate BVW boundary: fill out Sections I and II
- ❑ Method other than dominance test used (attach additional information)

Section I.

Vegetation	Observation Plot Number: 1 (Upland)		Transect Number: 1	Date of Delineation: 10/15/2020
A. Sample Layer & Plant Species (by common/scientific name)	B. Percent Cover (or basal Area)	C. Percent Dominance	D. Dominant Plant (yes or no)	E. Wetland Indicator Category*
Trees				
Ailanthus altissima / Tree of Heaven	63%	52%	Yes	NI
**Acer rubrum*/ Red maple	38%	31%	Yes	FACW+
**Acer negundo*/ Box elder	10.5%	9%	No	FAC+
**Ulmus rubra*/ Slippery elm	10.5%	9%	No	FAC
Total Percent Cover: 122%				
Shrubs/ Saplings				
**Acer negundo*/ Box elder	10.5%	100%	Yes	FAC+
Total Percent Cover: 10.5%				
Herbaceous				
Fallopia japonica/ Japanese knotweed	63%	86%	Yes	FACU-
Alliaria petiolata/ Garlic mustard	10.5%	14%	No	FACU-
Total Percent Cover: 73.5%				
Vines				
Celastrus orbiculatus/ Asian bittersweet	10.5%	50.00%	Yes	FACU
Vitis labrusca/ Fox grape	10.5%	50.00%	Yes	FACU
Total Percent Cover: 21%				

* *Use an asterisk to mark wetland indicator plants: plant species listed in the Wetlands Protection Act (MGL c.131, s.40); plants in the genus Sphagnum; plants listed as FAC, FAC+, FACW-, FACW, FACW+, or OBL; or plants with physiological or morphological adaptations. If any plants are identified as wetland indicator plants due to physiological or morphological adaptations, describe the adaptation next to the asterisk.*

Vegetation conclusion:

Number of dominant wetland indicator plants: 2 Number of dominant non-wetland indicator plants: 3

Is the number of dominant wetland plants equal to or greater than the number of dominant non-wetland plants? yes no

If vegetation alone is presumed adequate to delineate the BVW boundary, submit this form with the Request for Determination of Applicability or Notice of Intent

Section II. Indicators of Hydrology

Hydric Soil Interpretation

1. Soil Survey

Is there a published soil survey for this site? yes no
title/date: WebSoil Survey/ 2020
map number: 655
soil type mapped: Udorthents, wet substratum
hydric soil inclusions: Yes

Are field observations consistent with soil survey? yes no
Remarks:

2. Soil Description

Horizon	Depth	Matrix Color	Mottles Color	Texture
Ap	0-14"	10YR 2/1 (60%)	-	Sandy loam
		10YR 2/2 (40%)	-	
B	14"+	2.5YR 8/4 (90%)	-	Sandy loam
		10YR 7/8 (10%)	-	

Remarks: Area previously disturbed

3. Other:

Conclusion: Is soil hydric? yes no

Other Indicators of Hydrology: (check all that apply & describe)

- ❑ Site Inundated: ______________________________
- ❑ Depth to free water in observation hole: _____________
- ❑ Depth to soil saturation in observation hole: ___________
- ❑ Water marks: ________________________________
- ❑ Drift lines: __________________________________
- ❑ Sediment Deposits: ____________________________
- ❑ Drainage patterns in BVW: _______________________
- ❑ Oxidized rhizospheres: __________________________
- ❑ Water-stained leaves: ___________________________
- ❑ Recorded Data (streams, lake, or tidal gauge; aerial photo; other):
- ❑ Other: _Buttressing of *Ailanthus altissima*

Vegetation and Hydrology Conclusion

	Yes	No
Number of wetland indicator plants ≥ # of non-wetland indicator plants		X
Wetland hydrology present:		
Hydric soil present		X
Other indicators of hydrology present	X	
Sample location is in a BVW		X

Submit this form with the Request for Determination of Applicability or Notice of Intent.

MassDEP Bordering Vegetated Wetland (310 CMR 10.55) Delineation Field Data Form

Applicant: Thorndike Place Prepared by: BSC Group, Inc. (SMM & EPS) Project location: Isolated Area, behind houses DEP File #:

Check all that apply:

- ❑ Vegetation alone presumed adequate to delineate BVW boundary: fill out Section I only
- ❑ Vegetation and other indicators of hydrology used to delineate BVW boundary: fill out Sections I and II
- ❑ Method other than dominance test used (attach additional information)

Section I.

Vegetation	Observation Plot Number: 2 (Upland)		Transect Number: 1	Date of Delineation: 10/15/2020
A. Sample Layer & Plant Species (by common/scientific name)	B. Percent Cover (or basal Area)	C. Percent Dominance	D. Dominant Plant (yes or no)	E. Wetland Indicator Category*
<u>Trees</u>				
**Acer negundo/* Box elder	85.5%	64%	Yes	FAC+
Ailanthus altissima/ Tree of Heaven	38%	28%	No	NI
Quercus alba/ Northern white oak	10.5%	8%	No	FACU-
Total Percent Cover: 134 %				
<u>Shrubs/ Saplings</u>				
**Acer negundo/* Box elder	63%	52%	Yes	FAC+
Rosa multiflora/ Multiflora rose	38%	31%	Yes	FACU
**Ulmus rubra/* Slippery elm	20.5%	17%	No	FAC
Total Percent Cover: 121.5%				
<u>Herbaceous</u>				
Alliaria petiolate/ Garlic mustard	85.5%	100%	Yes	FACU-
Total Percent Cover: 85.5%				
<u>Vines</u>				
Absent				
Total Percent Cover: 0%				

* *Use an asterisk to mark wetland indicator plants: plant species listed in the Wetlands Protection Act (MGL c.131, s.40); plants in the genus Sphagnum; plants listed as FAC, FAC+, FACW-, FACW, FACW+, or OBL; or plants with physiological or morphological adaptations. If any plants are identified as wetland indicator plants due to physiological or morphological adaptations, describe the adaptation next to the asterisk.*

Vegetation conclusion:

Number of dominant wetland indicator plants: 2

Number of dominant non-wetland indicator plants: 2

Is the number of dominant wetland plants equal to or greater than the number of dominant non-wetland plants? yes no

If vegetation alone is presumed adequate to delineate the BVW boundary, submit this form with the Request for Determination of Applicability or Notice of Intent

Section II. Indicators of Hydrology

Hydric Soil Interpretation

1. Soil Survey

Is there a published soil survey for this site? yes no
title/date: WebSoil Survey/ 2020
map number: 655
soil type mapped: Udorthents, wet substratum
hydric soil inclusions: Yes

Are field observations consistent with soil survey? yes no
Remarks:

2. Soil Description

Horizon	Depth	Matrix Color	Mottles Color	Texture
Oe	1-0"			
HTM1	0-3"	10YR 2/2	-	Sandy loam
HTM2^	3-9"	10YR 3/3	-	Sandy loam

Remarks: Area previously disturbed

Soil sample location is inconclusive

3. Other:

Conclusion: Is soil hydric? yes no

Other Indicators of Hydrology: (check all that apply & describe)

- ❑ Site Inundated: ________________________________
- ❑ Depth to free water in observation hole: ______________
- ❑ Depth to soil saturation in observation hole: ___________
- ❑ Water marks: __________________________________
- ❑ Drift lines: ____________________________________
- ❑ Sediment Deposits: ______________________________
- ❑ Drainage patterns in BVW: ________________________
- ❑ Oxidized rhizospheres: ___________________________
- ❑ Water-stained leaves: ____________________________
- ❑ Recorded Data (streams, lake, or tidal gauge; aerial photo; other):
- ❑ Other: _

Vegetation and Hydrology Conclusion

	Yes	No
Number of wetland indicator plants ≥ # of non-wetland indicator plants	X	
Wetland hydrology present:		
Hydric soil present		X
Other indicators of hydrology present		X
Sample location is in a BVW		X

Submit this form with the Request for Determination of Applicability or Notice of Intent.

MassDEP Bordering Vegetated Wetland (310 CMR 10.55) Delineation Field Data Form

Applicant: Thorndike Place Prepared by: BSC Group, Inc. (SMM & EPS) Project location: Arlington- Near flag D-18 DEP File #:_______________

Check all that apply:

- ❑ Vegetation alone presumed adequate to delineate BVW boundary: fill out Section I only
- ❑ Vegetation and other indicators of hydrology used to delineate BVW boundary: fill out Sections I and II
- ❑ Method other than dominance test used (attach additional information)

Section I.

Vegetation	Observation Plot Number: 1 (Wetland)		Transect Number: 2	Date of Delineation: 10/15/2020
A. Sample Layer & Plant Species (by common/scientific name)	B. Percent Cover (or basal Area)	C. Percent Dominance	D. Dominant Plant (yes or no)	E. Wetland Indicator Category*
Trees				
Acer negundo/ Boxelder	20.5%	32%	Yes	FAC+
**Acer saccharinum/* Silver maple	20.5%	32%	Yes	FACW
Populus tremulas/ Quaking aspen	20.5%	32%	Yes	FACU
Prunus serotina/ Black cherry	3%	5%	No	FACU
Total Percent Cover: 64.5%				
Shrubs/ Saplings				
**Rhamnus frangula/* Glossy buckthorn	20.5%	55%	Yes	FAC
**Acer saccharinum/* Silver maple	10.5%	28%	Yes	FACW
**Fraxinus pennsylvanica/* Green ash	3%	8%	No	FACW
Rubus strigosus/ Common red raspberry	3%	8%	No	FAC-
Total Percent Cover: 37%				
Herbaceous				
*Onoclea sensibilis/ Sensitive fern	85.5%	100%	Yes	FACW
Total Percent Cover: 89%				
Vines				
Absent				
Total Percent Cover: 0%				

* *Use an asterisk to mark wetland indicator plants: plant species listed in the Wetlands Protection Act (MGL c.131, s.40); plants in the genus Sphagnum; plants listed as FAC, FAC+, FACW-, FACW, FACW+, or OBL; or plants with physiological or morphological adaptations. If any plants are identified as wetland indicator plants due to physiological or morphological adaptations, describe the adaptation next to the asterisk.*

Vegetation conclusion:

Number of dominant wetland indicator plants: 4 Number of dominant non-wetland indicator plants: 1

Is the number of dominant wetland plants equal to or greater than the number of dominant non-wetland plants? yes no

If vegetation alone is presumed adequate to delineate the BVW boundary, submit this form with the Request for Determination of Applicability or Notice of Intent

Section II. Indicators of Hydrology

Hydric Soil Interpretation

1. Soil Survey

Is there a published soil survey for this site? yes no
title/date: WebSoil Survey/ 2020
map number: 51A
soil type mapped: Swansea muck
hydric soil inclusions: Yes

Are field observations consistent with soil survey? yes no
Remarks:

2. Soil Description

Horizon	Depth	Matrix Color	Mottles Color	Texture
Oe	0-0.5"			
A	0-1"	10YR2/1	-	Mucky modified SL
AE	1-4"	10YR 4/2	5YR3/4 (5%)	Mucky modified sandy loam
Bg	4-14"	2.5YR 6/3	7.5YR 4/6 (12%)	sandy loam

Remarks:

3. Other:

Conclusion: Is soil hydric? yes no

Other Indicators of Hydrology: (check all that apply & describe)

- ❑ Site Inundated: ______________________________
- ❑ Depth to free water in observation hole: _____________
- ❑ Depth to soil saturation in observation hole: ___________
- ❑ Water marks: _______________________________
- ❑ Drift lines: ________________________________
- ❑ Sediment Deposits: ____________________________
- ❑ Drainage patterns in BVW: _______________________
- ❑ Oxidized rhizospheres: ____________yes____________
- ❑ Water-stained leaves: __________________________
- ❑ Recorded Data (streams, lake, or tidal gauge; aerial photo; other):
- ❑ Other: _

Vegetation and Hydrology Conclusion

	Yes	No
Number of wetland indicator plants ≥ # of non-wetland indicator plants	X	
Wetland hydrology present:		
Hydric soil present	X	
Other indicators of hydrology present	X	
Sample location is in a BVW	X	

Submit this form with the Request for Determination of Applicability or Notice of Intent.

MassDEP Bordering Vegetated Wetland (310 CMR 10.55) Delineation Field Data Form

Applicant: Thorndike Place Prepared by: BSC Group, Inc. (SMM & EPS) Project location: Arlington- Near flag D-18 DEP File #:_______________

Check all that apply:

- ❑ Vegetation alone presumed adequate to delineate BVW boundary: fill out Section I only
- ❑ Vegetation and other indicators of hydrology used to delineate BVW boundary: fill out Sections I and II
- ❑ Method other than dominance test used (attach additional information)

Section I.

Vegetation	Observation Plot Number: 2 (Upland)		Transect Number: 2	Date of Delineation: 10/15/2020
A. Sample Layer & Plant Species (by common/scientific name)	B. Percent Cover (or basal Area)	C. Percent Dominance	D. Dominant Plant (yes or no)	E. Wetland Indicator Category*
<u>Trees</u>				
Prunus serotina/ Black cherry	63%	75%	Yes	FACU
Ailanthus altissima/ Tree of Heaven	20.5%	25%	Yes	NI
Total Percent Cover: 83.5%				
<u>Shrubs/ Saplings</u>				
Rhus hirta/ Staghorn sumac	20.5%	49%	Yes	NI
Prunus serotina/ Black cherry	10.5%	25%	Yes	FACU
Rubus strigosus/ Common red raspberry	10.5%	25%	Yes	FAC-
Total Percent Cover: 41.5%				
<u>Herbaceous</u>				
Solidago canadensis/ Canada goldenrod	38%	65%	Yes	FACU
Phytolacca americana/ American pokeweed	20.5%	35%	Yes	FACU+
Total Percent Cover: 58.8%				
<u>Vines</u>				
Absent				
Total Percent Cover: 0%				

* *Use an asterisk to mark wetland indicator plants: plant species listed in the Wetlands Protection Act (MGL c.131, s.40); plants in the genus Sphagnum; plants listed as FAC, FAC+, FACW-, FACW, FACW+, or OBL; or plants with physiological or morphological adaptations. If any plants are identified as wetland indicator plants due to physiological or morphological adaptations, describe the adaptation next to the asterisk.*

Vegetation conclusion:

Number of dominant wetland indicator plants: 0 Number of dominant non-wetland indicator plants: 6

Is the number of dominant wetland plants equal to or greater than the number of dominant non-wetland plants? yes no

If vegetation alone is presumed adequate to delineate the BVW boundary, submit this form with the Request for Determination of Applicability or Notice of Intent

Section II. Indicators of Hydrology

Hydric Soil Interpretation

1. Soil Survey

Is there a published soil survey for this site? yes no
title/date: WebSoil Survey/ 2020
map number: 51A
soil type mapped: Swansea muck
hydric soil inclusions: Yes

Are field observations consistent with soil survey? yes no
Remarks:

2. Soil Description

Horizon	Depth	Matrix Color	Mottles Color	Texture
A	0-1"	10YR 2/2		
AB	1-6"	10YR 3/3	-	Sandy loam
BA	6-12"	10YR 4/4	-	Sandy loam

12"+ soil refusal

Remarks:

3. Other:

Conclusion: Is soil hydric? yes no

Other Indicators of Hydrology: (check all that apply & describe)

- ❑ Site Inundated: ______________________________
- ❑ Depth to free water in observation hole: _____________
- ❑ Depth to soil saturation in observation hole: ___________
- ❑ Water marks: _______________________________
- ❑ Drift lines: __________________________________
- ❑ Sediment Deposits: ____________________________
- ❑ Drainage patterns in BVW: _______________________
- ❑ Oxidized rhizospheres: _________________________
- ❑ Water-stained leaves: __________________________
- ❑ Recorded Data (streams, lake, or tidal gauge; aerial photo; other):
- ❑ Other: _

Vegetation and Hydrology Conclusion

	Yes	No
Number of wetland indicator plants ≥ # of non-wetland indicator plants		X
Wetland hydrology present:		
Hydric soil present		X
Other indicators of hydrology present		X
Sample location is in a BVW		X

form with the Request for Determination of Applicability or Notice of Intent.

MassDEP Bordering Vegetated Wetland (310 CMR 10.55) Delineation Field Data Form

Applicant: Thorndike Place Prepared by: BSC Group, Inc. (SMM & EPS) Project location: Arlington- Near flag C-14 DEP File #:______________

Check all that apply:

- ❑ Vegetation alone presumed adequate to delineate BVW boundary: fill out Section I only
- ❑ Vegetation and other indicators of hydrology used to delineate BVW boundary: fill out Sections I and II
- ❑ Method other than dominance test used (attach additional information)

Section I.

Vegetation	Observation Plot Number: 1 (Wetland)		Transect Number: 3	Date of Delineation: 10/15/2020
A. Sample Layer & Plant Species (by common/scientific name)	B. Percent Cover (or basal Area)	C. Percent Dominance	D. Dominant Plant (yes or no)	E. Wetland Indicator Category*
<u>Trees</u>				
**Populus deltoides/* Eastern cottonwood	20.5%	40%	Yes	FAC
Ailanthus altissima/ Tree of Heaven	20.5%	40%	Yes	NI
**Fraxinus pennsylvanica/* Green ash	10.5%	20%	Yes	FACW
Total Percent Cover: 51.5 %				
<u>Shrubs/ Saplings</u>				
Rhus hirta/ Staghorn sumac	20.5%	60%	Yes	NI
**Populus deltoides/* Eastern cottonwood	10.5%	31%	Yes	FAC
Rosa multiflora/ Multiflora rose	3%	9%	No	FACU
Total Percent Cover: 34%				
<u>Herbaceous</u>				
**Solidago patula/* Rough stem goldenrod	38%	53%	Yes	OBL
Phytolacca americana/ American pokeweed	20.5%	28%	Yes	FACU+
**Rubus hispidus/* Creeping dewberry	10.5%	15%	No	FACW
**Phragmites australis/* Common reed	3%	4%	No	FACW
Total Percent Cover: 72%				
<u>Vines</u>				
Absent				
Total Percent Cover: 0%				

* *Use an asterisk to mark wetland indicator plants: plant species listed in the Wetlands Protection Act (MGL c.131, s.40); plants in the genus Sphagnum; plants listed as FAC, FAC+, FACW-, FACW, FACW+, or OBL; or plants with physiological or morphological adaptations. If any plants are identified as wetland indicator plants due to physiological or morphological adaptations, describe the adaptation next to the asterisk.*

Vegetation conclusion:

Number of dominant wetland indicator plants: 4 Number of dominant non-wetland indicator plants: 1

Is the number of dominant wetland plants equal to or greater than the number of dominant non-wetland plants? yes no

If vegetation alone is presumed adequate to delineate the BVW boundary, submit this form with the Request for Determination of Applicability or Notice of Intent

Section II. Indicators of Hydrology

Hydric Soil Interpretation

1. Soil Survey

Is there a published soil survey for this site? yes no
title/date: WebSoil Survey/ 2020
map number: 655
soil type mapped: Udorthents, wet substratum
hydric soil inclusions: Yes

Are field observations consistent with soil survey? yes no
Remarks:

2. Soil Description

Horizon	Depth	Matrix Color	Mottles Color	Texture
A	0-1”	10YR 2/1	-	Sandy loam
Bwg	1-14”+	10YR 4/2	Depletion: 7.5YR 4/6 (12%) 10YR 6/2 (10%)	Sandy loam

Remarks:

3. Other:

Conclusion: Is soil hydric? yes no

Other Indicators of Hydrology: (check all that apply & describe)

- ❑ Site Inundated: ______________________________
- ❑ Depth to free water in observation hole: ______________
- ❑ Depth to soil saturation in observation hole: ___________
- ❑ Water marks: _______________________________
- ❑ Drift lines: __________________________________
- ❑ Sediment Deposits: ____________________________
- ❑ Drainage patterns in BVW: __Present_________________
- ❑ Oxidized rhizospheres: __________________________
- ❑ Water-stained leaves: ___________________________
- ❑ Recorded Data (streams, lake, or tidal gauge; aerial photo; other):
- ❑ Other: _

Vegetation and Hydrology Conclusion

	Yes	No
Number of wetland indicator plants ≥ # of non-wetland indicator plants	X	
Wetland hydrology present:		
Hydric soil present	X	
Other indicators of hydrology present	X	
Sample location is in a BVW	X	

Submit this form with the Request for Determination of Applicability or Notice of Intent.

MassDEP Bordering Vegetated Wetland (310 CMR 10.55) Delineation Field Data Form

Applicant:_Thorndike Place_____ Prepared by: Ethan Sneesby Project location: Dorothy Road, Arlington DEP File #:_______________

Check all that apply:

- ❑ Vegetation alone presumed adequate to delineate BVW boundary: fill out Section I only
- ◉ Vegetation and other indicators of hydrology used to delineate BVW boundary: fill out Sections I and II
- ❑ Method other than dominance test used (attach additional information)

Section I.

Vegetation	Observation Plot Number: Wetland (1)		Transect Number: 4	Date of Delineation: 12/23/2020
A. Sample Layer & Plant Species (by common/scientific name)	B. Percent Cover (or basal Area)	C. Percent Dominance	D. Dominant Plant (yes or no)	E. Wetland Indicator Category*
Tree Layer:				
Eastern cottonwood (*Populus deltoides*)	3%	12.7%	no	FAC
Box Elder (*Acer negundo*)	20.5%	87.2%	yes	FAC*
Saplings and Shrubs:				
Box Elder (*Acer negundo*)	10.5%	100%	yes	FAC*
Herbaceous:				
Japanese knotweed (*Polygonum cuspidatum*)	85.5%	100%	yes	FACU
Vine:				
Wild grape (*Vitis vinifera*)	10.5%	100%	yes	NI

* *Use an asterisk to mark wetland indicator plants: plant species listed in the Wetlands Protection Act (MGL c.131, s.40); plants in the genus Sphagnum; plants listed as FAC, FAC+, FACW-, FACW, FACW+, or OBL; or plants with physiological or morphological adaptations. If any plants are identified as wetland indicator plants due to physiological or morphological adaptations, describe the adaptation next to the asterisk.*

Vegetation conclusion:

Number of dominant wetland indicator plants: 2 Number of dominant non-wetland indicator plants:1

Is the number of dominant wetland plants equal to or greater than the number of dominant non-wetland plants? **yes**

If vegetation alone is presumed adequate to delineate the BVW boundary, submit this form with the Request for Determination of Applicability or Notice of Intent

Section II. Indicators of Hydrology

Hydric Soil Interpretation

1. Soil Survey

Is there a published soil survey for this site? **yes**
soil type mapped:655
hydric soil inclusions: yes

Are field observations consistent with soil survey? **no**
Remarks:
Soils in the field consist of multiple depositions of historic fill material

2. Soil Description

Horizon	texture	Depth	Matrix Color	Mottles Color
Oe		1-0		
HTM1	SL	0-11	10YR 2/1	4% 10YR 5/6 as soft masses
HTM2	GrSL	11-13	10YR 2/1	
HTM3	SL	13-20+	10YR 2/1	

Remarks:

3. Other:

Conclusion: Is soil hydric? **yes**

Other Indicators of Hydrology: (check all that apply & describe)

- ☐ Site Inundated: ____________________________________
- ■ Depth to free water in observation hole: _______11 inches_
- ■ Depth to soil saturation in observation hole: _____6 inches_
- ☐ Water marks: ______________________________________
- ☐ Drift lines: ____
- ☐ Sediment Deposits: __________________________________
- ■ Drainage patterns in BVW: ___________yes____________
- ■ Oxidized rhizospheres: ______________yes____________
- ■ Water-stained leaves: _______________yes____________
- ☐ Recorded Data (streams, lake, or tidal gauge; aerial photo; other):
  ____
  ____
  ____
- ☐ Other: ____

Vegetation and Hydrology Conclusion

	Yes	No
Number of wetland indicator plants $\geq$ # of non-wetland indicator plants	__X__	____
Wetland hydrology present:		
Hydric soil present	__X__	_____
Other indicators of hydrology present	__X__	_____
Sample location is in a BVW	____	___X__
Sample location is in an IVW	__X__	_____

Submit this form with the Request for Determination of Applicability or Notice of Intent.

MassDEP Bordering Vegetated Wetland (310 CMR 10.55) Delineation Field Data Form

Applicant:___Thorndike Place_____ Prepared by: Ethan Sneesby Project location: Dorothy Road, Arlington DEP File #:_______________

Check all that apply:

- ❑ Vegetation alone presumed adequate to delineate BVW boundary: fill out Section I only
- ◉ Vegetation and other indicators of hydrology used to delineate BVW boundary: fill out Sections I and II
- ❑ Method other than dominance test used (attach additional information)

Section I.

Vegetation	Observation Plot Number: Upland		Transect Number: 4	Date of Delineation: 1/05/2021
A. Sample Layer & Plant Species (by common/scientific name)	B. Percent Cover (or basal Area)	C. Percent Dominance	D. Dominant Plant (yes or no)	E. Wetland Indicator Category*
Tree Layer:				
Eastern cottonwood (*Populus deltoides*)	38%	78.4%	yes	FAC*
Box elder (*Acer negundo*)	10.5%	21.6%	yes	FAC*
Shrubs and Saplings:				
Box elder (*Acer negundo*)	10.5%	100%	yes	FAC*
Herbaceous:				
Japanese knotweed (*Polygonum cuspidatum*)	63%	100%	yes	FACU
Vine:				
Wild grape (*Vitis vinifera*)	10.5%	100%	yes	NI

* *Use an asterisk to mark wetland indicator plants: plant species listed in the Wetlands Protection Act (MGL c.131, s.40); plants in the genus Sphagnum; plants listed as FAC, FAC+, FACW-, FACW, FACW+, or OBL; or plants with physiological or morphological adaptations. If any plants are identified as wetland indicator plants due to physiological or morphological adaptations, describe the adaptation next to the asterisk.*

Vegetation conclusion:

Number of dominant wetland indicator plants: 3 Number of dominant non-wetland indicator plants:1

Is the number of dominant wetland plants equal to or greater than the number of dominant non-wetland plants? **yes**

If vegetation alone is presumed adequate to delineate the BVW boundary, submit this form with the Request for Determination of Applicability or Notice of Inten

Section II. Indicators of Hydrology

Hydric Soil Interpretation

1. Soil Survey

Is there a published soil survey for this site? **yes**
soil type mapped:655
hydric soil inclusions: yes

Are field observations consistent with soil survey? **no**
Remarks:
Soils in the field consist of multiple depositions of historic fill material

2. Soil Description

Horizon	Depth	Matrix Color	Mottles Color
Oe	1-0		
HTM1^	0-21	Variable colors: 80% 10YR 2/1 20% 10YR 3/3	
HTM2^	21-24+	Variable colors: 5YR 4/4, 10YR 8/1, 10YR 2/1	

Remarks:
Soil is considered to be upland soil because no redoximorphic features were observed in the top 20 inches. If redoximorphic features were there, we would have anticipated seeing them in the HTM1^ horizon.

3. Other:

Conclusion: Is soil hydric? **no**

Other Indicators of Hydrology: (check all that apply & describe)

- ❑ Site Inundated: ______________________________
- ❑ Depth to free water in observation hole: _____________
- ■ Depth to soil saturation in observation hole: ____24 inches
- ❑ Water marks: ________________________________
- ❑ Drift lines: __________________________________
- ❑ Sediment Deposits: ____________________________
- ❑ Drainage patterns in BVW: _______________________
- ❑ Oxidized rhizospheres: __________________________
- ❑ Water-stained leaves: ___________________________
- ❑ Recorded Data (streams, lake, or tidal gauge; aerial photo; other):
  ____
  ____
  ____
- ❑ Other: ____

Vegetation and Hydrology Conclusion

	Yes	No
Number of wetland indicator plants ≥ # of non-wetland indicator plants	__X__	_____
Wetland hydrology present:		
Hydric soil present	_____	__X___
Other indicators of hydrology present	_____	__X___
Sample location is in a BVW	_____	__X___
Sample location is in an IVW	_____	__X___

Submit this form with the Request for Determination of Applicability or Notice of Intent.

MassDEP Bordering Vegetated Wetland (310 CMR 10.55) Delineation Field Data Form

Applicant:____Thorndike Place______ Prepared by: Ethan Sneesby Project location: Dorothy Road, Arlington DEP File #:_______________

Check all that apply:

- ❑ Vegetation alone presumed adequate to delineate BVW boundary: fill out Section I only
- ◉ Vegetation and other indicators of hydrology used to delineate BVW boundary: fill out Sections I and II
- ❑ Method other than dominance test used (attach additional information)

Section I.

Vegetation	Observation Plot Number: Wetland		Transect Number: 5	Date of Delineation: 12/23/2020
A. Sample Layer & Plant Species (by common/scientific name)	B. Percent Cover (or basal Area)	C. Percent Dominance	D. Dominant Plant (yes or no)	E. Wetland Indicator Category*
Tree Layer:				
American elm (*Ulmus americana*)	20.5%	33%	yes	FACW*
Eastern cottonwood (*Populus deltoides*)	3%	5%	no	FAC
Box elder (*Acer negundo*)	38%	62%	yes	FAC*
Saplings and Shrubs:				
Box elder (*Acer negundo*)	5%	100%	yes	FAC*
Herbaceous:				
Garlic mustard (*Alliaria petiolata*)	38%	31%	yes	FACU
Japanese knotweed (*Polygonum cuspidatum*)	85.5%	69%	yes	FACU

* *Use an asterisk to mark wetland indicator plants: plant species listed in the Wetlands Protection Act (MGL c.131, s.40); plants in the genus Sphagnum; plants listed as FAC, FAC+, FACW-, FACW, FACW+, or OBL; or plants with physiological or morphological adaptations. If any plants are identified as wetland indicator plants due to physiological or morphological adaptations, describe the adaptation next to the asterisk.*

Vegetation conclusion:

Number of dominant wetland indicator plants: 3 Number of dominant non-wetland indicator plants:2

Is the number of dominant wetland plants equal to or greater than the number of dominant non-wetland plants? **yes**

If vegetation alone is presumed adequate to delineate the BVW boundary, submit this form with the Request for Determination of Applicability or Notice of Intent

Section II. Indicators of Hydrology

Hydric Soil Interpretation

1. Soil Survey

Is there a published soil survey for this site? **yes**
soil type mapped:655
hydric soil inclusions: yes

Are field observations consistent with soil survey? **no**
Remarks:
Soils in the field consist of multiple depositions of historic fill material

2. Soil Description

Horizon	texture	Depth	Matrix Color	Mottles Color
HTM1	SL	0-11	10YR 2/1	none visible
HTM2^	LS	11-20+	2.5YR 5/2	5% 10YR 5/8 As soft masses

Remarks:

3. Other:

Conclusion: Is soil hydric? **yes**

Other Indicators of Hydrology: (check all that apply & describe)

- ❑ Site Inundated: ________________________________
- ■ Depth to free water in observation hole: _____11 inches___
- ■ Depth to soil saturation in observation hole: _____6 inches_
- ❑ Water marks: ________________________________
- ❑ Drift lines: ________________________________
- ❑ Sediment Deposits: ________________________________
- ■ Drainage patterns in BVW: ____________yes____________
- ■ Oxidized rhizospheres: ______________yes_____________
- ■ Water-stained leaves: ______________yes______________
- ❑ Recorded Data (streams, lake, or tidal gauge; aerial photo; other):
  ____
  ____
  ____
- ❑ Other: ________________________________

Vegetation and Hydrology Conclusion

	Yes	No
Number of wetland indicator plants ≥ # of non-wetland indicator plants	__X__	____
Wetland hydrology present:		
Hydric soil present	__X__	_____
Other indicators of hydrology present	__X__	_____
Sample location is in a BVW	____	___X__
Sample location is in an IVW	__X__	_____

Submit this form with the Request for Determination of Applicability or Notice of Intent.

MassDEP Bordering Vegetated Wetland (310 CMR 10.55) Delineation Field Data Form

Applicant:___Thorndike Place____ Prepared by: Ethan Sneesby Project location: Dorothy Road, Arlington DEP File #:_______________

Check all that apply:

- ❑ Vegetation alone presumed adequate to delineate BVW boundary: fill out Section I only
- ◉ Vegetation and other indicators of hydrology used to delineate BVW boundary: fill out Sections I and II
- ❑ Method other than dominance test used (attach additional information)

Section I.

Vegetation	Observation Plot Number: Upland		Transect Number: 5	Date of Delineation: 1/05/2021
A. Sample Layer & Plant Species (by common/scientific name)	B. Percent Cover (or basal Area)	C. Percent Dominance	D. Dominant Plant (yes or no)	E. Wetland Indicator Category*
Tree Layer:				
Sweet birch (*Betula lenta*)	20.5	37.6%	yes	FACU
Ash *(Fraxinus sp.)*	20.5%	37.6%	yes	FACU (White) or FACW (Green)
Unknown	10.5%	19%	no	Unknown
Grey birch (*Betula populifolia*)	3%	6%	no	FAC
Saplings and Shrubs:				
Unknown	3%	50%	yes	Unknown
Sweet Birch (*Betula lenta*)	3%	50%	yes	FACU
Herbaceous:				
Garlic mustard (*Alliaria petiolate*)	85.5%	69%	yes	FACU
Japanese knotweed (*Polygonum cuspidatum*)	38%	31%	yes	FACU

* *Use an asterisk to mark wetland indicator plants: plant species listed in the Wetlands Protection Act (MGL c.131, s.40); plants in the genus Sphagnum; plants listed as FAC, FAC+, FACW-, FACW, FACW+, or OBL; or plants with physiological or morphological adaptations. If any plants are identified as wetland indicator plants due to physiological or morphological adaptations, describe the adaptation next to the asterisk.*

Vegetation conclusion:

Number of dominant wetland indicator plants: 0-1 depending on the ash species Number of dominant non-wetland indicator plants:4 or 5, depending on ash species

Is the number of dominant wetland plants equal to or greater than the number of dominant non-wetland plants? **no**

If vegetation alone is presumed adequate to delineate the BVW boundary, submit this form with the Request for Determination of Applicability or Notice of Intent

Section II. Indicators of Hydrology

Hydric Soil Interpretation

1. Soil Survey

Is there a published soil survey for this site? **yes**
soil type mapped:655
hydric soil inclusions: yes

Are field observations consistent with soil survey? **no**
Remarks:
Soils in the field consist of multiple depositions of historic fill material

2. Soil Description

Horizon	Depth	Matrix Color	texture	Mottles Color
Oe	1-0			
HTM1	0-7	10YR 3/3	SL	none visible
HTM2	7-24	10YR 5/6	LS	none visible
HTM3	24+	2.5YR 5/2	LS	5% 10YR 5/8 As soft masses

Remarks:

3. Other:

Conclusion: Is soil hydric? **no**

Other Indicators of Hydrology: (check all that apply & describe)

- ☐ Site Inundated: ________________________________
- ☐ Depth to free water in observation hole: ______________
- ☒ Depth to soil saturation in observation hole: ____24 inches_
- ☐ Water marks: __________________________________
- ☐ Drift lines: ____________________________________
- ☐ Sediment Deposits: ______________________________
- ☐ Drainage patterns in BVW: ________________________
- ☐ Oxidized rhizospheres: ___________________________
- ☐ Water-stained leaves: ____________________________
- ☐ Recorded Data (streams, lake, or tidal gauge; aerial photo; other):
  ____
  ____
  ____
- ☐ Other: ____

Vegetation and Hydrology Conclusion

	Yes	No
Number of wetland indicator plants ≥ # of non-wetland indicator plants	____	__X__
Wetland hydrology present:		
Hydric soil present	____	__X__
Other indicators of hydrology present	____	__X__
Sample location is in a BVW	____	__X__
Sample location is in an IVW	____	__X___

Submit this form with the Request for Determination of Applicability or Notice of Intent.

Town of Arlington, Massachusetts

Thorndike Place - Public Comments

ATTACHMENTS:

Type	File Name	Description
Reference Material	ALT_ZBA_ClimateResiliencyMemo_20210122.pdf	ALT_ZBA_ClimateResiliencyMemo_20210122
Reference Material	A_Dedekian_1-15-21.pdf	A Dedekian 1-15-21
Reference Material	B_Battuello_1-15-21.pdf	B Battuello 1-15-21
Reference Material	B_Willis_1-13-21.pdf	B Willis 1-13-21
Reference Material	G_McCormick_1-13-21.pdf	G McCormick 1-13-21
Reference Material	K_Petho-Read__1-13-21.pdf	K Petho-Read 1-13-21
Reference Material	M_McCabe_1-13-21.pdf	M McCabe 1-13-21
Reference Material	M_McCabe_12-8-20.pdf	M McCabe 12-8-20.pdf
Reference Material	S_Harris_1-23-21.pdf	S Harris 1-23-21.pdf
Reference Material	Patricia_Browne_1-13-21.pdf	Patricia Browne 1-13-21
Reference Material	Mugar_Wetlands.pdf	Mugar Wetlands.pdf
Reference Material	E_Murphy_1-24-21.pdf	E Murphy 1-24-21.pdf
Reference Material	E_Campbell_1-24-21.pdf	E Campbell 1-24-21.pdf
Reference Material	B_Micheel_1-24-21.pdf	B Micheel 1-24-21.pdf
Reference Material	pic4330.pdf	pic4330.pdf
Reference Material	pic4917.pdf	pic4917.pdf
Reference Material	pic5214.pdf	pic5214.pdf
Reference Material	pic4332.pdf	pic4332.pdf
Reference Material	pic4918.pdf	pic4918.pdf
Reference Material	pic4715.pdf	pic4715.pdf

🗋	Reference Material	pic0208.pdf	pic0208.pdf
🗋	Reference Material	pic0210.pdf	pic0210.pdf
🗋	Reference Material	GriffithMugarIssues1-20-21.pdf	GriffithMugarIssues1-20-21.pdf
🗋	Reference Material	GriffithMoreTrafficIssues1-20-21.pdf	GriffithMoreTrafficIssues1-20-21.pdf
🗋	Reference Material	E_Bitteker.pdf	E Bitteker
🗋	Reference Material	Burch1.pdf	Burch1
🗋	Reference Material	Edith1.pdf	Edith1
🗋	Reference Material	IMG_3347.pdf	IMG_3347
🗋	Reference Material	Margaret_1.pdf	Margaret 1
🗋	Reference Material	Osborne.pdf	Osborne
🗋	Reference Material	Streetview_1.pdf	Streetview 1
🗋	Reference Material	Streetview_2.pdf	Streetview 2
🗋	Reference Material	traffic_on_Mary_Margaret_corner.pdf	traffic on Mary Margaret corner
🗋	Reference Material	traffic_on_Mary.pdf	traffic on Mary
🗋	Reference Material	R_DiBiase_1-24-21.pdf	R DiBiase 1-24-21.pdf
🗋	Reference Material	A_Landry.pdf	A Landry.pdf
🗋	Reference Material	A_Meadows.pdf	A Meadows.pdf
🗋	Reference Material	B_Rowland.pdf	B Rowland.pdf
🗋	Reference Material	D_Mazor.pdf	D Mazor.pdf
🗋	Reference Material	D_Pereira.pdf	D Pereira.pdf
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ARLINGTON
LAND • TRUST

January 22, 2021 BY EMAIL

Christian Klein, Chair
Zoning Board of Appeals
Town of Arlington
Arlington, MA 02476

re: <u>Climate Resiliency Review, Mugar Lands</u>

Dear Christian:

Attached for the Board's consideration is a review of climate resiliency issues with respect to the proposed development of the Mugar site.

State policy encourages, and common sense demands, that the reality of climate change be taken into account in evaluating any proposed development in this area that already experiences regular and severe flooding. A short-sighted view of the potential adverse consequences of development in the floodplain would carry increased risks to public health and safety beyond the site itself to the surrounding East Arlington neighborhoods.

The Town of Arlington through its special permit process has demonstrated a commitment to requiring that any major development with significant environmental impacts must consider the effects of climate change. Such would be the case for any development proposed on this, the most environmentally sensitive land in the Town. That this project is being conducted under Chapter 40B cannot be an excuse to hold it to a lower standard.

Thank you for your consideration.

Very truly yours,
Arlington Land Trust, Inc.

by: ______________________
Christopher Leich, President

attachment: Weston & Sampson report
ecc: Arlington Conservation Commission c/o Emily Sullivan
Arlington Select Board c/o Lauren Costa

Arlington Land Trust, Inc. P.O. Box 492, Arlington, MA 02476 | **Phone:** 339-707-5020 | **Email:** info@arlingtonlandtrust.org | **Website:** www.arlingtonlandtrust.org

55 Walkers Brook Drive, Suite 100, Reading, MA 01867
Tel: 978.532.1900

MEMORANDUM

TO: Arlington Land Trust

FROM: Indrani Ghosh, Resiliency Technical Leader, Weston & Sampson

DATE: January 20, 2021

SUBJECT: Resiliency review consultation services related to the East Arlington Mugar site

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Weston & Sampson Engineers, Inc. (Weston & Sampson) is pleased to present this memorandum to the Arlington Land Trust to summarize climate resiliency considerations of the Thorndike Place proposed design at the East Arlington Mugar site (the "Site") being developed by OakTree Development and designed by BSC Group.

Executive Summary

The Arlington Land Trust (ALT) engaged Weston & Sampson to evaluate the climate resiliency of the Thorndike Place design at the East Arlington Mugar site. This was presented through production of talking points for the Zoning Board of Appeals (ZBA) meeting on December 22, 2020 and this memorandum summarizing the review comments. The key considerations described in this memorandum include the following:

1. Use of FEMA Data Compared to Neighboring Communities Standards
    a. Current design relies solely on regulatory FEMA base flood elevation (Zone AE, 100-yr floodplain, 6.8 ft NAVD88 elevation) and does not consider that the site is also located in the FEMA 500-yr floodplain, nor does it consider the effects of sea level rise and storm surge due to climate change.
    b. The Amelia Earhart Dam actively affects flood elevations around the site. As reported in the City of Cambridge's Climate Change Vulnerability Assessment (CCVA), the Boston Harbor Flood Risk Model (BH-FM) shows that the dam will likely be flanked in 2045 and overtopped by 2055. This overtopping or circumventing could cause the flow of water to be reversed, increasing the flood vulnerability of upstream communities.
    c. Regional coordination is a crucial component of climate resiliency, and neighboring communities of Cambridge and Boston have already considered future flooding for resilient design.
2. Design Storm Depths

a. The stormwater management system presented by the BSC Group meets current rainfall conditions, but it does not consider the increased magnitude of storm events in the future, such as the climate change projections for the 2070s planning horizon.
b. Future MassDEP wetlands regulations will likely incorporate the NOAA Plus Method for design storm depth, increasing the stormwater basin design size for most locations.
c. Future Climate Resilience Design Standards, as developed by the Resilient Massachusetts Action Team (RMAT), include design standards for future extreme precipitation. As demonstrated further in this memorandum, these percent increases in precipitation exceed the design storm depths considered in the proposed design of the Site.

3. Additional Resilient Design Issues:
    a. Deployable flood barriers are not recommended for precipitation flooding due to time needed for deployment and cost of retrofitting.
    b. Buildings proposed to be in any flood hazard area must be designed in Base Flood Elevation + 1 ft of freeboard, or the Design Flood Elevation, whichever is higher according the Massachusetts State Building Code.
    c. Provision of a compensatory flood storage ratio of 2 to 1 will minimize the area of Bordering Land Subject to Flooding and regrade a portion of the Site, impacting flood recovery.
    d. Site design does not consider or propose methods to mitigate and protect against future projections for extreme heat.

Background

History

The Site is located within a protected wetland in both a FEMA established 100-year floodplain and 500-year floodplain. OakTree Development is utilizing the Chapter 40B statute to seek to bypass the protected wetlands zoning regulations by providing a certain percentage of affordable housing in the Thorndike Place development. These wetlands serve as flood storage, and there is concern that developing on the wetlands will exacerbate an area that has already experienced extreme flooding events in recent decades. Figures 1 through 7 depict scenes after some of these previous extreme storm events. More images and videos of flooding events near the Mugar wetlands can be found at the following link: https://www.youtube.com/watch?v=1QyLmZv1hAs

Figure 1. People canoeing down Herbert St. & Lafayette St. after 1996 storm

Figure 2. Flooding on Thorndike St. after 1996 storm

Figure 3. Flooding on Alewife Brook Parkway after 1996 storm

Figure 4. Car submerged on Herbert St. and Lafayette St. after 2001 storm

Figure 5. DPW pumping from Route 2 to into Mugar site wetlands during 2001 storm

Figure 6. Flooding seen on Fairmont St. after 2010 storm

Figure 7. People canoeing at Magnolia Playground after 2010 storm.

Current Design

The planned project will include a 176-unit multi-family housing complex, a percentage of which will be designated as affordable housing. There will be 239 parking spaces, with 204 of these spaces located below ground. The current design of the Thorndike Place development meets regulatory requirements, with a 2 to 1 compensatory flood storage ratio, as well as a design flood elevation (DFE) in accordance with FEMA's 100-year base flood elevation (BFE). The first floor of livable units has a DFE of 13 feet NAVD88, while the DFE of the underground parking garage is unknown. Various stormwater management systems are included in the current design such as a rooftop detention system, a trench drain, a deep sump catch basin, porous asphalt, and deployable flood barriers. A HydroCAD model was used to model the watershed, comparing both pre-development and post-development conditions of the Site. However, the proposed design does not consider sea level rise (SLR), storm surge (SS), and precipitation effects that are very likely to occur during the useful life of the proposed development due to climate change. With the current design of the proposed development, it is likely that the residents who will be inhabiting the planned affordable housing units as well as neighboring Arlington residences may be subject to significant flooding effects when an extreme storm hits.

Figure 8. *BSC Group's conceptual site plan, as of September 2020*

FEMA Regulations vs. Neighboring Communities

Portions of the Site lie in both the 100-year floodplain and the 500-year floodplain, as established by the Federal Emergency Management Agency (FEMA). Current Massachusetts legislature requires that buildings be designed to the 100-year BFE, which is the elevation that Thorndike Place design relies on at 6.8 feet NAVD88. Although this is the regulatory DFE for Massachusetts developments, FEMA published that, "BFEs reflect estimates of flood risk, but there are many unknown factors that can cause flood heights to rise above the BFE, such as wave action, bridge and culvert openings being blocked by debris, and development in the floodplain. It is important to remember that floods more severe than the 1- percent-annual-chance event can and do occur."[1] This indicates that designing to the 100-year base flood elevation area may not be enough to prevent flood damage, especially in areas that are prone to flooding. Since the Site is additionally located within the 500-year floodplain, there are further concerns about the current design of the Thorndike Place development. According to flood profiles of

[1] FEMA , *Building Higher in Flood Zones: Freeboard – Reduce Your Risk, Reduce Your Premium* https://www.fema.gov/media-library-data/1438356606317-d1d037d75640588f45e2168eb9a190ce/FPM_1-pager_Freeboard_Final_06-19-14.pdf

Alewife Brook (Little River)[2] created by FEMA, the 500-year elevation for the Site is 10.75 feet NAVD88. Furthermore, all of FEMA's elevations for the Site are based on data collected up to June 4, 2010, and do not consider SLR or SS effects due to climate change. The first floor living space for the Thorndike Place development is designed at an elevation of approximately 13 feet-NAVD88, making it suitable for projected SLR and SS effects, but the underground parking area is at a severe risk of flooding.

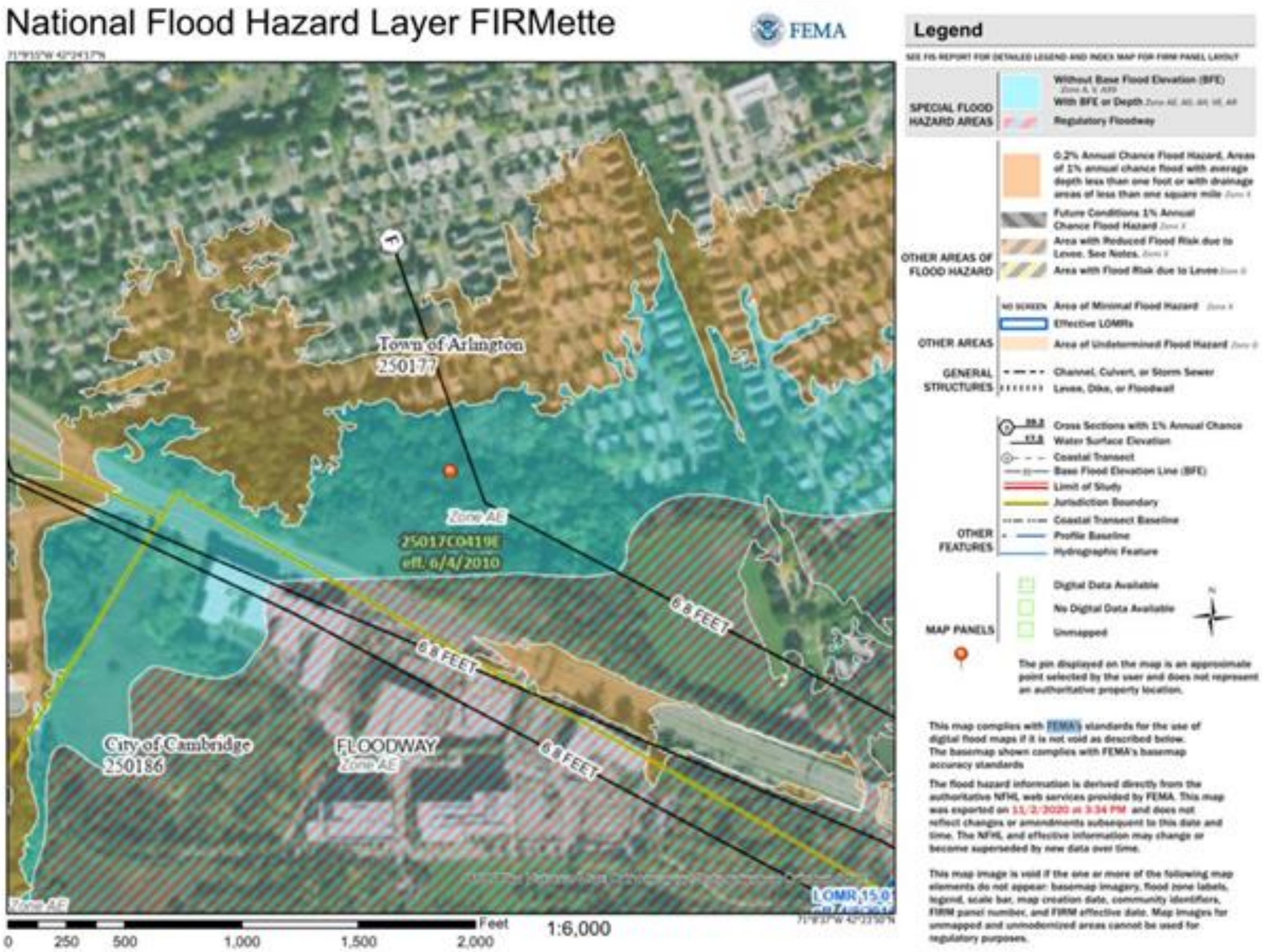

Figure 9. *FEMA FIRMette for Site*

One factor that FEMA's 100-year BFE does not consider is the effect that SLR and SS are predicted to have on nearby infrastructure such as the Amelia Earhart Dam (AED) in Somerville. This dam affects flood elevations along the Mystic River, Lower Mystic Lake, and Alewife Brook (Little River). According to the Cambridge Climate Change Vulnerability Assessment, which utilizes the Boston Harbor Flood Risk Model (BH-FRM), the AED is likely to be flanked by 2045 and overtopped by 2055. If the AED is flanked and overtopped, it implies that the coastal flooding from the Boston Harbor will affect the

[2] FEMA, Flood Profiles, Alewife Brook (Little River), p. 11P – 13P. https://map1.msc.fema.gov/data/25/S/PDF/25017CV003C.pdf?LOC=78020f32f89217822e61ed46a9aab90e

proposed development site, and the site is likely to experience a greater than 20% annual probability of flooding by 2070.[3] The Department of Conservation and Recreation (DCR) is actively undertaking a Feasibility Analysis on raising and extending the AED and pursuing this effort in coordination with regional resiliency efforts. The timeline for these improvements is uncertain, which is why the Thorndike Place Development should consider these future flooding impacts. Figure 10 shows a map of the 1% annual chance flood depth projected throughout Arlington for 2070 by the BH-FRM, which was the model used in the Cambridge Climate Change Vulnerability Assessment. This map indicates a projected flood depth of at least 10 feet throughout the Mugar site.

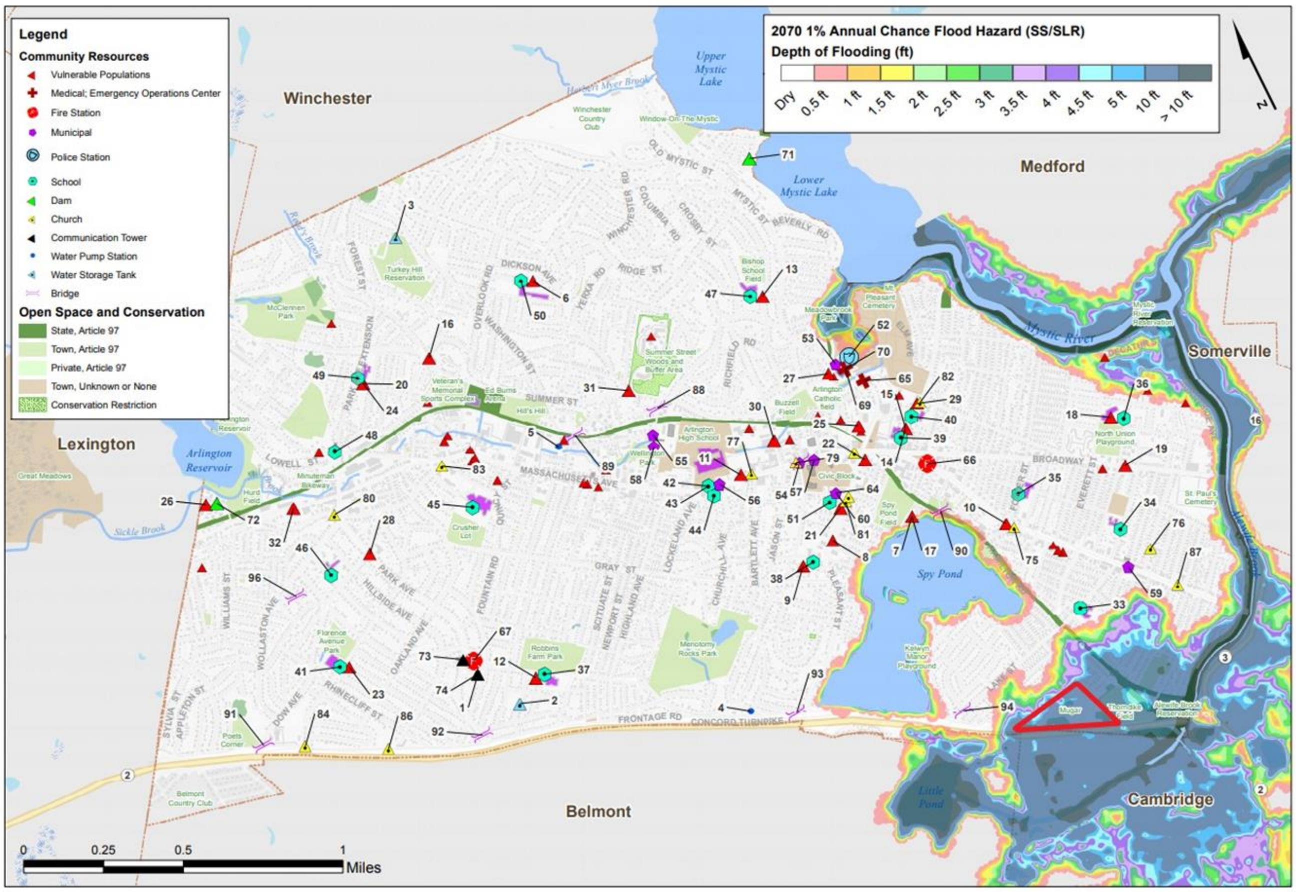

Figure 10. Map from the BH-FRM showing the 2070 1% Annual Chance Flood

Regional coordination is a crucial component of climate resiliency. Coordination and collaboration across communities, State Agencies, and jurisdictions can help strengthen resilient designs and implementation. Similar to Cambridge conducting a Climate Change Vulnerability Assessment, other neighboring communities have taken advantage of updated climate change data in designing new developments. Boston has included coastal flood resilient design that accounts for SLR and SS projections from the BH-FRM developed by the Woods Hole Group for MassDOT. These projections

[3] "Climate Change Vulnerability Assessment. Part 2." February 2017. https://www.cambridgema.gov/-/media/Files/CDD/Climate/vulnerabilityassessment/finalreport_ccvapart2_mar2017_final2_web.pdf

are currently being updated as part of the Massachusetts Coastal Flood Risk Model (MC-FRM), which will serve as new design standards for buildings and infrastructure projects across the Commonwealth and will be recommended that cities and towns adopt. Prior to the MC-FRM flood elevations being available, the BH-FRM elevations can serve as a minimal estimate of future projections at the proposed site, as the MC-FRM has consistently projected higher elevations for adjacent areas. Additionally, the City of Cambridge is recommending that all new developments build to the higher of the precipitation or SLR/SS 2070 10-year flood elevation, as well as having the ability to recover from the higher of the precipitation or SLR/SS 2070 100-year flood elevation.

Design Storm Depths

In the November 2020 Stormwater Report, prepared by the BSC Group, design of the stormwater management system was stated to exceed the provisions of the Department of Environmental Protection (DEP) Stormwater Management Standards. HydroCAD Stormwater Modeling Software was used to model the watershed, comparing both pre-development and post-development conditions of the Site. The HydroCAD model analyzed the following recurrence intervals and inches of precipitation over 24 hours, shown in Table 1, below. The design storm depth values that were used for the HydroCAD analysis may meet the rainfall conditions outlined by the current regulatory DEP standards, but they do not accurately consider the increased magnitude of storm events predicted out to the 2070s planning horizon. For example, research on what climate change projections neighboring communities of Cambridge and Boston are using demonstrates that the present-day 100-yr storm event is comparable to the 25-yr storm in 2070.

As discussed in the MassDEP Stormwater Advisory Committee Meeting on September 22, 2020, MassDEP is currently evaluating updating the wetlands regulations to "incorporate the risk observed in the current data to reflect the range of larger observed storms and provide greater resiliency for infrastructure than National Oceanic Atmospheric Administration (NOAA) Atlas 14 design values."[4] These updated statewide stormwater standards would include the NOAA Atlas 14 Plus Method for determining design standards for precipitation. The NOAA Atlas 14 Plus Method uses 0.9 times the upper confidence interval of the NOAA Atlas 14 estimate of the 24-hour rainfall depth as a standard for resilient design. MassDEP states that these larger stormwater controls will be better able to accommodate runoff from larger storms and therefore will likely increase the stormwater basin size at most locations.[5]

Expected in early 2021 is the release of the Climate Resilience Design Standards and Guidelines on ResilientMA.org developed by the Resilient MA Action Team (RMAT). Led by the Executive Office of Energy and Environmental Affairs (EEA) and the Massachusetts Emergency Management Agency (MEMA), the RMAT is an interagency steering committee responsible for implementation, monitoring,

[4] *MassDEP Stormwater Advisory Committee Meeting 3*. September 22, 2020. https://www.mass.gov/doc/stormwater-advisory-committee-meeting-3-presentation/download
[5] *MassDEP Meeting Summary.* September 22, 2020. https://www.mass.gov/doc/stormwater-advisory-committee-meeting-3-summary/download

and maintenance of the State Hazard Mitigation and Climate Adaptation Plan (SHMCAP)[6]. These design standards and guidance are for State projects and expected as a resource for MVP projects and other grants. While not regulatory for this project, these standards will be implemented statewide and provide recommendations for design for extreme precipitation.

Climate resilient design for the average level of effort ("Tier 2"), as proposed by the RMAT Standards, include percent increases for NOAA Atlas 14 estimates. These percent increases for the mid-century (2030/2050) and late-century (2070/2090) show greater design storm depths than used for the proposed project. A comparative representation of the precipitation depths discussed in this memorandum is shown in Figure 11, with the corresponding values indicated in Table 1, below. It is recommended that these updated precipitation depths be evaluated within the HydroCAD model to appropriately design a stormwater management system at the Site that will be effective in the 2070s planning horizon.

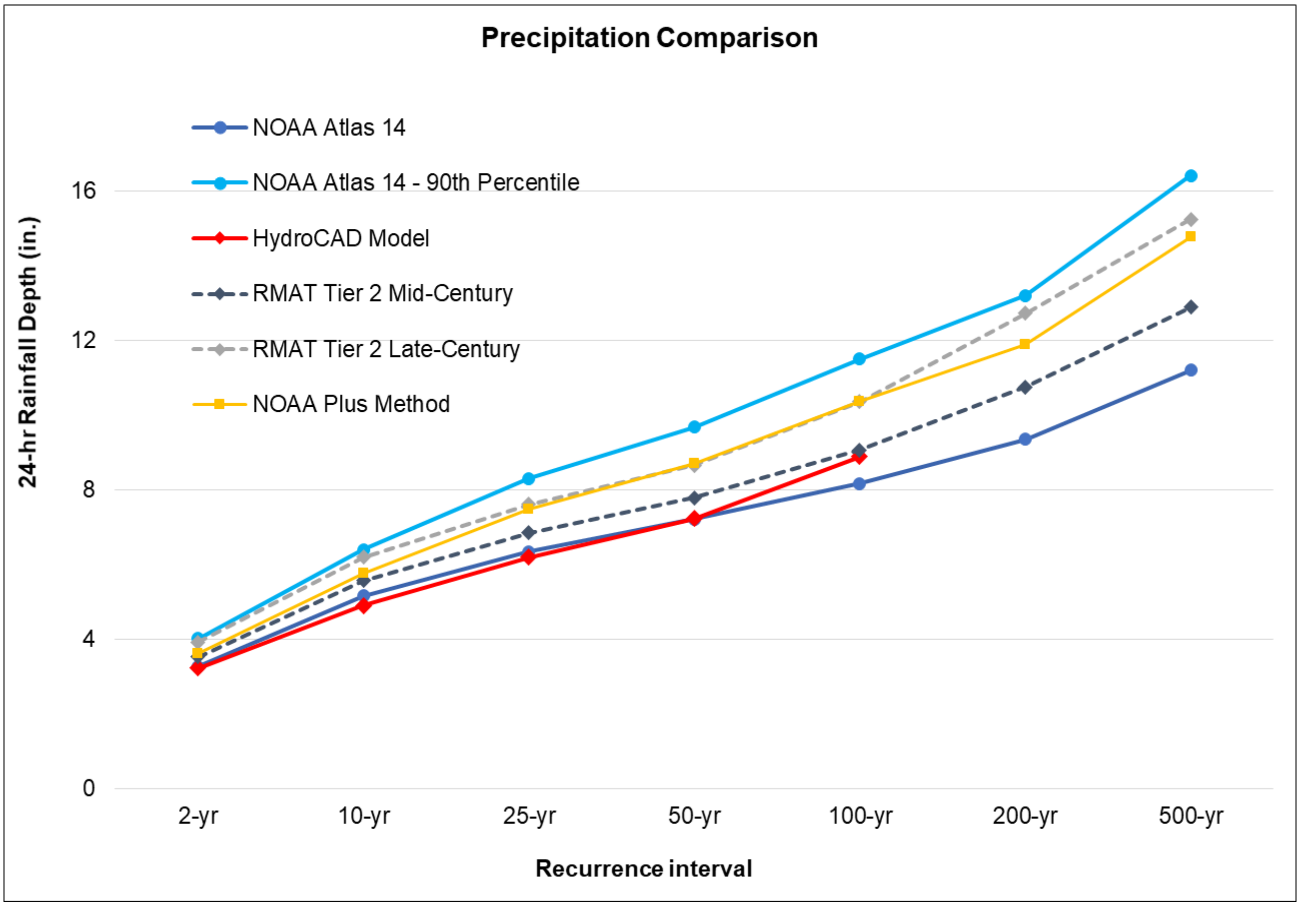

Figure 11. Comparison of Total Storm Depths

[6] Resilient Massachusetts Action Team (RMAT), 2020. https://www.mass.gov/info-details/resilient-ma-action-team-rmat

Table 1. Total Storm Depth (inches/24-hours) comparison across sources and standards.

Recurrence Interval	NOAA Atlas 14 (in/24-hr)[7]	Values used in the HydroCAD Model (in/24-hr)	NOAA Plus (in/24-hr)	RMAT Tier 2 Mid-Century (in/24-hr)	RMAT Tier 2 Late-Century (in/24-hr)
2-yr	3.27	3.23	3.62	3.53	3.92
10-yr	5.16	4.90	5.76	5.57	6.19
25-yr	6.34	6.20	7.47	6.85	7.61
50-yr	7.21	7.23	8.70	7.79	8.65
100-yr	8.16	8.89	10.35	9.06	10.36
200-yr	9.35	NA	11.88	10.75	12.72
500-yr	11.2	NA	14.76	12.88	15.23

Additional Resilient Design Issues

Deployable Flood Barriers

The BSC Group stated in the December 8, 2020 ZBA Meeting that they had considered projections for extreme precipitation and consequent flooding in 2070 and proposed the use of deployable flood barriers to protect the Site against flood waters. Deployable flood barriers, however, are not recommended for precipitation flooding due to installation time in preparation of the storm event and preliminary cost of retrofitting. There are pre-installation site modifications required for use of these barriers with structural considerations that have not yet been acknowledged or specified by the BSC Group.

Operational capacity is essential for the effectiveness of deployable flood barriers. Example operational considerations include installation needs (time range for deployment, manpower, installation cost, etc.), repair during storm event, retraction needs, storage, and re-use of the products. Furthermore, the use of deployable flood barriers does not consider how barrier protection will impact adjacent properties and affect the stormwater management system design. Please refer to the Boston Public Works Department Climate Resilient Design Standards and Guidelines for Protection of Public Rights-of-Way for further considerations[8].

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[7] NOAA Atlas 14 Point Precipitation Frequency Estimates. https://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_cont.html

[8] *Climate Resilient Design Standards & Guidelines for Protection of Public Rights-of-Way* https://www.boston.gov/sites/default/files/embed/file/2018-10/climate_resilient_design_standards_and_guidelines_for_protection_of_public_rights-of-way_no_appendices.pdf

Base Flood Elevation

Buildings proposed to be located in any flood hazard area must be designed in accordance with ASCE 24 guidelines[9]. ASCE 24 requires a minimum elevation of the lowest floor as the BFE + 1 foot of freeboard, or the DFE, whichever is higher.

Compensatory Flood Storage Ratio

Provision of a compensatory flood storage ratio of 2 to 1 in southeast quadrant of the Site will minimize the area of Bordering Land Subject to Flooding and regrade a portion of the Site, impacting flood recovery. More detail into how the 2:1 compensatory storage ratio was achieved should be provided.

Urban Heat Island Effect

Review of available design documents for the Site does not indicate how development will change land surface temperatures or mitigate the already increasing urban heat island effect. Furthermore, the current Site design does not consider or propose methods to mitigate and protect against future projections for extreme heat.

Taken from the Town of Arlington Community Resilience Building 2018 Report, Figure 12 depicts the current heat island analysis for the Arlington area based on land surface temperature[10]. This figure demonstrates that the Site is one of limited areas within the Town that has lower land surface temperatures. The Cambridge CCVA further shows that ambient air temperatures are projected to increase through 2070, becoming dangerous to human health, worsening the situation for already vulnerable populations expected to be living on the Site[11].

With changes in land cover and removal of existing vegetated species, it is essential to evaluate how extreme heat could be exacerbated or mitigated at the Site. The proposed building footprint is approximately 1.2 acres, not including the paved parking area with 35 parking spots located adjacent to the building.

[9] https://ascelibrary.org/doi/book/10.1061/9780784413791

[10] *Town of Arlington Community Resilience Building Workshop Summary of Findings & Recommendations.* May 2018. https://www.mass.gov/doc/2017-2018-mvp-planning-grant-report-arlington/download

[11] "Climate Change Vulnerability Assessment. Part 1." November 2015. https://www.cambridgema.gov/-/media/Files/CDD/Climate/vulnerabilityassessment/ccvareportpart1/cambridge_november2015_finalweb.pdf

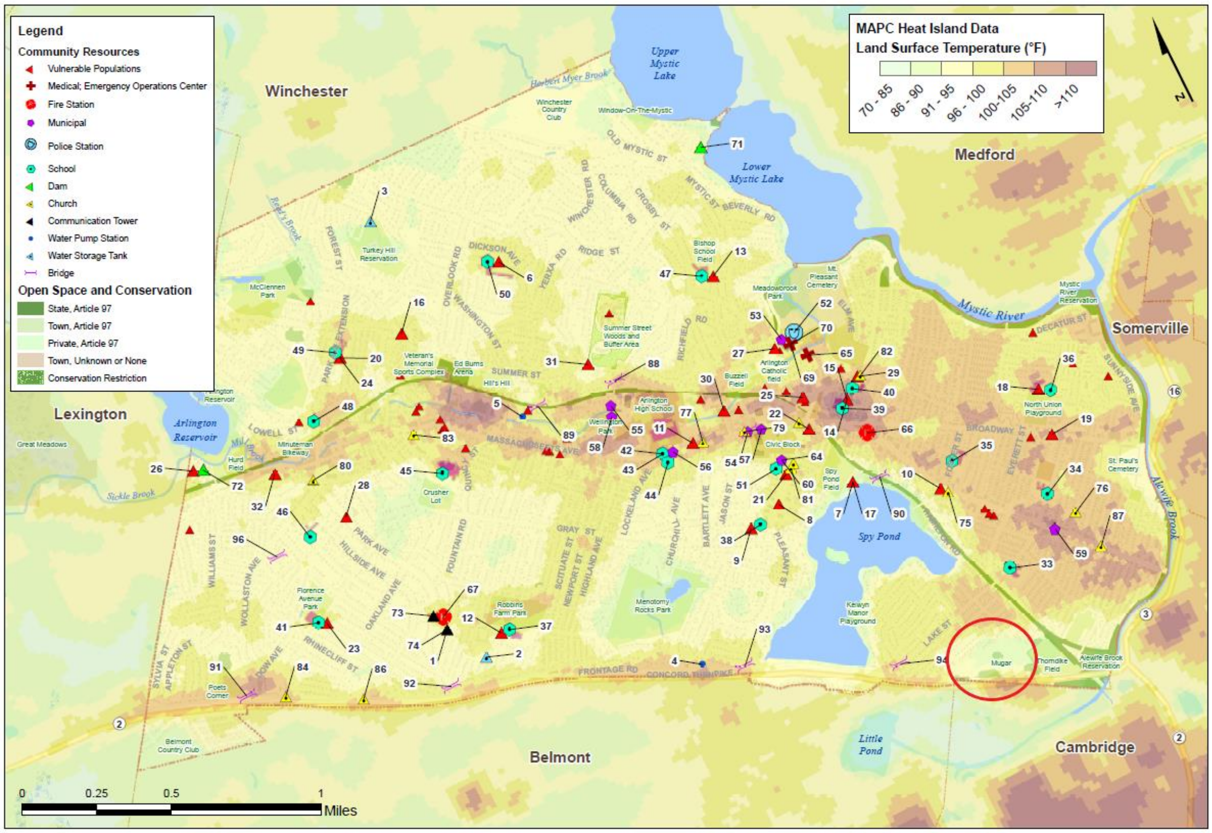

Figure 12. Arlington Land Surface Temperature Map, 2018

Summary of Recommendations

The Town of Arlington has historically experienced extreme flood events and therefore, the design of future developments within the Town should consider increased sea level rise, storm surge, and precipitation projections due to climate change. The Mugar site has previously been used as an area for flood storage, and as such should use extreme caution in development planning. The current design of the Thorndike Place Development does not utilize the best available climate data for this location, and therefore the impacts of the proposed development under future climate scenarios should be assessed. Weston & Sampson Engineers, Inc. provides the following recommendations regarding the design of the Thorndike Place Development:

1. Coordinate to discuss flood elevation findings from Climate Change Vulnerability Assessments conducted by surrounding municipalities and utilize the findings to come up with a DFE that would provide flood protection for the 2070s planning horizon.
2. Utilize updated 24-hr design storm depths in the HydroCAD model to appropriately design a stormwater management system that will be effective in the 2070s planning horizon. The RMAT Tier 2 Methodology provides percent increases to the NOAA Atlas 14 design depths used in the current design of the Thorndike development. The efficacy of the proposed stormwater management at the Site should be assessed using the recommended RMAT Tier 2 Late Century percent increases.
3. Consider alternative means of flood protection since relying on deployable flood barriers are not recommended for precipitation flooding due to installation time in preparation of the storm event and preliminary cost of retrofitting.
4. Consider how provision of a compensatory flood storage ratio of 2 to 1 in the southeast quadrant of the Site will minimize the area of Bordering Land Subject to Flooding and regrade a portion of the Site, impacting flood recovery.
5. Provide information on how development of the Site will change land surface temperatures to prevent exacerbating the already increasing urban heat island effect.

Limitations

Weston & Sampson has completed this memorandum for the Arlington Land Trust based on the level of information provided about the project to this date. The opinions presented within the memorandum are not intended for final opinions for construction and will continue to be vetted with future design changes. Within the limitations of scope, schedule, and budget, our services have been executed in accordance with the generally accepted practices in this area at the time this memorandum was prepared. No warranty, expressed or implied, is given.

List of Acronyms

AED – Amelia Earhart Dam

ALT – Arlington Land Trust

BFE – Base Flood Elevation

BH-FRM – Boston Harbor Flood Risk Model

CCVA – Climate Change Vulnerability Assessment

DCR – Department of Conservation and Recreation

DEP – Department of Environmental Protection

DFE – Design Flood Elevation

EOEEA – Executive Office of Energy and Environmental Affairs

FEMA – Federal Emergency Management Agency

MC-FRM – Massachusetts Coastal Flood Risk Model

MEMA – Massachusetts Emergency Management Agency

NOAA – National Oceanic Atmospheric Administration

RMAT – Resilient Massachusetts Action Team

SHMCAP – State Hazard Mitigation and Climate Adaptation Plan

SLR – Sea Level Rise

SS – Storm Surge

ZBA – Zoning Board of Appeals

Glossary

Terms	Description
100-year floodplain	Area with a 1% annual chance of flooding (or 1 in 100 chance)[1]. Also known as a 1% Annual Exceedance Probability (AEP) flood event (see definition for Annual Exceedance Probability below).
500-year floodplain	Area with a 0.2% annual chance of flooding (or 1 in 500 chance).[1] Also known as a 0.2% Annual Exceedance Probability (AEP) flood event (see definition for Annual Exceedance Probability below).
Accommodate	Adaptation strategy that mitigates the potential impact of a hazard by making space for, or buffering, the associated climate condition.
Adaptation	An action that seeks to reduce vulnerability and risk to an anticipated climate impact. For the Tool, this term is focused on the design of physical assets only.
Annual Exceedance Probability (AEP)	Probability of a flood event being equaled or exceeded in a given year.
Base Flood Elevation (BFE)	The elevation of surface water resulting from a flood that has a 1% chance of equaling or exceeding that level in any given year.
Best Practices	Successful activities exemplified in case studies. Available to provide examples for how the Guidelines are best applicable to a project.
Boston Harbor Flood Risk Model (BH-FRM)	A hydrodynamic model created in 2015 to identify projected flood risk and depth from coastal storms and sea level rise.
Climate Change	According to SHMCAP, climate change refers to "a change in the state of the climate that can be identified by statistical changes of its properties that persist for an extended period, whether due to natural variability or as a result of human activity."
Design Flood Elevation (DFE)	The anticipated flood elevation to which an asset should be designed, to protect the asset.
Design Storm	The magnitude and temporal distribution of precipitation from a storm event defined by probability of occurrence (e.g., five-year storm) and duration (e.g., 24 hours), used in the design and evaluation of stormwater management systems.
Flood Insurance Rate Map (FIRM)	Official map of a community on which FEMA has delineated the Special Flood Hazard Areas (SFHAs), the Base Flood Elevations (BFEs), and the risk premium zones applicable to the community, based on historic information.
Freeboard	Freeboard is a factor of safety usually expressed in feet above a flood level for purposes of floodplain management.
Risk	According to SHMCAP, risk is defined as "the potential for an unwanted outcome resulting from a hazard event, as determined by its likelihood and associated consequences; and expressed, when possible, in dollar losses. Risk represents potential future losses, based on assessments of probability, severity, and vulnerability."
Sea level rise (SLR)	The worldwide average rise in mean sea level, which may be due to a number of different causes, such as the thermal expansion of sea water and the addition of water to the oceans from the melting of glaciers, ice caps, and ice sheets; contrast with relative sea-level rise.

Storm Surge (SS)	An abnormal rise in sea level accompanying a hurricane or other intense storm, whose height is the difference between the observed level of the sea surface and the level that would have occurred in the absence of the cyclone.
Tidal Benchmarks	Tidal datums are standard elevations defined by a certain phase of the tide and are used as reference to measure local water levels. Such datums are referenced to known fixed points called tidal benchmarks.

References

"Alewife Area Floods Near Mugar Wetlands". May 13, 2015. https://www.youtube.com/watch?v=1QyLmZv1hAs

"Climate Change Vulnerability Assessment. Part 1." November 2015. https://www.cambridgema.gov/-/media/Files/CDD/Climate/vulnerabilityassessment/ccvareportpart1/cambridge_november2015_finalweb.pdf

"Climate Change Vulnerability Assessment. Part 2." February 2017. https://www.cambridgema.gov/-/media/Files/CDD/Climate/vulnerabilityassessment/finalreport_ccvapart2_mar2017_final2_web.pdf

Climate Resilient Design Standards & Guidelines for Protection of Public Rights-of-Way https://www.boston.gov/sites/default/files/embed/file/2018-10/climate_resilient_design_standards_and_guidelines_for_protection_of_public_rights-of-way_no_appendices.pdf

FEMA , *Building Higher in Flood Zones: Freeboard – Reduce Your Risk, Reduce Your Premium* https://www.fema.gov/media-library-data/1438356606317-d1d037d75640588f45e2168eb9a190ce/FPM_1-pager_Freeboard_Final_06-19-14.pdf

FEMA, Flood Profiles, Alewife Brook (Little River), p. 11P – 13P. https://map1.msc.fema.gov/data/25/S/PDF/25017CV003C.pdf?LOC=78020f32f89217822e61ed46a9aab90e

NOAA Atlas 14 Point Precipitation Frequency Estimates. https://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_cont.html

MassDEP Stormwater Advisory Committee Meeting 3. September 22, 2020. https://www.mass.gov/doc/stormwater-advisory-committee-meeting-3-presentation/download

MassDEP Meeting Summary. September 22, 2020. https://www.mass.gov/doc/stormwater-advisory-committee-meeting-3-summary/download

Resilient Massachusetts Action Team (RMAT), 2020. https://www.mass.gov/info-details/resilient-ma-action-team-rmat

Town of Arlington Community Resilience Building Workshop Summary of Findings & Recommendations. May 2018. https://www.mass.gov/doc/2017-2018-mvp-planning-grant-report-arlington/download

Dear Committee Members: I'm a resident of 88 Brooks Ave, Arlington, MA 02474. I do wish to go on the record to voice my very strong objections to the Mugar construction project. My two concerns are the damage it will do to the wetlands and to the traffic on Lake St. and all the streets off Lake Street between Rte 2 and Mass Ave. The worst choke point will be the new traffic lights at the Minuteman bike path and the intersection of Lake St. and Brooks Ave... I'm aware that traffic is light now on Lake Street and pretty much across the State due to Covid-19. But once life returns to normal, the traffic congestion and bottlenecks on Lake Street will return. And if we allow the Mugar construction to happen, the cars that this complex will add to Lake St. will be horrendous. I strongly urge the Committee to vote against the Mugar Wetlands construction project. Thank you.
Armen Dedekian
88 Brooks Avenue, Arlington, MA 02474

Our family is fortunate to live in the Kelwyn Manor area across Lake Street from the neighborhood affected by the proposed development. Until the recent reduction of traffic caused by Covid-19, it was well known that Lake Street was essentially unusable from 4:30pm until 6ish weekday evenings. As I'm sure you know, traffic backed up into Belmont and onto the ramps from Route 2.

Once things return to "normal" the traffic will return. There are no alternate routes into the proposed development, and the situation will be even worse than before. In prior times, you could occasionally get a kind soul to wave you out onto Lake Street, where you would patiently wait as the traffic crept up to Mass Ave. If we add significant additional residents, it is less likely that someone that has waited a long time to get off Route 2 and is almost home will be so considerate.

While our area grew naturally into single family homes and duplexes, there was never any planning for major infill beyond our existing infrastructure. I urge you to consider the existing situation before adding substantial extra traffic.

Thank you very much for your consideration and for volunteering for this important function.

Brian Battuello
22 Spy Pond Parkway
Arlington

I am a resident at 65 Dorothy Rd. My commute takes me from southbound route 2 to Lake street to Burch Street. Before March 2020, it would often take me 20 minutes to from the time I exit Route 2 until I turn onto Burch street because of the large amount of traffic going through Lake street. The difficulty of getting onto Lake street from Route 2 would occasionally cause traffic to backup onto Route 2 itself.

The current infrastructure does not support the additional cars that would come along with Thorndike Place. We should be trying to fix this problem, not making it worse.

Thanks,
Ben Willis

Cars along Lake Street use Hamilton Rd as a short cut even though that's not legal. The Spy Pond Condo complex has spent an enormous amount of money paving and repaving our road as a result of this, and children and elderly living here are endangered by drivers passing through at high speeds. So additional traffic coming from new development is a terrible idea.

On top of that we can expect more flooding as a result of climate change and that will make driving along Lake Street even more problematic than it already is.

Gail McCormick
30 Hamiton Rd

Good morning,

I wanted to provide input for the traffic discussion. While traffic is overall way down due to the COVID 19 pandemic, I have noticed it picking up lately and have seen more traffic on Lake street.

But during normal times traffic on Lake street is intense. My kids attend Hardy school and there is significant traffic in the morning heading towards Route 2. It backs up past the school and the light at Hardy and Brooks is very busy.

In the evening starting around 3pm traffic on Lake street barely moves from Route 2 (or further back), and is incredibly slow all the way to Mass Ave. It takes forever to travel this short distance.

Any increase in traffic would make this already difficult situation worse. This is a major concern due to the number of housing units and parking associated with the development of the Mugar property.

Thank you,
Karen Petho-Read

Zoning Board,

Any traffic study performed during the Pandemic is like measuring the amount of snowfall in July . It will not be a true representation of the amount of vehicles that normally use Lake Street, especially, during working hours, when companies and other places of business are back in working condition.

I do not have access to attend the meeting on zoom. I would appreciate the reading of this email. It doesn't take a traffic engineer to realize that this is not a time that will be a true result of what the amount of vehicles use Lake Street.

Thank you,

Mark W. McCabe
4 Dorothy Road
Arlington, MA 02474

To:Town of Arlington ZBA,

According to floodplain management the purpose is to protect human life and health, **minimize property damage, protect unwittingly buying land subject to flood hazards, to protect water supply, sanitary sewage disposal and natural drainage.** The prevention of unwise development in areas subject to flooding will reduce financial burdens to the **community** and the State, and will prevent future displacement and suffering of its residents.
According to the Flood Disaster Protection Act of 1973 EXIT (Public Law 93-234, 87 Star. 975), in order avoid to the extent possible the long and short term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct or indirect support of floodplain development wherever there is a practicable alternative, it is hereby ordered as follows:
In carrying out the activities described in Section 1 of this order, each agency has a responsibility to evaluate the potential effects of any actions it may take in a floodplain; to ensure that its planning programs and budget requests reflect considerations of flood hazard and floodplain management; and to prescribe procedures the policies and requirements of this Order, as follows:

(b) If, after compliance with the requirements of this Order, new construction of structures or facilities are to be located in a floodplain, accepted flood proofing and other flood protection measures shall be applied to **new construction** or rehabilitation. To achieve flood protection, agencies shall, wherever practicable, elevate structures (**not to include underground parking**) above the base flood level rather than filling in land.

The development of the Mugar site will extend the existing floodplain into the neighborhoods leading to a decrease in property value and possible destruction to the surrounding properties.

I have confidence in Arlington ZBA that these facts will be taken into consideration when making any decisions to development of the Mugar property.

THank you,
Mark W. McCabe
4 Dorothy Road
Arlington

Dear ZBA Members,

Florence Murphy has lived on Mary St. since the mid-80's; I have lived here since 1997. Throughout our years here, we have seen so much positive change: Re-paved streets, replaced water pipes & gas lines; attention to our sidewalks; & the DO NOT ENTER signs at Wilson Ave., Littlejohn St., & Homestead Rd. These changes have all improved our neighborhood, making it a great place for families to live, as the streets are safe for recreational activities, such as walking, running, & cycling.

The proposed construction of Thorndike Place would negate all of these positive changes. For what purpose, other than to line the pockets of the Mugars and the developers, tarnishing the Mugar family name. Below are the key concerns that we have about the proposed development on Dorothy Rd.:

- Traffic Impact: The Traffic Study from 2 or 3 years ago would be most appropriate to assess the large volume of cars that already use our neighborhood streets. I am referring to the one prior to the institution of the DO NOT ENTER signs
- Impact of construction vehicles on the neighborhood:
    - Traffic delays to neighbors
    - Dust
    - Noise
    - Vibration
    - Safety concerns for walkers, runners, cyclists, & kids
- Impact of actual construction on the neighborhood
    - Piledriving will cause foundation damage to existing homes. We already have cracks in our back steps from the months/years of piledriving across Route 2 during construction of VOX on 2, etc. Having piledriving even closer is absolutely frightening when we think about the impact on our home and those of our friends & neighbors.
    - NOISE
    - Hours of construction
    - Detrimental to the quality of neighborhood life in general. Dogs will be terrified: kids will be frightened; neighbors who work night shift will be unable to sleep
    - Rats, coyotes, and other wildlife will be flushed out, causing sanitation & safety hazards. Of note, a bald eagle was sighted in these woods
    - Where are the homeless in the encampment going to be relocated to?
    - Tremendous negative environmental impact, such as:
        - FLOODING: The already elevated water table will continue to rise.
        - Climate change does not help this situation, either, and the construction will contribute to an already-compromised ozone layer
    - Disruption of sports play on Thorndike Field due to flooding and construction
- Safety Concerns over increased traffic after the build

    - Kids actually play outside here and ride their bikes on our currently safe streets
    - Negative impact on the Hardy School and other town properties, as has been voiced by other concerned neighbors
- Aesthetic Impact – the building is too tall & large for this area. Six townhomes would be fine. Build those and call it a day!

Our sincere thanks to the ZBA over the years for listening to our concerns about this project.

Respectfully yours,

Florence Murphy and Sarah Harris

Hello

I live on Mary St and my biggest concern around Thorndike Place is traffic. I am 100% for building more housing in Arlington. But I have a question that no one seems to be asking.

Can this be built with a total allotment of about 100 parking spaces for the apartment buildings?

The developer keeps talking about "car-free, public-transit-oriented" housing. How about really going all-in on the "transit-lifestyle"? Let everyone live the car-free lifestyle that the developer is selling…

Why allocate 1.4 parking spaces per unit? How about creating units that, by lease or by sale, simply do not come with parking? This is not out of character with Somerville, Cambridge, or Boston – other towns with "transit-oriented" housing. How about Arlington embracing this trend? Can we think beyond a car-centric development?

Here is what I am proposing:

- 75-80 spaces for people with needs (disability, health, age, family) The parking spaces could only be allocated strictly by demonstrated, documented need. Since it is a new development, this should be easy to implement from the beginning. People would know upfront the conditions for getting a parking space. Anyone whose needs change can be put on a waitlist or can choose to move. Anyone who is moving in going forward would know if parking is or is not available for them. Parking would not be by-right but by allocation by management. Draw up a specific set of criteria for applying for a parking space.

- 10 "admin-flex" spaces for current residents that could be emergency use for people with genuine immediate needs who are on the waitlist or have temporary needs. Unused spaces could be day-use for visitors.

- 3-5 Zipcar spaces for shared-use vehicles. Right outside the door. For the person who needs a car only occasionally, this might be an attractive solution. Perhaps a discounted Zipcar membership could be a perk for renters or owners. Since much of the "use study" by the developer includes rarely-used cars, this is something to consider.

- 10-15 Visitor spaces where overnight parking is not allowed except by prior approval by apartment complex management. They will need to agree to enforce this so that these spaces don't turn into defacto resident parking. Apartment residents that don't have parking spots at Thorndike will not be able to park on the streets instead. Because Arlington does not allow overnight, on-street parking, this should be easy to enforce.

- Covered, secure bike parking. If you're going car-free, having a secure, safe, clean, well-lit, attractive, covered spot to store and access your bike would encourage this. You could store dozens of bikes in the same amount of space as 3-4 cars. And how about adding chargers for electric bikes or scooters? There must be a pay-per-use solution for this growing trend. Maybe even a solar solution so charging could be free.

- Separate issue around cars: are there plans to install electric vehicle chargers on some of the spaces? Perhaps some of the visitor spaces could be allocated for this to encourage a charge-it and move-it system.

And in a win for the environment and flood-control, this would leave about 2/3 of the previously-planned paved area as open land and could be used as buffer and containment.

I really struggle with having this additional density in our neighborhood. And I am concerned that the developer has to do an exceptional job at buffering rain water to prevent flooding and providing an attractive transition into the complex from the neighborhood. But I think we need more housing in Arlington.

Here are my specific concerns around traffic and why I am proposing an alternative:

The streets in our neighborhood are narrow. When cars are parked on both sides of the street – which is often – it is very difficult for cars to get through. I can only imagine that a large vehicle like a fire truck might be forced to back up and turn around and find another way in case of an emergency.

We have many, many cars that drive over from other parts of Arlington and Cambridge and Belmont who park near Magnolia Field so they don't have to pay for parking or endure the traffic mess that is Alewife. And guess where they park? Right out in front of where Thorndike Place is proposed.

The current traffic on Lake Street is in no way comparable to before the COVID shutdown. Before COVID, from about 3:30-6:30, traffic is backed up behond the traffic signals at Route 2 all the way to Mass Ave. While I hope that the new crossing signal for the bike path will help with the throughput, the volume will return. Any current traffic study is in no way related to pre-COVID reality. You could roller skate down Lake Street at most hours of the day right now and not hit much traffic.

The two access roads that would handle all the traffic are as narrow as any of the other roads – and there is nowhere to expand these roads except right up to resident's front doors. I can't imagine adding another 300+ cars to our already dense neighborhood.

Thank you for reading and considering my very long email.

Patricia Browne
49 Mary St.

I live on Mary St. and am completely against having a MULTI-STORY complex in a RESIDENTIAL neighborhood. And any "engineering" baloney the builder is feeding the Town of Arlington is mostly likely BS. This is not about us; it's about them and their bank accounts. They don't care if they turn this neighborhood upside down.

Car-free lifestyle? Do these BS-ers realize that there are a LOT of older people in this neighborhood? And how would parents with children live a car-free lifestyle? I can't believe they are actually trying to sell such garbage...because that's all it is. Do they walk or bike, everywhere they go? Bet not. It's a desperate act, which should speak volumes to the town. I have NO intention of living my older life car-free. Most of us OWN a CAR…and that will NOT change.

Everything's at stake:

Flooding: We need our wet sponge for obvious reasons. This is a serious issue, and I find it extremely hard to believe the "engineers" have figured out how to absorb water without a RESOURCE….or one that will work.

Environment: Where will the wildlife go with NO home? This is easy to figure out: walking the streets of our neighborhood, looking for FOOD. We've already seen it.

Traffic: We just had lights put in at the bike path after YEARS of being tortured trying to get up our own street to get home from work, sitting in BACKED UP traffic. We do NOT need MORE traffic in our neighborhood.

Hardy School: Overcrowded schools means overburdened and overworked teachers -- not to mention spending more money on the schools to accommodate the increase. Who's paying for that? Us.

Thorndike Field Usage: Where's the alternate space for town sports?

Increased Costs: Who's paying for all these costs? How many times can the town raise taxes? They're high enough as it is, which the developers surely don't care about; they don't live here.

Open Space: One of the last open spaces, which, to me, is damaging enough on its own that some greedy developer wants to come in and build on it. Any intelligent person should be able to see that.

Surrounding homes: Possible foundation damage and ongoing flooding damage. Enough said.

Let the greedy developer build a COMPLEX in Boston or some other LARGE city that can actually handle such a structure. It doesn't belong amongst residential HOMES.

This project is nothing more than people destroying property for their own greedy purpose. When they finish, they will move on to the next destructive project with the same attitude. They won't care what happens once they're gone, and they won't look back.

A Disgusted Resident

Members of the Board,

I emailed you on August 25, 2020 to express my concerns about the negative impacts the proposed Thorndike Place development will have on my neighborhood. Now that the hearings are nearing their conclusion, I feel compelled to write to you again and re-emphasize my concerns.

My primary concern is that it looks from the plans like Lake Street is the only main artery in and out of the development. Prior to the COVID-19 pandemic causing many people to work from home, the traffic on Lake Street was bumper-to-bumper during rush hour. I couldn't leave my house on Pondview Road between 4 pm and 7 pm without having to sit in crawling traffic on Lake Street to get to Route 2 or Mass Ave. Adding a large 176 apartment complex on the Mugar property will lead to hundreds more cars (if we assume 1.5 cars per unit) regularly utilizing Lake Street and make traffic absolutely unbearable.

Beyond being concerned about traffic, I am also concerned that the development will exacerbate flooding in the area and lead to overcrowding at Hardy School.

Thank you for your consideration,
Emma Murphy
Pondview Road resident

--
Emma K. Murphy

Our town needs this area to be free from any developments for so very many reasons, especially for wildlife, and to prevent flooding issues for those who live close to the field.
Sincerely,
Elaine Campbell

Dear Zoning Board,

Our family lives at 23 Littlejohn Street in Arlington. We are strongly opposed to the Thorndike Place development currently being proposed.

The proposed entrance at the end of our street would turn this quiet neighborhood full of kids who play in the street into a traffic nightmare. The traffic on Lake Street outside of pandemic times is already untenable.

The other big reason for our opposition to the project is that this is a wetland. It already floods regularly. We get water in our basement from on street flooding at least 4-5 times per year. With the additional development we are terrified at the potential impact to the existing properties in the area.

We are big fans of Arlington and not at all opposed to greater density. But this location is absolutely the wrong choice and will materially impact the quality of life for everyone in the neighborhood.

Sincerely,

Ben Micheel, Anna O'Driscoll, Pierce Micheel (6), Cora Micheel (2), and Marcel the greyhound (11)

23 Littlejohn Street,
Arlington, MA 02474


CHILDREN


339 FY8


832 WX6


CHILDREN
STOP

January 20, 2021

Zoning Board of Appeals
Town of Arlington
51 Grove Street
Arlington, MA 02476

RE: **Mugar Property - Thorndike Place Development – Additional Issues**

Dear Zoning Board of Appeals Members:

I am writing to add to the concerns I've expressed in separate letters specific to traffic and water topics. The concerns I want to express in this letter focus on:

- Size of the project, including noise and light pollution
- Foundation pile driving
- Stormwater and sewage management

The massive size of this project and its' associated noise and light pollution are not remotely in character with the surrounding neighborhood. The neighborhood bounded by the Minuteman Bikeway and Lake Street is made up of two-family homes (including townhouses) along with some single-family homes. The amount of traffic, noise and lighting associated with these homes is not great. It is very quiet at night. The portion of Dorothy Road and Little John Street where the project is proposed currently has a total of approximately 35 units. The giant apartment building has almost five times the number of units as its surrounding area. It is also much taller and **will create a significant shadow** negatively impacting neighboring homes and the wetland habitat. The project **will create significant light pollution** at night, again negatively impacting neighboring homes and the wetland habitat. Utilities installed to service massive buildings **create a significant amount of noise**, again negatively impacting surrounding homes and the wetland habitat. An additional factor you should consider is the total height of the building above the current ground level, including all the utility structures on the roof. **The proposed building is not "four stories" – it is MUCH taller**, but should not be allowed to be. Keep the maximum total height to 40 feet above the current ground surface INCLUDING the above ground height of the parking level and all the rooftop utilities.

When the apartment and office buildings and hotel were built across Route 2, a large number of piles were driven. In addition to the infuriating noise, **the foundation of my house and others in the neighborhood shook terribly.** This proposed project is MUCH closer and driving piles for the foundation will cause damage to the homes in the surrounding neighborhood. The developer should be required to undertake inspections of all basements in the neighborhood to document the baseline condition before any construction starts and be required to pay for remediation of any and all damage that occurs.

To reiterate and add to previous comments on stormwater and sewage management. As everyone should be aware, the neighborhood where this proposed project is located has major issues with water, particularly with a high groundwater level and subsequent basement flooding, and developing this project will only make them worse. When it rains a lot, the water table rises and impacts basements in the area. In many areas, the groundwater rises to the surface and ponds. Therefore, stormwater management is of great concern. All retention ponds and outlets from stormwater management structures **must be located far away from nearby homes** because the groundwater level will be raised locally around them. All grading of the property **must direct overland flow AWAY from all nearby homes**. Any below ground level areas of the proposed building will be in contact with the groundwater, particularly when it rises during and after storm events. This will interfere with groundwater flow, **funneling it around the structure, increasing basement flooding of nearby homes**. In addition, over time, initially tight construction will develop cracks and the groundwater will enter below-ground stormwater management structures **rendering them ineffective**.

The proposed project will add a significant amount of sewage to the system in the area. The system relies on gravity to work properly. Much of the piping in the project area is in contact with the groundwater, particularly when it rains a lot and the groundwater level rises. Unfortunately, this old piping has leaks and allows groundwater to infiltrate. During the big storms of October 1996 and March 2010, sewage was bubbling up out of the manhole in Margaret Street at the entrance to Thorndike Field (it is labeled as sewer not stormwater). **There are serious questions about the capacity of the sewage system to safely handle the significantly increased flow the proposed project will generate.**

The massive size of the building is not compatible with the size and scale of the neighborhood, and the light and noise pollution will cause harm. Foundation pile driving will damage the foundations of numerous homes. Basement flooding due to the groundwater level in the neighborhood, particularly during and after storm events will be made worse. The project will have devastating impacts on the neighborhood. Please do not allow it. Please contact me with any questions or for additional information.

Sincerely,

Jennifer Griffith
4 Edith Street
Arlington, MA 02474

January 20, 2021

Zoning Board of Appeals
Town of Arlington
51 Grove Street
Arlington, MA 02476

RE: **Another Letter on Traffic Issues – Mugar Property - Thorndike Place Development**

Dear Zoning Board of Appeals Members:

I am writing to add new and reiterate my earlier comments on traffic issues (letters dated September 21 and December 6, 2020) which are on:

- Vox on Two is NOT a valid comparison for traffic generation
- Pedestrians walking to Alewife and soccer fields are still an issue
- Turning left onto Lake Street to access Route 2/Belmont

Vox on Two is located in Cambridge which is not known for its schools and in an area that is not near any schools and consists of studio, 1 bedroom, and 2 bedroom units. Vox on Two is physically closer to the Alewife T station and appeals to young adults and others without children. Thorndike Place located in Arlington which is known for its schools and is proposed with 1, 2, and 3 bedroom units. Cambridge appeals to people without children and Arlington appeals to people with children. Households with children generate many more car trips than those without – going to/from schools (the middle school and high school are not walkable), grocery and other necessary errands and appointments are greater. Traffic generation data from Vox on Two is NOT a valid comparison and should not be allowed to be used as is. A development of the same mix of bedroom units and that is located outside of Cambridge and further from public transportation should be used.

While the updated project design as currently proposed alleviates some of the safety concerns related to how the neighborhood is used (during "normal" times) for parking during the week for commuters accessing the Alewife T station and families for soccer practices and games in Thorndike and Magnolia Fields it does not eliminate the issues. A significant amount of this parking and resulting pedestrian traffic is on Burch Street and the portion of Dorothy Road between Parker and Margaret Streets. Due to the significant abuse of the neighborhood by commuters, cars on Lake Street are prohibited from turning onto Little John (or Wilson or Homestead) streets during the morning and evening commuting times. Therefore, the only entrances to the neighborhood are via Burch or Margaret Streets. Those accessing the project site would need to navigate through the neighborhood. The streets are narrow and cars park on both sides of the streets – allowing space for just one car in one direction to pass through. People are walking everywhere. Even if everyone stayed on the sidewalks (which do not exist everywhere), there are several street crossings. Because of all the parked cars, there are limited sight lines. **Adding a significant number of additional cars to this situation is dangerous**. The neighborhood access restrictions during commuting times must remain. If parking is restricted to just one side of a street, or if street parking is eliminated altogether, then the cars that are driving will just go faster, increasing the danger to pedestrians and bicyclists. Especially during the week, drivers that have been stuck in the back-up on Lake Street, speed once they are "released" into the neighborhood. Traffic calming and additional stop signed intersections are already needed. **Adding more cars into the neighborhood is unacceptable.**

To reiterate my ongoing primary concern – turning left onto Lake Street to access Route 2 and Belmont. In normal times, as everyone is aware, the traffic on Lake Street heading towards Massachusetts Avenue is backed-up for hours both in the morning and in the evening. Leaving the neighborhood to access Route 2, the Alewife area, and Belmont, is treacherous. The cars on Lake Street are basically parked. There are NO sightlines for cars that need to turn left out of the neighborhood. Cars on Lake Street block the intersections so it can take time for someone to leave space to get out. And then you cannot see if anyone is coming from the right. After their frustration with the back-ups at the Brooks Avenue traffic light and the bike path, once "released" cars are traveling Lake Street at speed. Turning left out of the neighborhood is treacherous enough and takes enough time as it is. **Adding a significant number of additional cars to this situation is extremely dangerous** and will also cause a significant line of back-ups in the neighborhood**. A new traffic light will be needed on Lake Street at the intersection with Little John Street** to let all these additional cars from the proposed project out of the neighborhood safely.

Bottom line – the number of additional cars and car trips WILL be significant and adding more cars to the neighborhood is unacceptably dangerous. Please do not allow it. Please contact me with any questions or for additional information.

Sincerely,

Jennifer Griffith
4 Edith Street
Arlington, MA 02474

Dear Mr Dupont, Hanlon, Klein, Mills and O'Rourke,

I am a 20 year resident at 4 White St. in the area that will be impacted by the proposed development known as "Thorndike Place". I want to voice my concerns about the proposed development along Dorothy Rd. and ask that you consider the following regarding traffic:

In the traffic assessment, the developer proposes to add 236 cars to an area that currently has 13 houses along Little John and 6 townhouses across the street on Dorothy Rd. The current homes have an estimated 45 cars between them. The proposal means a 500% increase of cars that will need to travel down Little John or Dorothy/Margaret St. to Lake St.! Then they conclude that the proposed development "is not anticipated to significantly impact traffic operations" citing Sept 2020 (COVID shutdown) traffic counts, 10 year old census data regarding commuting patterns and unclear "corrections" to the resulting number.

Lets remember the traffic conditions pre-COVID: During morning and evening rush hour, Lake Street was a parking lot. Anyone living in this area can tell you that the access into and out of this neighborhood is already precarious at best. Lake St. commuters were attempting short cuts via Little John, Mary and Margaret St. creating traffic jams into the neighborhood streets as you can see in the pictures. Getting home from Rt. 2 ramp to Margaret St. during rush hour took 30 min.

Oaktree projects only 20 cars to exit the development during rush hour. Those cars will be backed up on Little John waiting to turn left onto Lake St. or drive down Dorothy Rd to wait for a right turn from Margaret onto packed Lake St. Their reported 1 second travel time added to the cars exiting the development does not consider the additional wait time for everyone in the back of the line coming from Rt. 2.

Now, the proposal also assumes that many residents of the development would commute by public transportation easily accessible from that location. However, estimates for post-COVID public transportation assume that people will opt for individual transportation over shared or public transportation long after we've all be vaccinated. This is expected to lead to budget cuts for public transport leading to a further decline in ridership. If these assumptions come to pass, the proposed number of spots at this facility won't be enough for its residents. This will leave the residents of Thorndike place scrambling to find parking for additional cars even at the current proposed number of spots. The night time parking ban is currently only occasionally enforced and would need to be stepped up to ensure the safety of all neighbors.

In the pictures you can also note that the streets in this 100 year-old established neighborhood are narrow and additionally narrowed by parked commuter cars on both sides making 2-way traffic difficult. This will lead to further congestion by 430 trips traveling down Little John St., Dorothy Rd and Margaret St. in and out of the new development.

At 236 cars, the developer should be required to pay for additional parking enforcement in the area, add safety features to all impacted streets to reduce cut-through traffic and slow down overall traffic as an offset to the additional traffic caused by the development. Within the development, the number of parking spots must be drastically reduced. 20 spots would be appropriate according to the number of townhouses that could fit along

Dorothy Rd. to keep within the current sizing of streets and traffic.

The proposed project will have devastating impacts on the neighborhood. Please do not allow it to move forward.

Regards, Eva Bitteker

PS: Pix will come in multiple drops, too big for just one message!


CHEVROLET
44B B98


E
36


179 GN9


MARY St
CAUTION
CHILDREN

January 24, 2021

Members of the Board,

We are writing to you regarding several serious concerns that we have as direct abutters to the Mugar Property. During the ZBA meetings, we have expressed these concerns but, have had no direct response to any of the items we have brought forward. Below is a list of concerns that we would like answers or clarification on:

1. Permitting: On September 1, 2016, the developer had given submittals to permitting this project with a package that was far from complete: missing several key components such as wetlands, traffic impact, and conservation studies. ***Why was the 2016 permitting date accepted for this project when it was not complete?*** Now that the entire project has been revised with significant changes, Oaktree should be required to submit new permitting applications as the project has changed in location, footprint, structure and demographics. ***Why is this revised plan being allowed to continue with the 2016 permitting date?***

2. ZBA: At the cost of removing one- and two-family dwellings along Dorothy Road, this revised project is in a totally different area than the original setting. As this land is zoned for one- and two-family dwellings, this will cause a significant change to the neighborhood. This project demographically does not fit in and will cause financial hardship to all residents in this small East Arlington neighborhood. Oaktree has compared this project to the Vox situated on Route 2 which has multiple access points on Route 2 and a secondary access road behind the development. The Vox is set in a commercial atmosphere with no one and two-family residential abutters. This is far from comparable. The ZBA should be protecting the residents and the existing zoning protocol. This new proposed footprint should have been submitted under current times with a fully completed submittal package. Therefore, once again the 2016 submittals should have been rejected as well as this most recent change. This four-story building will now put all the homes on Dorothy Road in the shade. ***What impact studies will be performed to ensure these homes of sunshade loss?***

3. Wetlands: Under the recently submitted plans, it appears that the 100-year floodplain map being used does not illustrate the true setbacks. Based on today's FEMA 100-year floodplain map, the developer would be building in the middle of the wetlands. All direct abutters will feel the ramifications of this project being constructed as it will raise the water table significantly and dramatically increase the floodplain. Recently, a wetland's study was performed. The credibility of this study is severely in question as we have been in a severe drought with water levels being the lowest in a decade. ***What floodplain map is being used and will Oaktree be reproducing a new wetlands study?***

4. Traffic Impact: The developer Oaktree has submitted traffic impact studies which have been based on the Vox Study. This is not comparable as this area has been zoned for one- and two-family dwellings. Our home will be directly impacted by this development as the entrance/exit will be at the foot of our driveway causing significant hardship. We feel that any access through our small neighborhood should be denied. Again, this traffic study should have included in the original submittals for permitting. Having the study submitted during the pandemic is unrealistic with adjustment factors not having any credibility***. Why is egress of this building going through our thickly settled district?***

5. Value Impact: Oaktree's development will cause significant loss of value to all our homes in this small community as we will be living next to a 40B development with a commercial setting. The comings and goings of traffic patterns will cause a significant drop in value. Now Oaktree is trying to tell us that each unit will only need 1.3 spaces per unit, which will leave us as abutters with parked cars up and down our already crowed side streets. ***How will this issue be addressed?***

We would appreciate your time in reviewing our questions and concerns.

Sincerely,

Robert & Julie DiBiase

Hello All

Please include this chart entitled "Twenty years of Building Residential Units in Arlington" at the Zoning Board meeting tonight.

One of my arguments about Thorndike Place, and much of the building in Arlington, is that Arlington does not need more rental units. If you notice "30 Mill St. Rental", on the chart attached, many units are unoccupied.

In my original letter to the Zoning Board of September 11, 2020, I stated that there will be less demand for rental units starting in 2026 as most colleges in the area see that as the turning point when there will be a significant drop in student population after decades of low birth rates.**

Would you tell me if this will be part of the presentation or listed at the end of the Agenda as many emails/letters were for the last meeting.

Thank you,

Adrienne Landry
East Arlington resident

**https://www.npr.org/2019/12/16/787909495/fewer-students-are-goingto-college-heres-why-that-matters

Dear Members of the Arlington Zoning Board of Appeals,
I'm writing to ask that you please preserve the Mugar Wetlands. The Mugar Wetlands act as a buffer for stormwater and help to absorb the excess water during storms. If this were to be removed, the amount of flooding in the neighborhood would increase. I have lived in this area for 50 plus years and have seen many storms that cause flooding. I am hugely concerned this would increase.

I am also deeply concerned about all the animals that live in this wildlife area. I have seen the effect of shrinking homes for the animal population. More rats in the area from this construction is also a problem.

The issue of traffic in this area is also high on the list of concerns. As a resident of Mary Street, I have experienced first hand the amount of cars in this area. In pre covid times, there were days I had to wait to open my car door parked at the curb in front of my house because of all the traffic that came down Mary street a little before 4:00 in the afternoon. Adding hundreds of more cars to this area will only add to this issue.

Thank you for reading my comments and I hope you will vote to not build on this site. A reasonable solution would be to allow two family units as the rest of the neighborhood represents. Some of these two family units could be affordable housing.

Sincerely,
Amy Meadows
Mary Street resident

Good Morning,

I live in the neighborhood Thorndike Place is proposed along with families with school aged children, working couples, retired couples and some single, working people in two family or single family houses. A 176 unit apartment building is not keeping with current footprint of the neighborhood.

Based on previous construction in the neighborhood over the past five years, construction equipment and delivery drivers go wherever they want. Regardless of one way or no entry signs, they seem to be exempt from following the rules. Trucks idle while waiting their turn to deliver equipment or materials. The additional traffic of construction equipment, worker's vehicles, material delivery vehicles and finally vehicles of the occupants and guests will have a negative impact on all of us living in the neighborhood.

In a healthier time, we had block parties. Dorothy Road was closed at the Parker Street end. You had a chance to meet your neighbors, share food, listen to music and enjoy the diversity of our neighborhood. Children and adults now ride their bikes in the road. Street hockey, scooter races and basketball is played on our streets. On Halloween there was a parade of kids walking in costumes. Chalk decorating parties in the road in front of someone's house to celebrate a birthday. These simple, pleasures most likely will become a memory.

There has been flooding on Dorothy Road. I've watched people pile sandbags at the end of their driveways and in front of their garages to reduce the amount of water coming into their basements and garages. Dorothy Road it self has flooded. We are in a climate change. Building on a wetland will not stop the flooding. When it floods, the elevator, if Thorndike Place is built, will not be usable. Anyone with a disability will be unable to leave their unit without assistance. The proposed underground garage will flood. Who will tow 176 cars?

I understand that the Mugar's want to make a profit. But at what cost to our community? I have four questions.

1. How many of the 176 units are designated for low income housing?
2. Has the impact on Hardy School enrollment been assessed?
3. Units will be rented, not owned. Is this really different than a commercial structure in a residentially zoned area?
4. Can you justify building in wetlands that is a flood zone and place vulnerable people, anyone there?

I ask that all of you come and walk in our neighborhood. Get a feel for the impact this structure will have on the people who live here. This massive building will impact not only Lake Street and neighborhood traffic but our property values. The closer a house, the greater the resale devaluation. It's a fact. It doesn't matter if the structure is a church, school, factory or restaurant. Few would choose to be their neighbor. We chose this neighborhood for the qualities it has now. Please help us keep the current footprint.

I oppose the building of Thorndike Place and respectively ask that you vote no.

Thank you for your time and for serving on this board.

Barbara Rowland
10 Mott St, 1
Arlington, MA 02474

Hello,
I'm writing to express my concerns regarding flooding as it pertains to the proposed Mugar/Thorndike Place project.

I live on Fairmont St. in East Arlington, and my neighborhood abuts Magnolia and Thorndike fields. After almost every heavy rainstorm, I observe my neighbors' yards/driveways, and see large torrents of water being pumped out of their homes/basements/yards and into the street. I also see how saturated the playing fields get.

I can only imagine how much this would be exacerbated by additional building in the area.

I strongly oppose the project.

Please let me know if I can provide any additional information.

Best,
Dori Mazor
12B Fairmont St.

To Whom it may concern,
I live and own a house on 151 Mary Street in East Arlington, my neighbors and I were made aware of the massive project at the Mugar Wetlands.
I work as a nurse at the MGH hospital and will not be able to be more involved with the town project because work is hectic during COVID-19 times.
However, I would like to express my vote and concerns that I oppose 100% of the Oaktree project at this time. This 176 unit is poised to bring more harm to the wonderful community we have than good. Here are the reasons why:
-Lake street has one of the worst traffic in East Arlington, probably the worst of the entire town. This will worsen this problem several times over and this will extend the problems to our doors.
-The mugar wetlands is the ONLY green space for the east arlington community, This is the ONLY barrier to the already loud and busy Rt 2. This area promotes cleaner air and decreases visual pollution to the area. Nothing can substitute this. The Oaktree project will be devastating to us, to our kids and the environment.
-There will be worsening with flooding in the area.
-Hardy school will need massive renewal to accommodate the new residents, a project that will be paid by the town and ultimately WE will be paying with our already high taxes. Many people cannot afford this at this time. I talk to my neighbors, and they need money to remodel their aging homes not to pay for accomodation of a project that is poised to decrease the value of our community.
-There are many other concerns that our neighbors are discussing at this time and I hope the town listens to us.

Thank you for your attention and, please, MAKE MY VOTE COUNT against Oaktree Thorndike development.

Thank you for your attention to this matter.

Dirceu Pereira
dirceurp@gmail.com

Dear Arlington ZBA,

I am writing to add my voice to all those who oppose building on Thorndike Place/ Mugar Property.

In my research to better understand this issue, I have learned some fascinating facts about wetlands.

Our town owes it to ourselves to truly understand the nature of wetlands before we can have an honest conversation about the issue. If the land is developed, we will realize what was truly at stake, all that we don't yet know, but at that point it will be too late.

Wetlands are important to protect because:

Wetlands are the most biologically diverse of all ecosystems

- There is **more animal diversity** in the wetlands compared to **any other biome** in the world.
- Although they only cover a small portion of the continental U.S., **half of all North American bird species** use wetlands for feeding or nesting.
- Additionally, more than **1/3 of all threatened or endangered species** are dependent on wetland habitat.
- Wetlands host to nearly **1/3 of all plant species** on Earth.
- More than 19,500 animal and plant species depend on wetlands for survival globally.

Wetlands are natural water filters, the "kidneys of the landscape"

- Wetlands can hold pollutants such as heavy metals and phosphorus and can even aid in converting dissolved nitrogen into nitrogen gas.
- Wetland areas can also break down suspended solids thus playing a vital role in neutralizing harmful bacteria.
- Wetlands clean, filter, and store water thereby acting as the "kidneys" of the earth's ecosystems.
- Surprisingly, **wetlands can remove up to 60% of metals contained in the water, trap, and hold up to 90% of sediment from runoff and get rid of up to 90% of nitrogen.** They do this mainly through uptake by plants and percolation through the soil.

Wetlands combat climate change

- The area of earth covered by wetlands is very small, but their carbon-capturing abilities are amazing.
- Wetlands, especially peat wetlands, can store up to **50 times more carbon (the heat-trapping gas) compared to rain forests** thereby helping to combat climate change.

Wetlands are the planet's "sponge" and their existence prevent flooding and extreme events such as hurricanes and typhoons

- According to EPA, up to **1.5 million gallons of floodwater can be stored in an acre of wetland** thereby qualifying as a natural flood control mechanism.
- Wetlands are excellent at absorbing floodwater and freeing it slowly into the ground, serving as "reservoirs" for excess stormwater thus preventing flooding.
- The increasing initiative to protect wetlands, to a great degree, is because they are crucial for keeping rivers at a normal level.
- **This helps to keep at bay the potential of flooding and extreme events such as hurricanes and typhoons.**

The Town of Arlington has the opportunity to

- protect the feeding and nesting sites of up to **half of all North American bird species**
- protect **threatened or endangered species** who are dependent on wetland habitat
- support nearly 1/3 of all plant species on Earth
- **contain pollutants** such as heavy metals and phosphorus
- neutralizing harmful bacteria
- clean, filter, and store water
- combat **climate change**
- retain up to 1.5 millions of gallons of floodwater
- **prevent flooding in nearby neighborhoods**
- maintain normal levels of local rivers, AND
- prevent extreme events such as hurricanes and typhoons
- **if they can prevent building on the Thorndike Place/ Mugar Property.**

Imagine if the property were a rainforest- would we allow development on the land? The majority (~75%) of our nation's wetlands are on private property. Many citizens, including myself until recently, aren't aware of the amazing and necessary role that wetlands play in our ecosystem. And our laws haven't caught up to protect them. But when we know better, we should do better. I urge you to oppose all construction on the property with all the powers you have.

Thank you,
Erin Freeburger
20 Parker Street
Arlington, MA

Sources:
https://www.conserve-energy-future.com/facts-about-wetlands.php
https://www.nrcs.usda.gov/

Dear Sr. or Madam,

I lived on Dorothy Road for 10 years. In 2020 I moved to 101 Varnun Street next to Magnolia. When I was on Dorothy Road we experienced increase in flooding in the last 3-4 years. There was a city drainage in front of the property but that did not seen to work. The basement got flooded several times.

Now, on Varnun St, I see every time it rains how Thorndike and Magnolia field get drenched with water. In the spring and summer the town needs to close the fields every time it rains which interrupts scheduled sports activities. It takes a day or two to dry out and open up.

I'm very concerned about the propose development, although very supportive of building more affordable housing in Arlington, I do not believe that the wetlands are the place to put this project. I think we need to look at our zoning laws and change it to allow more affordable housing in Arlington to bring the diversity and mixed of income that we need to have a thriving community.

However, we cannot solve one problem for the city and create another. Destroying the Mugar Wetlands will destroy an ecosystem that is allowing the City to manage flooding in East Arlington. As environmental scientist have documented well, "**Wetlands prevent flooding** by temporarily storing and slowly releasing stormwater. **Wetlands** also reduce water flow, thus allowing sediments and associated pollutants to settle out." We are so lucky to have this an East Arlington, why would we destroy it?

I hope the City of Arlington decides to protect it wetlands. With climate change we will get more rain and more flooding and if we destroy the natural environment around us that reduces the risk of flooding, we will have a bigger and more expensive problem to solve.

Thank you,

Elizabeth Gonzalez Suarez
Owner

Hello Zoning Board Members,
As a 20+ year resident and homeowner in East Arlington I'd like to voice my strong opposition to the proposed development of the open space of the Mugar site.

However, I would also like to state that I support larger developments in general, and especially those that incorporate affordable and subsidized housing. But let's focus on re-devlopment of existing built-up sites (like the ones on Broadway) rather than developing precious open-space - especially wetlands areas.

thank you,
Jamie Leef
16 Thorndike St.

To the Zoning Board of Appeals,

I have lived in Arlington for almost five years, and have lived close to the proposed development of Thorndike Place for the last two and a half years. My wife and I greatly value the quality of life in Arlington, so we have recently purchased a home close to this neighborhood (on the other side of Lake Street from where we are now).

I have serious concerns about the proposed development, especially from a transportation perspective. I am not a transportation planner by profession, but I have training in this area, and my knowledge of the subject makes me extremely skeptical of the conclusions of the traffic impact study conducted for this development. One of the key conclusions to me sounds exceedingly optimistic: "....During the weekday evening peak hour, the Project is expected to generate 33 vehicle trips (20 entering and 13 exiting)." Given that there would be 176 new housing units built, this means that there would be a person commuting to work by car **in fewer than one out of every five housing units**. I find that extremely hard to believe.

It is also important to scrutinize any assumptions made about public transit ridership returning to pre-covid levels. We simply don't know if they can return, or ever will return, especially given the proposed cuts in MBTA services. For example, when Philadelphia's commuter rail line went on strike in the 1980s, ridership stopped completely, and then took over 10 years to recover. We simply don't know what will happen with the MBTA, and approving a major development like this that relies heavily on pre-covid use of mass transit to avoid devastating impacts to traffic in the area is simply too big of a risk to take.

I would therefore urge you to have an independent expert(s) review the traffic impact study with these factors in mind.

I also urge you to consider that there are currently roughly 300 units of housing in the entire triangle between Route 2, Lake Street, and the Bike Path. This development would increase that by more than 50%. And this would be done in an area where there is simply no more room to expand road capacity. If the extremely optimistic projections for transit ridership do not materialize, there will be no way to address this problem. What will we do then--add another lane to Lake Street (and knock down 40 or 50 houses in the process)?

Traffic on Lake Street prior to the pandemic was a disaster and an embarrassment to the town. I've heard people who said they were stuck in traffic for up to half an hour just getting home from route 2 via lake street. I have been stuck in traffic myself for more than 45 minutes to make the final mile of my trip back home. The situation was untenable. Until the town finds a long-term transformative solution to address these underlying problems, ***adding any more traffic to an already unacceptable situation should simply not be considered.***

Lastly, while this project is likely to be touted as "transit oriented" for its proximity to Alewife Station, please also bear in mind that there are no shopping or entertainment destinations (or pretty much any other kind of destination) in this area that can reasonably be reached without a car. So every time one of the hundreds of new residents needs or wants to leave their home, it's a pretty sure thing they will do so in a car.

Thank you for your serious consideration of the serious potential harm that this project presents to our long-standing community and the quality of life in Arlington.

Best regards,
Joe

--

Joseph Stanford
15 White Street
Arlington, MA 02474
202-701-0632 (cell)

A public comment from a current resident and home owner residing in the town of Arlington, Massachusetts.

The Mugar Development (henceforth "Development", or "Project"):

176 Units
205 Underground parking spaces

40B Design Review Concerns:

According to the Massachusetts "Handbook: Approach to Chapter 40B Design Reviews":[1]

"... commitment to ensuring that 40B affordable housing developments adhere to high standards of site and building design that enhance the quality of life for residents and the communities in which they reside."

The handbook continues:

"This Handbook instead suggests that the site and building design, not the numerical density, determines if a development is 'generally appropriate for the site.' In some instances, a proposed development may contain more units than a site can reasonably accommodate."

The scope of the Development, as quoted from the original application submission to the Massachusetts Housing Authority in 2015:[2]

"The Project will include 12 homeownership units (3 affordable) and 207 units of rental housing (52 affordable) and will be located off of Dorothy Road in Arlington, MA (the 'Municipality' or the 'Town') on 17.814 acres (5.6 buildable acres) of land in an area currently zoned Planned Unit Development (PUD). The Project will include 6 duplex style townhouse homes and 1, four-story apartment building. A total of 304 parking spaces will be provided including 2 garage spaces for each townhouse (24 total), 178 covered spaces in the apartment podium garage, and 102 surface parking spaces."

The Development has undergone significant changes since the original 40B submission. In an updated document submitted to the Arlington Zoning Board of Appeals (ZBA) on November 3rd, 2020:[3]

1) The proposed six (6) duplex style townhouse homes have been removed altogether
2) The apartment complex has been moved to sit along Dorothy Road

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[1] https://www.mass.gov/files/documents/2017/10/16/handbook-approachtoch40b-designreviewa.pdf
[2] https://www.arlingtonma.gov/home/showpublisheddocument?id=32279
[3] https://www.arlingtonma.gov/home/showpublisheddocument?id=53976; https://www.arlingtonma.gov/home/showpublisheddocument?id=54004

3) The 207 units of rental housing have been decreased to 176
4) The 178 underground parking spaces have been increased to 205
5) The three (3) vehicular ingress and egress points have been reduced to one (1)

Using the Handbook as comparison, we'll step through some of the "Key Design Issues" as related to the Development:

1) Scale – The scale of a structure should be compatible with the surrounding architecture and landscape context.

The scale of the Development is not compatible with the surrounding architecture. Locating the structure along Route 2, similar to the Vox on Two complex, would scale the site correctly. However, in the most recent iteration, the Development resides on Dorothy Road, where the surrounding community is a mix of single, and multi-family homes.

2) Height – The height of the proposed buildings should generally be compatible with the surrounding buildings and structures.

The Development will be a three, stepping back to four-story apartment complex; larger in height than any of the existing homes in the surrounding neighborhood.

3) Proportion – The proportions of building elements can define the character of a building. The widths, heights, and separations of doors, windows, signs and other architectural elements should be generally compatible with existing buildings and structures.

The Development will be proportionally out of place in the surrounding neighborhood, which is a mix of single, and multi-family homes.

Local street concerns:

Unlike the aforementioned Vox on Two apartments, the Development would not have direct access to Lake Street, or Route 2. Instead, all residents of the 176 units would exit out via a single driveway located at the intersection of Littlejohn Street and Dorothy Street, before exiting the community through local streets onto Lake Street.

Due to complaints from neighbors on both sides of Lake Street, the town instituted "No Entry" restrictions from 7am - 9am, and 4pm - 7pm Monday through Friday for Wilson Avenue, Littlejohn Street, and Homestead Road.

In Fall of 2020, the town installed traffic calming measures on Mary Street, from Littlejohn Street to Margaret Street, as part of the "Shared Streets" pilot program.[4] Any traffic illegally turning into the community on Wilson Avenue, or Littlejohn Street, was slowed, but could continue down

[4] https://www.arlingtonma.gov/home/showpublisheddocument?id=53093

Littlejohn St. to Dorothy Rd., bypassing the Shared Street pilot, and inconveniencing the lesser trafficked Dorothy Street.

According to an Arlington ZBA meeting held on January 12, 2021,[5] the town stated that the “No Entry” restrictions would remain in place. In addition, the traffic calming measures tested on Mary Street would also continue for the foreseeable future.

Assuming that a development with the scale, height, and proportions to the existing neighborhood is built, it would include approximately 12 parking spaces. The 205 proposed underground parking spaces is a 17x increase in vehicle traffic to the neighborhood. It is unknown if any traffic calming restrictions will be implemented for vehicles entering or exiting the Development.

Flooding:

Flooding is a major concern not only in the community adjacent to the Development, but in all of East Arlington. The Mugar property is included in the “Community Resilience Building Workshop Summary of Findings & Recommendations” from the town of Arlington, May 2018.[6]

In the section “CURRENT CONCERNS & CHALLENGES PRESENTED BY HAZARDS”, the summary states: “Participants identified a variety of factors that could influence stormwater flooding in town, including geology, groundwater levels, topography, drainage systems, land use, and dam/reservoir management. They were also concerned that decisions made by private property owners, neighboring communities, and regional agencies could be worsening Arlington’s flood risks.”

Under its “TOP RECOMMENDATIONS”, the summary also states that “East Arlington is more exposed to flooding and heat hazards than any other neighborhood in Arlington. Its exposure to flooding is related to its topography and proximity to Alewife Brook and the Mystic River. Its high heat exposure is due to the density of housing and limited tree cover and pervious surfaces.”

The Development would further aggravate issues already plaguing East Arlington by removing trees, excavating large amounts of open land for an underground parking garage, installing impervious surfaces, and building upon land shown by FEMA[7] and BSC[8] to be within a floodplain, and which borders sensitive wetlands.

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[5] https://www.youtube.com/watch?v=18716bRjcb8
[6] https://www.arlingtonma.gov/home/showdocument?id=43409

[7] https://www.arlingtonma.gov/home/showdocument?id=20413
[8] https://www.arlingtonma.gov/home/showpublisheddocument?id=53974

Conclusion:

The Mugar Development, as it stands presently, will be an infrastructure and ecological disaster for East Arlington, and the neighborhood community situated around it.

The numerous changes made after the 40B application approval should be resubmitted to the Massachusetts Department of Housing and Community Development (DHCD), both for review, and for further public comment.

Sincerely, and with utmost respect to the Mugar family,
Matthew McKinnon
9 Littlejohn St., Arlington, MA

Good Evening Members of the ZBA,

My husband and two children and I live on White Street, in the neighborhood to be affected by the Thorndike Place development. I support the development because we have a housing shortage and we all have to do our part. But also, because it's an opportunity. This is Arlington's last chance to preserve its last woods, and I ask you to make that solution happen. No more playing violins on the Titanic, gentlemen. Make this developer preserve our open space.

As I see it, the Town missed the opportunity to get another Route 2 off-ramp (an onerous MassDOT process that takes a lot of collaboration), instead burning bridges and huge amounts of my money on futile legal battles. Traffic is going to be terrible in our neighborhood. That's how it is. But we - YOU - can still help achieve a win: publicly-accessible, eco-friendly, adequately-funded open space. If in five years we have 179 new units, terrible traffic AND a huge fence? That will be some legacy.

Please help us control what we still can, and preserve this rare natural space. Please find a way to work with this developer to create a public, woodland park that will be an asset to Arlington.

Sincerely, a neighbor and constituent,

Michelle Shortsleeve

Town of Arlington, Massachusetts

Thorndike Place - Previous Correspondence Received

ATTACHMENTS:

Type	File Name	Description
Reference Material	M_McCabe_letter_12-2-20.pdf	M McCabe letter 12-2-20
Reference Material	S_Dominguez_letter.pdf	S Dominguez letter
Reference Material	B_Barton_letter_11-28-20.pdf	B Barton letter 11-28-20
Reference Material	E_Brown_letter_11-25-20.pdf	E Brown letter 11-25-20
Reference Material	L_Krupp_11-25-20.pdf	L Krupp letter 11-25-20
Reference Material	N_Dangle_letter_12-3-20.pdf	N Dangle letter 12-3-20
Reference Material	ACC_Comments_at_ZBA_Hearing_Thorndike_Place_08DEC2020_Chapnick.pdf	ACC Comments at ZBA Hearing Thorndike Place_12-8-20 Chapnick
Reference Material	MugarWaterIssues12-6-20.pdf	MugarWaterIssues12-6-20
Reference Material	MugarTrafficIssuesAmmended12-6-20.pdf	MugarTrafficIssuesAmmended12-6-20
Reference Material	Letter_to_ZBA_Thorndike_Place_November_2020.pdf	P Fiore letter 11-2020
Reference Material	Mugar_site_AU-B9_1983.pdf	Fiore Mugar site 1983(1)
Reference Material	Mugar_site_CS-1_1983.pdf	Fiore Mugar site 1983
Photograph / Image	008_Deer_58_Mott.JPG	Fiore Deer 58 Mott(1)
Photograph / Image	009_Deer_58_Mott.JPG	Fiore Deer 58 Mott
Photograph / Image	263_Mugar_turkeys.JPG	Fiore Mugar turkeys
Photograph / Image	DSCN0510.JPG	Fiore DSCN0510
Photograph / Image	759_Mugar_fox.JPG	Fiore Mugar fox
Photograph / Image	Deer_drinking_water_58_Mott_St.jpg	Fiore Deer drinking water 58 Mott St
Photograph / Image	DSCN0461.JPG	Fiore DSCN0461
Photograph / Image	DSCN0490.JPG	Fiore DSCN0490
Photograph / Image	DSCN0517.JPG	Fiore DSCN0517
Photograph / Image	DSCN0648.JPG	Fiore DSCN0648
Photograph / Image	DSCN0594.JPG	Fiore DSCN0594
Photograph / Image	DSCN0844.JPG	P Fiore DSCN0844
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🗋	Photograph / Image	DSCN0924.JPG	P Fiore DSCN0924
🗋	Photograph / Image	DSCN0944.JPG	P Fiore DSCN0944
🗋	Reference Material	M_Shapiro_letter_10-13-20.pdf	M Shapiro letter 10-13-20
🗋	Reference Material	A_Lenk_letter_12-26-20.pdf	A Lenk letter 12-26-20
🗋	Reference Material	L_Culverhouse_12-22-20.pdf	L Culverhouse 12-22-20

Conservation Commission,

According to floodplain management the purpose is to protect human life and health, **minimize property damage, protect unwittingly buying land subject to flood hazards, to protect water supply, sanitary sewage disposal and natural drainage.** The prevention of unwise development in areas subject to flooding will reduce financial burdens to the **community** and the State, and will prevent future displacement and suffering of its residents.
According to the Flood Disaster Protection Act of 1973 EXIT (Public Law 93-234, 87 Star. 975), in order avoid to the extent possible the long and short term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct or indirect support of floodplain development wherever there is a practicable alternative, it is hereby ordered as follows:
In carrying out the activities described in Section 1 of this order, each agency has a responsibility to evaluate the potential effects of any actions it may take in a floodplain; to ensure that its planning programs and budget requests reflect considerations of flood hazard and floodplain management; and to prescribe procedures the policies and requirements of this Order, as follows:

(b) If, after compliance with the requirements of this Order, new construction of structures or facilities are to be located in a floodplain, accepted flood proofing and other flood protection measures shall be applied to **new construction** or rehabilitation. To achieve flood protection, agencies shall, wherever practicable, elevate structures (not to include underground parking) above the base flood level rather than filling in land.

The development of the Mugar site will extend the existing floodplain into the neighborhoods leading to a decrease in property value and possible destruction to the surrounding properties.

I have confidence in the Conservation Commission that these facts will be taken into consideration when making any decisions to development of the Mugar property.

Thank you,
Mark W. McCabe
4 Dorothy Road
Arlington, MA 02474

Hello

There is nothing more important than leaving wetlands alone under the current and near future context of climate change. Its time for towns to stop listening to developers when it comes to avoiding massive flooding of our homes. Please stop this an any development in this limited and struggling to survive parcel.

Nothing these developers can do to alter the fact that the wetlands need to be protected.

Silvia Dominguez
Town Meeting member District 4.

Dear ZBA members,

As a resident at 27 Burch Street, I am writing to ask that in your review of the new documents submitted by the Oaktree development, that you ensure that you take into account the important questions raised by the Arlington Town Trust in their review and to share my confidence and expectation that you will hold the developer to full compliance with the local Wetland Protection Bylaw and regulations pertaining to stormwater and flood zones by denying waiver of these requirements.

As an environmental professional and local resident, I would emphasize the significant degrees of warming we are locked into in the decades ahead due to historical global carbon emissions, which will put a premium on the value of our natural and constructed green infrastructure (wetlands, permeable pavements) in protecting our community from the full range of flooding risks we face.

Thank you for your diligence and support on this review.

Sincerely,
Brooke Barton
27 Burch Street, Arlington, MA 02474
VP, Innovation & Evaluation, Ceres

To: The Honorable Members of the Zoning Board of Appeals, Town of Arlington,

First let me thankyou for your dedicated service to the town of Arlington and its citizens. Your continued focused efforts on this and all the important topics before the board is very important and I applaud you.

My comment on the proposed project called "Thorndike Place" is based on and informed by over three decades of development & construction project experience in the healthcare sector where I have experienced numerous, similar challenges with projects not unlike the one before you in both Massachusetts and Connecticut

In short, my expectation is that the Zoning Board of Appeals hold the developer to full compliance with the local Wetlands Protection Bylaw and regulations pertaining to stormwater and flood zones by denying any waivers of these requirements, as the regulations are to protect critical resources and public safety, and should be fully enforced.

Sincerely and Respectfully Submitted

Ed

Edward M. Browne
49 Mary Street
Arlington, Ma
M: 617-849-2145

Hi,

Larry Krupp here, listened in on last night's discussion re posting website content. Strongly suggest you consider a sort-able table or more than one. E.g., each document or public comment is a separate row, with columns such as Title, Date, Submitter, Type, Whether Controlling, and Full Text (or link to it). This gives different people the ability to see the data their own way; e.g., someone might want to see just what's new in the last week - so they can click and sort by date. Others might want to see all items of a particular type (e.g., Public Comments) so they click that column. Etc.

I work with this kind of stuff a lot, and listening to your conversation last night this immediately came to mind.

Done the right way it can be easy to manage/update and provide the public with a lot more of what they want.

My 2 cents,

- Larry

Hello,

Adding my name to the opposition for this build out. The wetlands are needed more than ever.

Thank you.

Nancie Dangel
4-B Sargent Street
Cambridge, MA 02140

Comments Summarized from the Arlington Conservation Commission

as given by Susan Chapnick, Chair

ZBA Hearing Dec. 8, 2020

Thank you, Chairman Klein, for the opportunity to summarize the Arlington Conservation Commission's comments from our fourth set of written comments on the Thorndike Place submittals – by letter dated Nov. 20, 2020 and from the Working Session held at the Conservation Commission's public meeting of Dec 3rd, where BSC Group and BETA Group (Town's peer review consultant) discussed the supplemental materials presented by the Applicant in November (as presented tonight).

The purpose of the Working Session was informational and to define next steps.

The ACC is pleased that the supplemental materials were responsive to many of our prior comments, however an important requirement of the ACC's wetland regulation to protect the ability of the 100-year floodplain to hold flood waters has not been fully addressed, as was discussed and will be summarized tonight.

In addition to those issues specifically discussed at the Working Session, I want to stress that the ACC's prior comments concerning the value of the wetland resources, vegetation replacement, floodplain, and stormwater impacts are still valid. I will summarize issues discussed at the Working Session as well as some others and recommend next steps.

Issue #1. Wetlands Delineation
ACC understands that BETA Group has performed a review of BSC's wetland boundary delineations and has agreed with the updated delineation. However, the Conservation Commission does not yet agree with the conclusion of BSC and BETA that the 2 Isolated Vegetated Wetlands no longer exist on the site. BETA's review does not appear to be based on any examination of the soils at the site. The Commission agrees with the Town Engineer's observation that the potential for the existence of the 2 isolated wetlands has not be adequately evaluated.

Recommendation:

- ***Perform soil investigation to evaluate the potential for Isolated Vegetated Wetlands in the northeast disturbed portion of the site, consistent with 310 CMR 10:55(2)(c)3 and Arlington Wetland Regs Section 21.B.(3)(c).*** BETA concurred at our Working Session.

These regulations say that "Where an area has been disturbed (e.g., by cutting, filling, or cultivation), the boundary is the line within which there are indicators of saturated or inundated conditions sufficient to support a predominance of wetland indicator plants, or credible evidence from a competent source that the area supported, or would support under undisturbed conditions, a predominance of wetland indicator plants prior to the disturbance or characteristic of hydric soils."

Issue #2. Floodplain & Compensatory Flood Storage
ACC understands that BETA Group has found that the flood storage volume lost and compensatory flood storage proposed are consistent.

ACC finds the 2:1 compensatory flood storage proposed consistent with Town Bylaw and Regulations.

Recommendations:

- ***Require that the applicant provide plans for floodplain restoration for the proposed compensatory flood storage area, compliant with the Vegetation Removal and Replacement Section 24 of the Arlington Wetland Regulations.***

- ***Review existing FEMA Floodplain line.*** The ACC included this in our comment letter of July 9th; however, it has not been addressed by BSC or BETA but was brought up in Public Comment of the Working Session last week. The existing FEMA mapping is 10 years old and likely not based on the Cornell dataset (as required in our Wetland Regulations). When the Commission has valid documentation or compelling evidence suggesting that the FEMA floodplain and base flood elevation is not accurate, it can require an Applicant to re-delineate the floodplain line. Reference the Arlington Wetland Regulations Section 23.B(1)(c)ii:

"Notwithstanding the foregoing, where National Flood Insurance Program (NFIP) profile data [FEMA Floodplain line] is unavailable or determined by the Commission to be outdated, inaccurate or not reflecting current conditions, the boundary of bordering land subject to flooding shall be the maximum lateral extent of floodwater which has been observed or recorded or the Commission may require the applicant to determine the boundary of Bordering Land Subject to Flooding by engineering calculations which shall be…" [continues with specific requirements, including use of Cornell precipitation data]

- ***Require that climate change impacts be evaluated in consideration of the requirements of the "Limited environmental impact" review criteria specified in the ZBA Comprehensive Permit Regulations (adopted 7/08/2015) Section 6.2 & 6.3*** – specifically, how the development demonstrates that it will "improve water quality, control flooding, maintain ecological diversity, promote adaptation to climate changes." The ACC recommends using data available for Arlington in the Massachusetts Coastal Flood Risk Model (MC-FRM, communication from Woods Hole Group) and information generated by Cambridge's Climate Change Vulnerability Assessment - *considering that the base flood elevation/extent of flooding in the area is projected to rise in the coming decades.*

Issue #3. Stormwater Management

ACC understands that BETA Group reviewed the efficacy of the stormwater management design presented by BSC and has enumerated several concerns. We have further recommendations for the design of the stormwater management system.

Recommendations:

- ***Require the use, in the stormwater modeling, of minimum standards now recommended by the MassDEP Stormwater Advisory Committee and the Town of Arlington proposed Stormwater requirements including the use of "NOAA Plus" precipitation data, 90% TSS removal, and revised recharge guidance.*** While ACC is aware that formal revisions to MassDEP regulations will not occur until next spring 2021, these stormwater standards will be in effect prior to the proposed project construction and, furthermore, it is within the spirit of the State Executive Order 569, State Hazard Mitigation and Climate Adaption Plan, and Arlington's Comprehensive Permit Regulations to conservatively design a stormwater management system so that *climate change and hazard mitigation are taken into account.*

- ***Require verification of existing groundwater elevations based on test-pit data.*** BETA concurred at our Working Session.

Issue #4. Evaluation of Wildlife Habitat & Vegetation
BSC provided a comprehensive Wildlife Habitat and Vegetation Evaluation report supported with field survey notes, as requested by the ACC.

Recommendation:

- ***Require the Applicant to quantify the numbers and types of trees (including species and DBH) that will be removed during construction in the AURA and impacted in the floodplain and provide a vegetation replacement planting plan as mitigation for loss of canopy, wildlife habitat, and climate change resilience attributes.*** This type of tally is required by Section 24 of the Arlington Wetlands Regulations on Vegetation Replacement.

Issue #5. Conservation Restriction for Undeveloped Lands of the Mugar Parcel

Recommendation:

- ***Propose an appropriate conservation and stewardship mechanism for the undeveloped portions of the site as a condition of the permit.*** ACC recommends that the ZBA work with the ACC, the Arlington Land Trust, the Arlington Open Space Committee and other Town officials to develop an appropriate conservation and stewardship mechanism similar to the Symmes Conservation areas that are protected resource areas under the Town Bylaw and implementing Wetlands regulations. This mechanism should include funding considerations.

December 6, 2020

Zoning Board of Appeals
Town of Arlington
51 Grove Street
Arlington, MA 02476

RE: **Water Issues – Mugar Property - Thorndike Place Development**

Dear Zoning Board of Appeals Members:

I am writing in regard to the proposed Thorndike Place development. The changes generated by this proposed project would have a devastating impact on the neighborhood. There are three major issues:

- Removal of trees
- Sewage system limitations
- Stormwater management

As everyone should be aware, the neighborhood where this proposed project is located has major issues with water, particularly with a high groundwater level and subsequent basement flooding, and developing this project will only make them worse. When it rains a lot, the water table rises and impacts basements in the area. In many areas, the groundwater rises to the surface and ponds.

Trees help lower the water table by drinking up groundwater. Removing trees will impact the groundwater level in the area. Replacing trees with impermeable surface will further reduce the area that can act as a sponge and soak up water. Trees also take carbon dioxide, a greenhouse gas out of the air and help efforts to fight global warming. In addition, trees provide cooling and help mitigate the urban heat effect, reducing the energy use for cooling in the summer. We need to do everything we can to combat climate change which has known negative impacts to this area due to storms with increased rainfall and subsequent flooding. Lastly, trees provide much needed habitat for animals and birds and should be preserved.

The proposed project will add a significant amount of sewage to the system in the area. The system relies on gravity to work properly. Much of the piping is in contact with the groundwater, particularly when it rains a lot and the groundwater level rises. Unfortunately, this old piping has leaks and allows groundwater to infiltrate. During the big storms of October 1996 and March 2010, sewage was bubbling up out of the manhole in Margaret Street at the entrance to Thorndike Field (it is labeled as sewer not stormwater). There are serious questions about the capacity of the sewage system to safely handle the significantly increased flow the proposed project will generate.

Stormwater management is of the greatest concern. The stormwater management and compensatory system must be designed using the current industry-standard which is the100-year rainfall amount supplied by NOAA or Cornell. **Using old rainfall data published in 1961**

(Technical Paper 40) is unacceptable and morally wrong. Scientists and lay-persons alike know that climate change has increased the frequency and intensity of high-rainfall events since the pre-1960 years, and are only going to increase further as climate change continues. The system must at least be able to handle the amount of rainfall that professional and ethical stormwater management engineers use – the NOAA or Cornell data sets – and provide adequate compensatory storage. There are other negative impacts associated with the proposed project, including:

- Retention ponds will raise the groundwater level around them (mounding) and impact homes located in close proximity.
- All outlets from stormwater management structures must be located far away from nearby homes because the groundwater level will be raised locally around the outlet.
- Any below ground level areas of the proposed building will be in contact with the groundwater, particularly when it rises during and after storm events. This will interfere with groundwater flow, creating a barrier and raising the groundwater level upgradient, increasing basement flooding of nearby homes.
- **Over time, initially tight construction will develop cracks and the groundwater will enter below-ground stormwater management structures rendering them ineffective.** In addition, they will interfere with groundwater flow as discussed in the prior bullet.

Bottom line – given the existing high groundwater level in the neighborhood, particularly during and after storm events, the project will have devastating impacts on the neighborhood. Please do not allow it. Please contact me with any questions or for additional information.

Sincerely,

Jennifer Griffith
4 Edith Street
Arlington, MA 02474

December 6, 2020

Zoning Board of Appeals
Town of Arlington
51 Grove Street
Arlington, MA 02476

RE: **Amend My September 2020 Letter on Traffic Issues – Mugar Property - Thorndike Place Development**

Dear Zoning Board of Appeals Members:

I am writing to update my earlier letter, dated September 21, 2020 in regard to traffic issues related to the proposed Thorndike Place development to reflect the changes in design submitted since then. In my earlier letter I outlined two major issues:

- Pedestrians walking to Alewife and soccer fields
- Turning left onto Lake Street to access Route 2/Belmont

The updated project design as currently proposed largely alleviates the safety concerns related to how the neighborhood is used for parking during the week for commuters accessing the Alewife T station and on weekends in the Spring and Fall by families for soccer games in Thorndike and Magnolia Fields. Most of this parking and resulting pedestrian traffic is in the Burch, Edith, Margaret, and Osborne Street areas and the portion of Dorothy Road between Parker and Margaret Streets, and the current design does not bring traffic in or out through this area any longer.

However, the other concern – turning left onto Lake Street to access Route 2 and Belmont is still valid. In normal times, as everyone is aware, the traffic on Lake Street heading towards Massachusetts Avenue is backed-up for hours both in the morning and in the evening. Leaving the neighborhood to access Route 2, the Alewife area, and Boston and other areas via Belmont, is treacherous. The cars on Lake Street are basically parked. There are NO sightlines for cars that need to turn left out of the neighborhood. Cars on Lake Street block the intersections so it can take time for someone to leave space to get out. And then you cannot see if anyone is coming from the right. After their frustration with the back-ups at the Brooks Avenue traffic light and the bike path, once "released" cars are traveling Lake Street at speed. Turning left out of the neighborhood is treacherous enough and takes enough time as it is. **Adding a significant number of additional cars to this situation is extremely dangerous** and will cause a significant line of back-ups in the neighborhood**. A new traffic light will be needed on Lake Street at the intersection with Little John Street** to let all these additional cars from the proposed project out of the neighborhood safely.

Bottom line – adding more cars into the neighborhood is unacceptably dangerous. Please do not allow it. Please contact me with any questions or for additional information.

Sincerely,

Jennifer Griffith
4 Edith Street
Arlington, MA 02474

Mr. Christian Klein November 23, 2020

Chair, Zoning Board of Appeals

Arlington, MA 02474

Dear Mr. Klein,

Most of my life has been spent living in a home that abuts the Mugar property. I was attending Hardy School in 1970 when Town Meeting zoned the Mugar Property for Planned Unit Development. My family's name is mentioned as one of the abutters in Warrant Article 99 that year. I write you now about the latest proposal by the Mugar family: Thorndike Place.

I stand in solidarity with my neighbors concerns regarding the future overcrowding at Hardy School, the increased vehicle traffic, the increased likelihood of neighborhood flooding, rodents, and increased strain on municipal services.

In this letter I choose to focus on the areas designated CS – 1 and AU – B9 in the BSC Group <u>Wildlife Habitat and Vegetation Evaluation</u> of November 2020. These are areas of proposed parking lots.

I have observed these loci from my kitchen window and backyard for decades. I witnessed the individual in his green vest doing the evaluation out behind my house approximately 9:00 A.M. on Tuesday, October 27th. However, a report based on one day of surveying cannot do this area justice.

As recently as Monday November 9th at 7:30 A.M. there were three deer in my backyard. I attached a photo of one drinking water from the bird bath I have out back on the lawn. I attached another photo from earlier in the summer of a deer eating mulberries off the ground as do many species of birds and other wildlife from the Mugar property when the berries ripen. These deer have been coming for several years now and I watch them come out from the Mugar property and disappear back into it in the areas of CS-1 and AU-B9.

There are numerous species of what might be considered garden variety birds and animals that go in and out of the property. I have attached photos of some of them. I do not have photos of owls and hawks, but I have seen them in the trees out there. Fireflies have returned in the evenings at the edge of my backyard where it meets the Mugar property.

While I have photographed a fox and seen a coyote, they have not been problems and no doubt are feeding on rodents. If there is destruction of their habitat and they are driven out the rodent problem will no doubt go from bad to worse and possibly require the use of poison and the risk that poses to raptors and other wildlife.

It is to the Mugar's credit that through their passive management of the property they have allowed the area of CS-1 and AU-B9 to become forested. The trees there are soaking up groundwater and cleaning the air of CO2. Cleaning the air of CO2 is probably particularly helpful given the proximity of Route 2 and the volume of traffic on it. It would be a shame to clear cut this area for parking lots and destroy wildlife habitat decades in the making and increase the likelihood of additional neighborhood flooding.

This is an area that would seem to be of future use by students of biology and ecology in the Arlington Public Schools if conserved.

As for the parking lots, if the tenants of the development want the benefit of parking, they should shoulder the burden of it. The parking lots should be immediately adjacent to the development. To put their parking lots in the neighbors back yards requires the clear cutting of trees that consequently destroys privacy. The parking lots and the associated 24/7 noise, exhaust, and traffic in the lots will lead to permanent loss of neighbor's quiet enjoyment of their property. It also is likely that plows, sanders, dumpsters, and other maintenance equipment needed to maintain the parking lots and the development itself would be stored in these lots.

I have also attached photos from 1983, pre-forestation, to demonstrate the prevalence of water in the area. The first photo of the rear of two homes and the water in the foreground is the area of CS-1. In other photos those of us of vintage age will remember the large Faces nightclub sign across Route 2. This dry summer is an exception.

These two areas, CS-1 and AU-B9, provide habitat for wildlife, trees that soak up ground water and clean the air of CO2, and act as a buffer for the neighbors from the property. They should be preserved for such.

Thank You for your consideration.

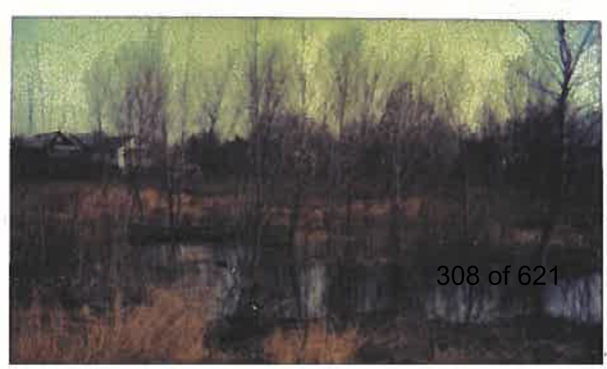
Sincerely, Peter Fiore, 58 Mott Street, Arlington, MA 02474

2

3

5

6



3/2/83 A.M
various
places on
the Mugar
Site

4

Dear Town of Arlington Zoning Board of Appeals and Conservation Commission,

For almost 13 years now, I have been a resident of the neighborhood directly impacted by the development of the Mugar Wetlands/property which the hopeful developers call "Thorndike Place."

I was very surprised at the October 1, 2020 meeting of the Conservation Commission to learn that the developers have intended to greatly decrease the size of the development, but I am still very concerned about the overall size and scope of the project.

First, I still object that this project as only a 40b project in name--as a social worker who helps many individuals with the complex task of securing truly affordable housing, I can assure you 20% of units made "affordable" or below market rate, for just 20 years, is NOT true affordable housing.

Second, is the developer really allowed to pull a "bait and switch" where the building is much smaller with less impact (on paper)? As I understand it, the flood plain study was conducted by the developer in winter during a drought, and the independent company who was supposed to verify this mapping was not given the information as of the October 1, 2020 meeting of the Conservation Commission to do so. Please assure me they are not allowed to forge ahead without this important step.

In addition, I can assure you, given the minimal plans presented at last month's Conservation Commission meeting, the building is still way too big for the area. The new October 2020 proposal is three stories along Dorothy Road, and four to five stories as it goes back into the woods? The houses in that area are MUCH smaller than that.

I invite you to come and take a walk with me along the proposed length of Dorothy Road, and see how large the proposed apartment building would look right along the road. It is still WAY too big for that area, and although I am not an engineer, I can tell you a full underground parking garage in that area, official flood plain or not, is just going to cause more flooding in the surrounding houses and streets.

And twenty to thirty units??? Once again, unless they are ALL affordable apartments (30% of someone's income, with income guidelines, to follow as well), it is really not true affordable housing, and not really helping the community out, in addition to just being too large for that part of the neighborhood. The new proposed single building is still too big for the marked area out of the flood plain delineated by the developers. I am also very concerned about the process of building a very large underground parking garage, and the damage that the process of building it will cause to the houses in the neighborhood.

If the developers really want to build multiple units, and make a lot of money, which is of course why they are developing land known as wetlands at all, why don't they just build the six to seven townhouses, with two units each, as was part of the original plan, leaving out the building behind it? Each of the twelve to fourteen units would sell for about a million dollars each, and fine, the developers would make some money, but the houses would at least be within the scope of the existing neighborhood.

I also hope you ensure that the continued and ongoing review of the wetlands is thorough and accurate, and includes investigation of whether they have been been altered or covered by dumping or filling during the site's decades of neglect. Please don't take the developers at their word that they have done their "due diligence" and continue to monitor and assess what they are telling you. From the newest proposed building, it is clear to me that money is the most important issue to the owners of this land, NOT making affordable housing NOR protecting our dwindling natural environment, let alone take care of a property that has essentially been abandoned for many years with little care or concern for prior dumping or filling.

Thank you for reading my comments, and please feel free to contact me further if you would like to discuss true affordable housing issues, or tour the neighborhood with me. I am passionate about this project, because I care deeply about the area in which I live, the environment, my neighbors, and low income housing and their residents.

Regards,

Marci Shapiro Ide
152 Lake Street
Arlington, MA 02474

Windows User

W i n d o w s   U s e r   M i c r o s o f t
W o r d

Dear Members of the Arlington Zoning Board of Appeals,

I hope that you and your loved ones are able to find joy during these "unprecedented" times - that's a term we'll all be glad to leave behind in better days ahead!
I'm writing to ask that you please do whatever is in your power to preserve the Mugar Wetlands. As you're already aware, this unique area provides myriad benefits to its surroundings. The Mugar Wetlands provides crucial open space, including old growth trees that absorb water flow coming down from Arlington Heights, gradually releasing it to avoid catastrophic flooding in this dense residential area. In addition, the Mugar Wetlands provides critical habitat for wildlife, perhaps some who had to flee the Silver Maple Forest when tragically, a large area was cleared to make way for "The Royale" development - certainly an ironic name given that the developer manipulated 40B/Affordable Housing guidelines to obtain his permit after a decade-long battle with citizens, including myself, who fought to save this rare urban wild, for parallel reasons that the Mugar Wetlands should also be saved.
As a former member of the Coalition to Preserve the Silver Maple Forest/Belmont Uplands, I beg you not to acquiesce to pressure/s in this matter. We ALL want/need an increase in affordable housing in the Arlington/Belmont/Cambridge area but, for myriad reasons, the Mugar Wetlands is a totally inappropriate location to address this need.

Thank you for your consideration,

Allison V. Lenk
(Belmont resident on Cambridge/Arlington line)

I can't tell you how concerned I am about the proposed housing development for the Mugar wetlands. There are so many reasons why this is a really bad idea. The building of luxury apartments even if there are a smattering of affordable units will increase the price of housing in that part of town and make living in Arlington that much more out of reach for middle and low income households. This goes against our stated goal of creating more affordable housing and will make it that much more difficult to reach the state mandated goal of 10%.
Equally as troubling is the concern for local residents of the increased risk of flooding. We know this will happen so how can we move forward with a plan that places residents' homes at risk.
And for me the most troubling is that at a time when urbanization is removing animal habitats and wild areas that we need in order to protect our planet and ecosystem we are considering killing a whole habitat. The animals that live in this area help manage the rodent population and by decimating it I can guarantee that our rodent problem will increase and then we will all be left scratching our heads and wondering what happened. When you remove natural predators that is what happens. Knowing this, how can you in good conscience allow this project to go forward. The pursuit of profit and the pursuit of affordable housing do not go hand in hand. We need to be focusing on creating additional affordable units before more market priced units. And we need to be inviting non profit developers to help us with that.
Please do the right thing. Mugar can find plenty of other places to increase their profits but not on our wetlands and not at the expense of our low income residents.
Thank you for your consideration.
Lynette Culverhouse
TMM precinct 11

Town of Arlington, Massachusetts

Thorndike Place - New Documents

ATTACHMENTS:

	Type	File Name	Description
🗋	Reference Material	TAC_Comment_Letter_21_0106.pdf	TAC_Comment_Letter_21_0106
🗋	Reference Material	VAI_Appendix_to_DPCD_Letter_(21_0115).pdf	VAI_Appendix_to_DPCD_Letter_(21_0115)
🗋	Reference Material	VAI_Letter_to_DPCD_(21_0115)_(1).pdf	VAI_Letter_to_DPCD_(21_0115) (1)

Arlington Transportation Advisory Committee

Date: January 6, 2021.
To: Arlington Zoning Board of Appeal.
From: TAC Executive Committee.
Subject: Review of Thorndike Place Traffic Impact Assessment

Memorandum

At the request of Jenny Raitt, Director of the Department of Planning and Community Development, the TAC Executive Committee has reviewed the Traffic Impact Assessment (TIA) for the proposed Thorndike Place development, dated November 2020, the December 1, 2020 Beta review of that TIA, and other documents. The comments presented below have not been reviewed or approved by the full TAC membership.

1. The TAC Executive Committee concurs with the findings, comments, and recommendations of the Beta review except as noted below:

    a. The proponent should consider providing subsidized MBTA passes in the proposed TDM program.
    b. The project proposes an average of 1.3 parking spaces per unit which the Executive Committee believes is too high for a transit-oriented development (TOD). The Committee recommends the Board of Appeals reduce the required number of spaces as allowed by the Zoning Code. A maximum of one space per unit is more appropriate for a TOD. This would be consistent with the findings in the MAPC Perfect Fit Parking for metro Boston (Arlington was included in the report).
    c. Vox on 2 is approximately 0.5 mile from the Alewife Station whereas the proposed development is 0.8 miles from the station. Should the vehicle mode share be increased to reflect that the proposed project is farther from the station than Vox on 2?
    d. Add to Beta comment T20 that the dramatic level of service (LOS) improvements on Lake Street EB at Brooks Avenue do not seem correct. The TIA shows LOS improves from E to A in the AM and from D to A in the PM. Previous analyses of the then proposed Lake Street signals did not yield such dramatic improvements in LOS
    e. Table 7 of the TIA should be expanded to include traffic volumes and percentage increases on Lake St. between Littlejohn Street and Route 2, and between Margaret Street and Brooks Ave.
    f. The operations analysis should be expanded to include a discussion of queueing on Lake Street at the bikeway and at Brooks Avenue.
    g. Consideration should be given to locating the proposed Bluebikes station farther to the west near the west end of the Thorndike Field parking lot.
    h. In T15 include changes in student attendance at the Hardy School in the review of 2020 volumes.

2. In addition to the requests and comments above, the Executive Committee believes the answers to the following Beta comments are critically important:

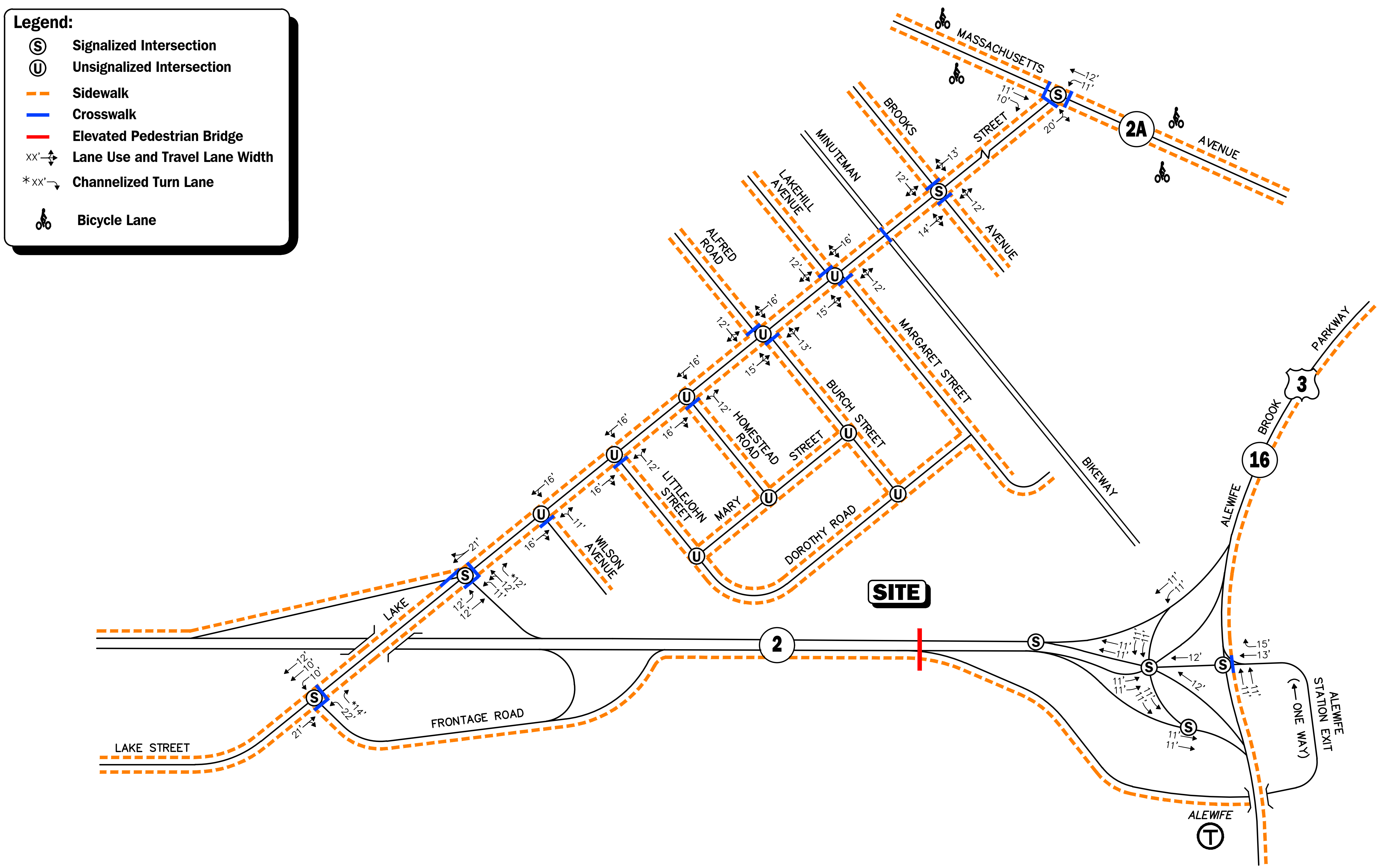
   a. T32. Existing signed turning restrictions exist from 7-9 AM and from 4-7 PM on weekdays from Lake Street onto Wilson Avenue, Littlejohn Street, and Homestead Road *(Note: The Beta review incorrectly indicates there is also a turn restriction on Burch Street).* Assess the impact of this restriction and clarify whether discontinuance of this restriction is proposed.
   b. T41. Quantify and analyze the effect of construction on the Dorothy Road neighborhood. It is expected that the earthwork required for the site will result in a significant number of trips for large dump trucks, in addition to other construction vehicles related to the grading and construction of the Site building. Verify turning path of large construction vehicles at affected intersections within the neighborhood and to/from Lake Street
   c. T42. Provide additional commentary on the impact of the Project on the Dorothy Road neighborhood, including summarizing expected increases in daily and peak hourly traffic on Littlejohn Street, Dorothy Road, Burch Street and Margaret Street.
      The Executive Committee believes the traffic impacts on Littlejohn Street, Dorothy Street and Burch Street may result in a significant percentage increase in neighborhood traffic volumes. This is a quality-of-life issue rather than a roadway capacity issue. The Executive Committee recommends a post-development monitoring study be included in the TDM program. The study may identify traffic calming measures which are needed to mitigate impacts on the neighborhood streets.

TAC Executive Committee:
Howard Muise, Chair.
Jeff Maxtutis, Vice Chair.
Shoji Takahashi, Secretary.
Dan Amstutz, Senior Transportation Planner, DPCD.

APPENDIX

REVISED TRAFFIC VOLUME NETWORKS
LAKE STREET AT BROOKS AVENUE TRAFFIC COUNTS
PEDESTRIAN/BICYCLE COVID ADJUSTMENT CALCULATIONS
K-FACTOR CALCULATION
VEHICLE OCCUPANCY RATE
MODE SPLIT DATA
PEDESTRIAN PATH TO ALEWIFE STATION FIGURE
CAPACITY ANALYSIS

REVISED TRAFFIC VOLUME NETWORKS



Note: Imbalances exist due to numerous curb cuts and side streets that are not shown.

Not To Scale

Figure 2R

Existing Intersection Lane Use, Travel Lane Width, and Pedestrian Facilities

Vanasse & Associates inc

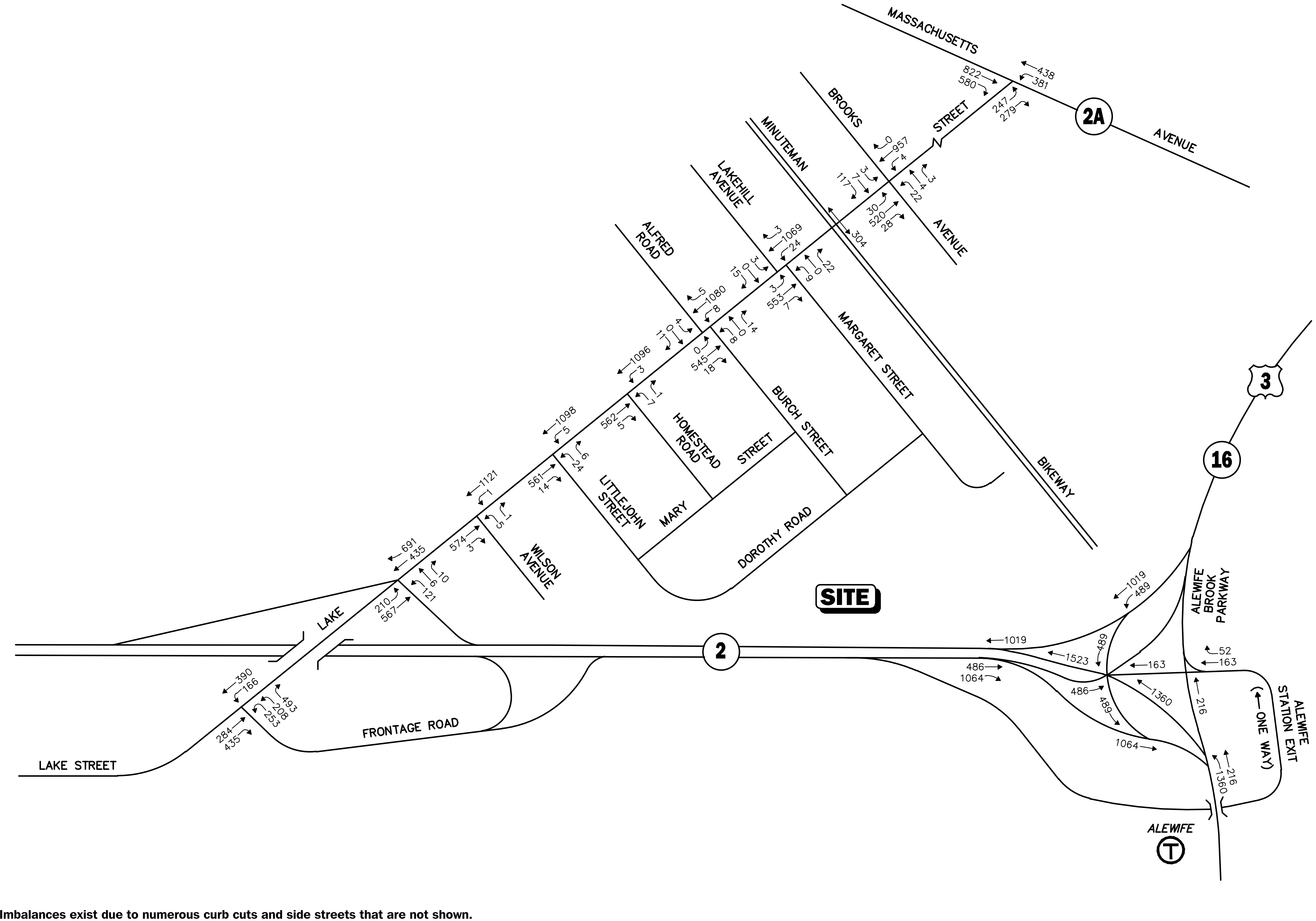
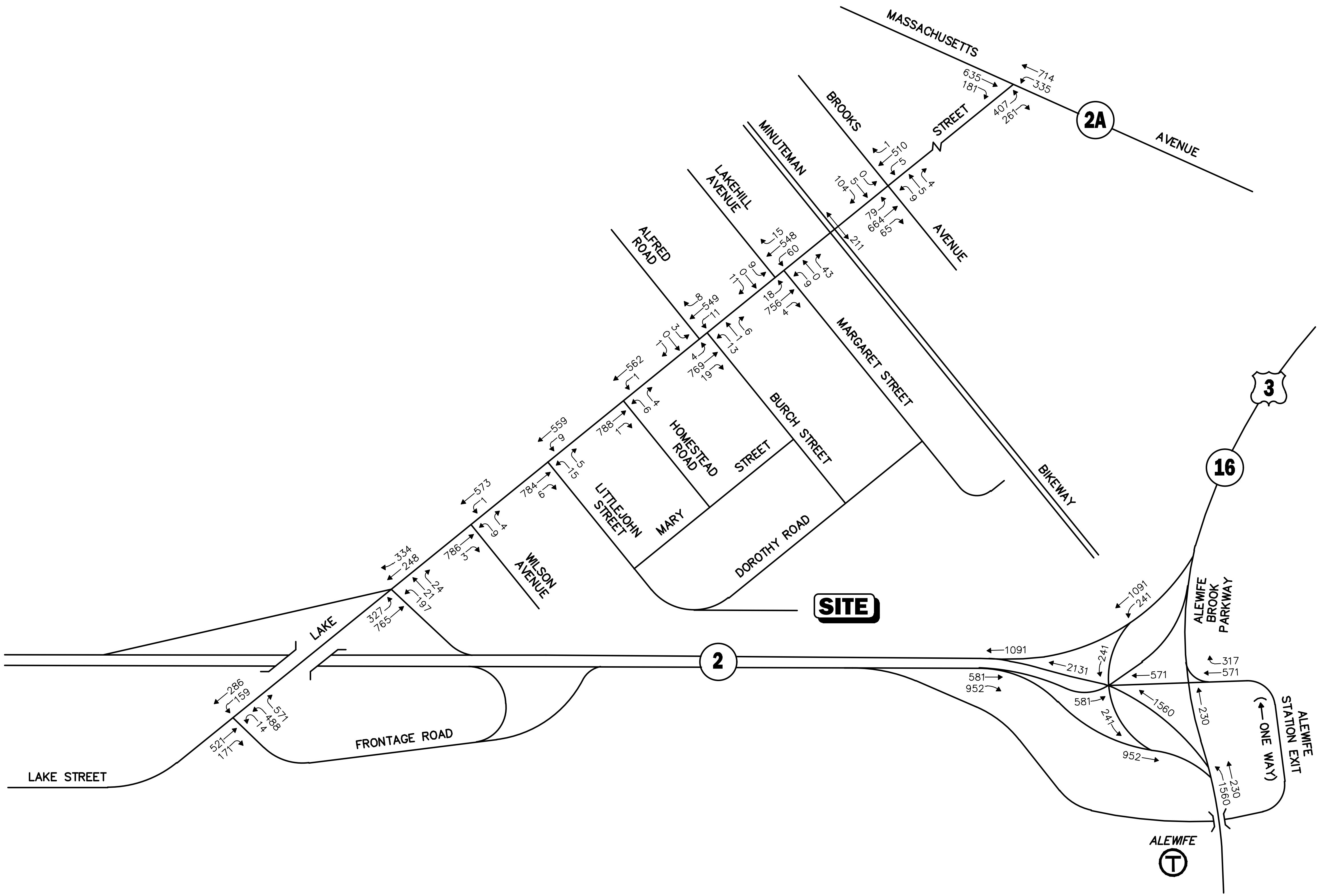


Figure 3R

2020 Baseline Weekday Morning Peak Hour Traffic Volumes

Vanasse & Associates inc



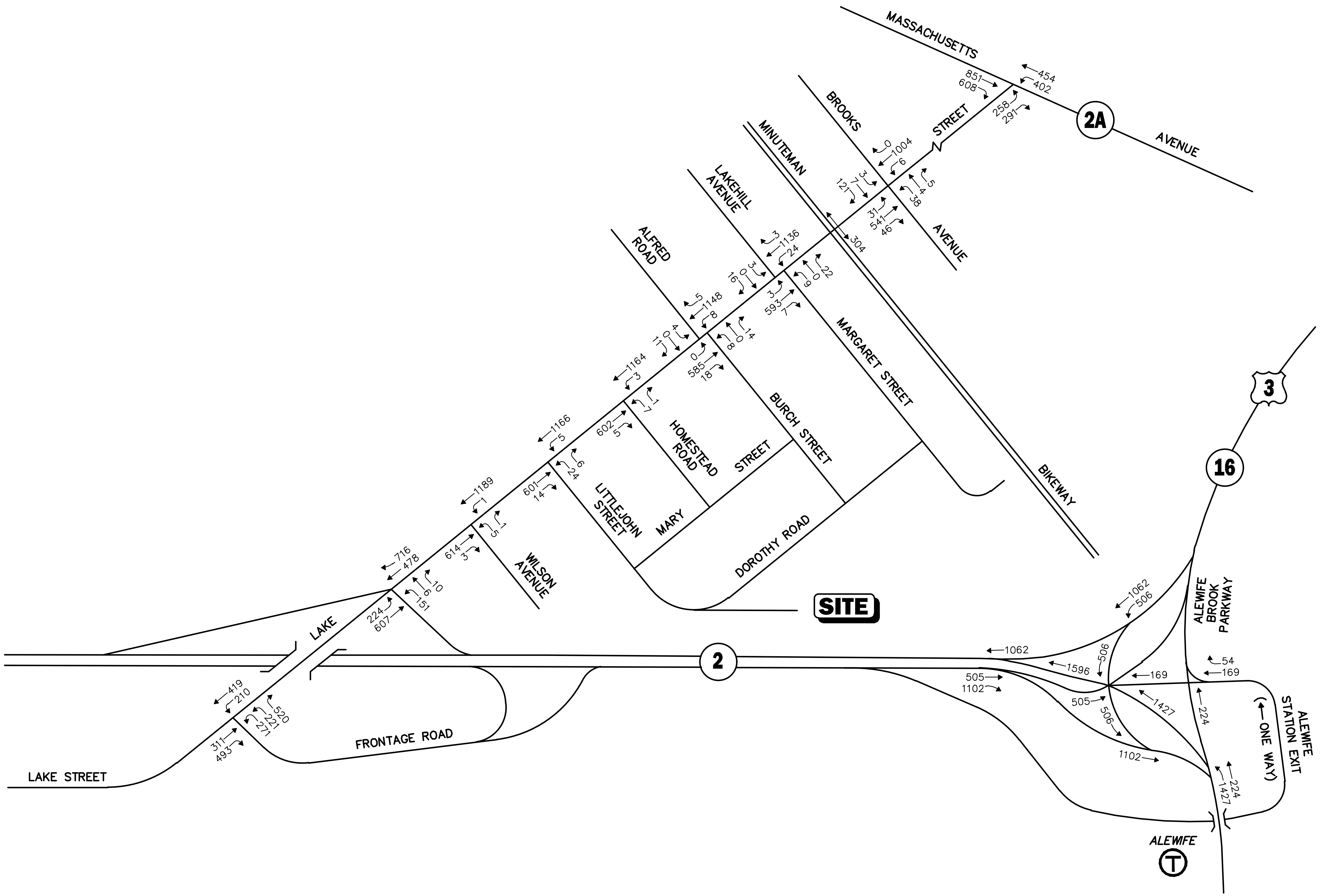
Note: Imbalances exist due to numerous curb cuts and side streets that are not shown.

Not To Scale

Figure 4R

2020 Baseline
Weekday Evening
Peak Hour Traffic Volumes

Vanasse & Associates inc



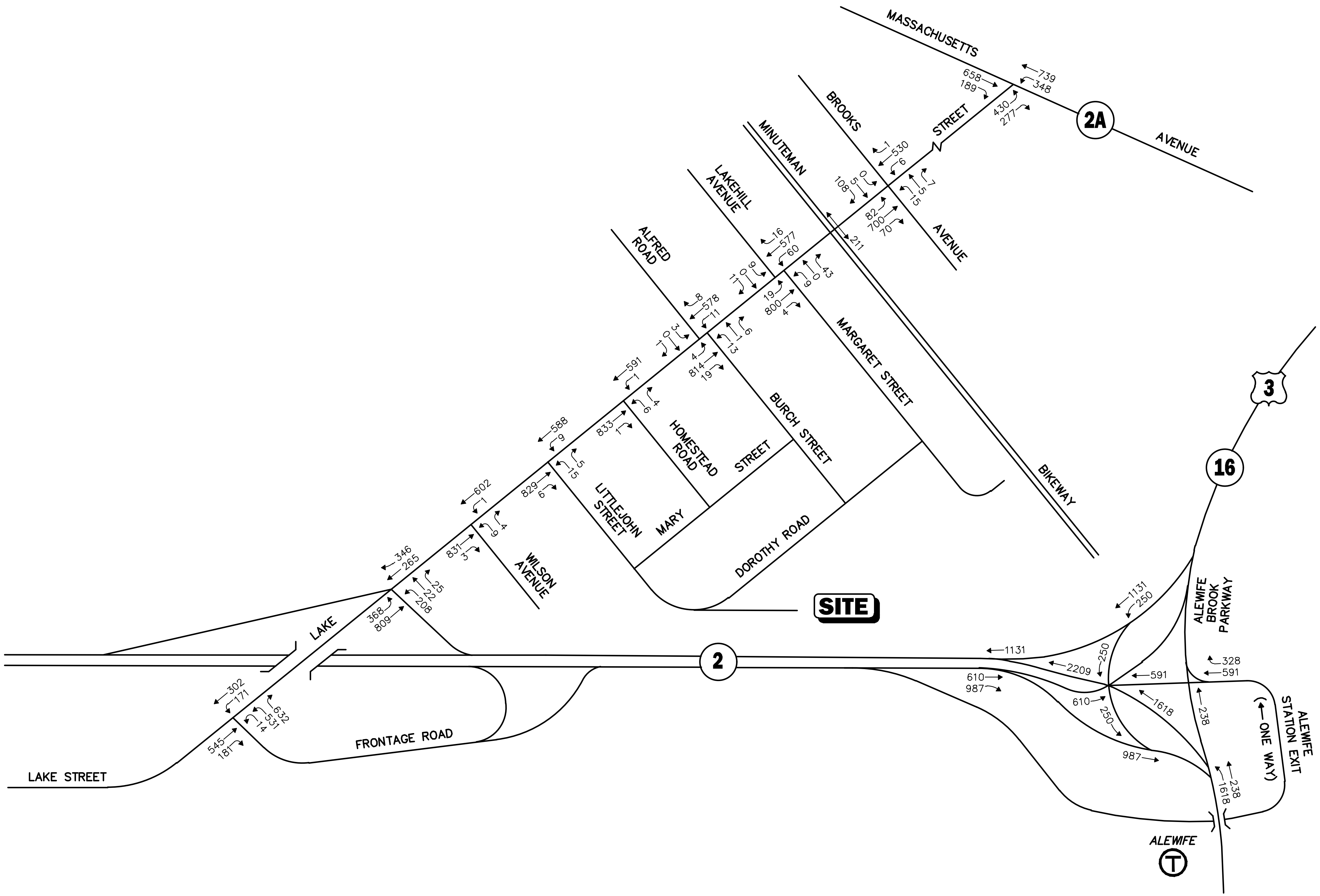
Note: Imbalances exist due to numerous curb cuts and side streets that are not shown.

Not To Scale

Figure 5R

2027 No-Build Weekday Morning Peak Hour Traffic Volumes

Vanasse & Associates inc



Note: Imbalances exist due to numerous curb cuts and side streets that are not shown.

Not To Scale

Figure 6R

2027 No-Build
Weekday Evening
Peak Hour Traffic Volumes

Vanasse & Associates inc

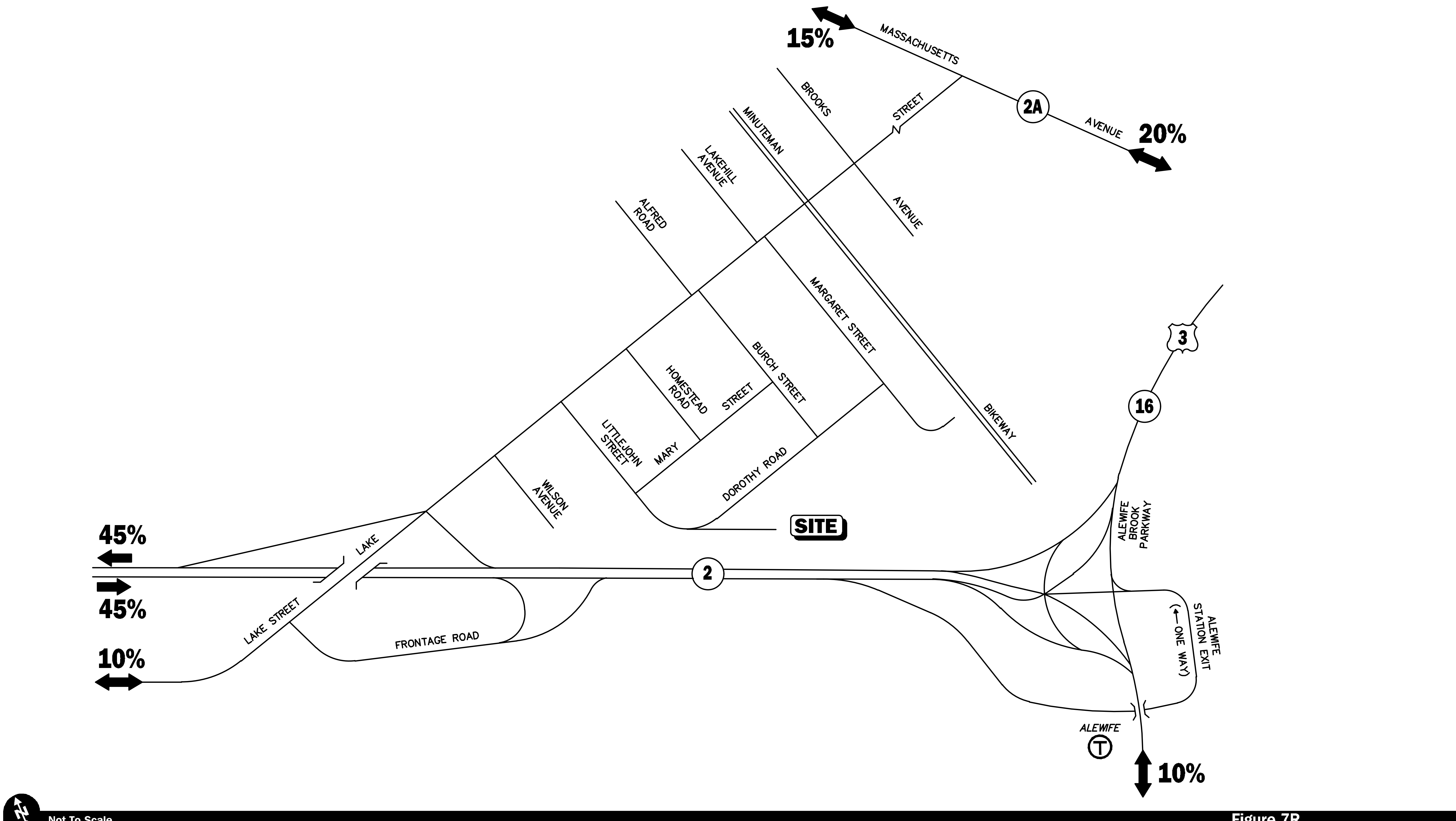
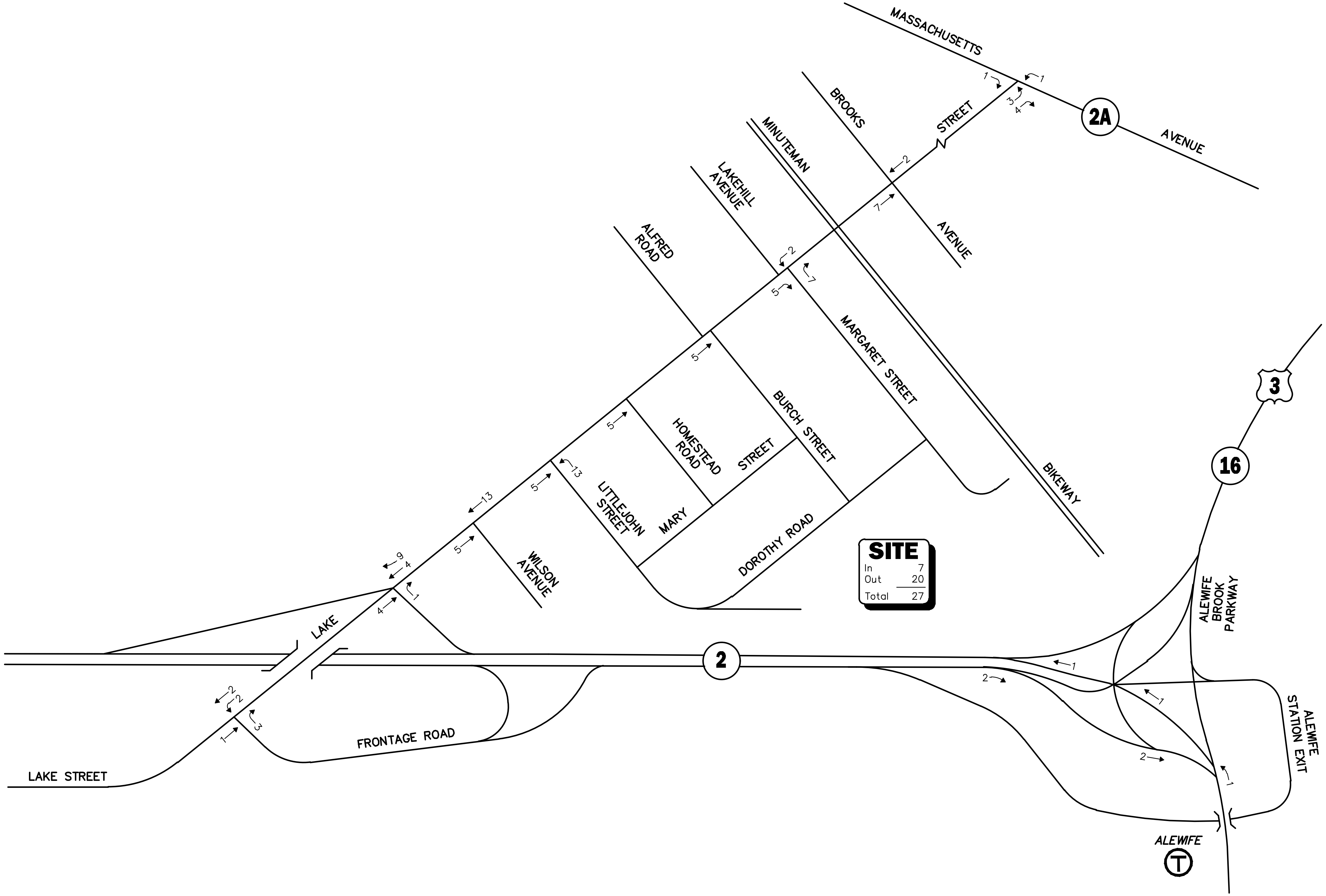


Figure 7R

Trip Distribution Map

Vanasse & Associates inc



Vanasse & Associates inc

Figure 8R

Site Generated Weekday Morning Peak Hour Traffic Volumes

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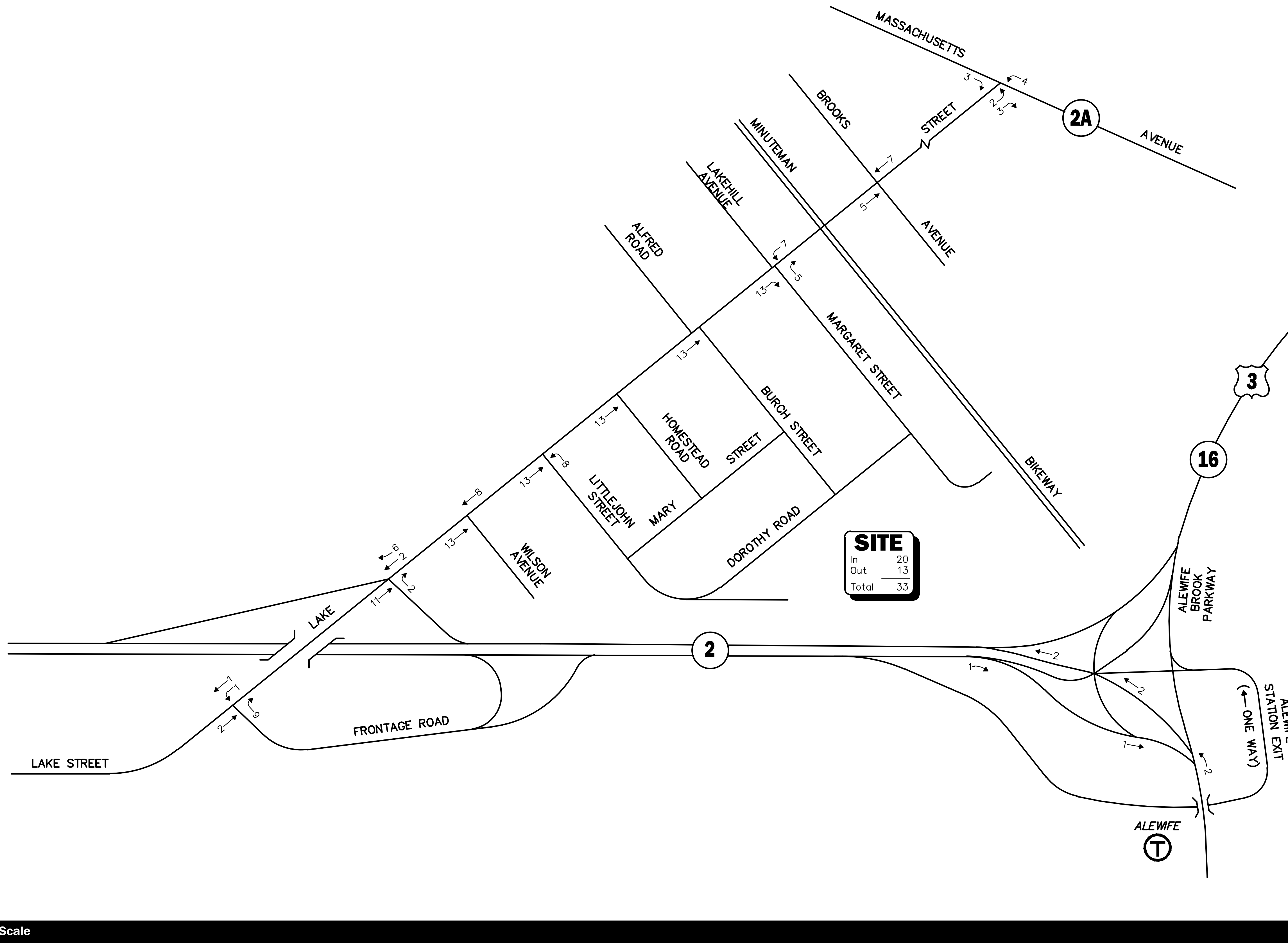
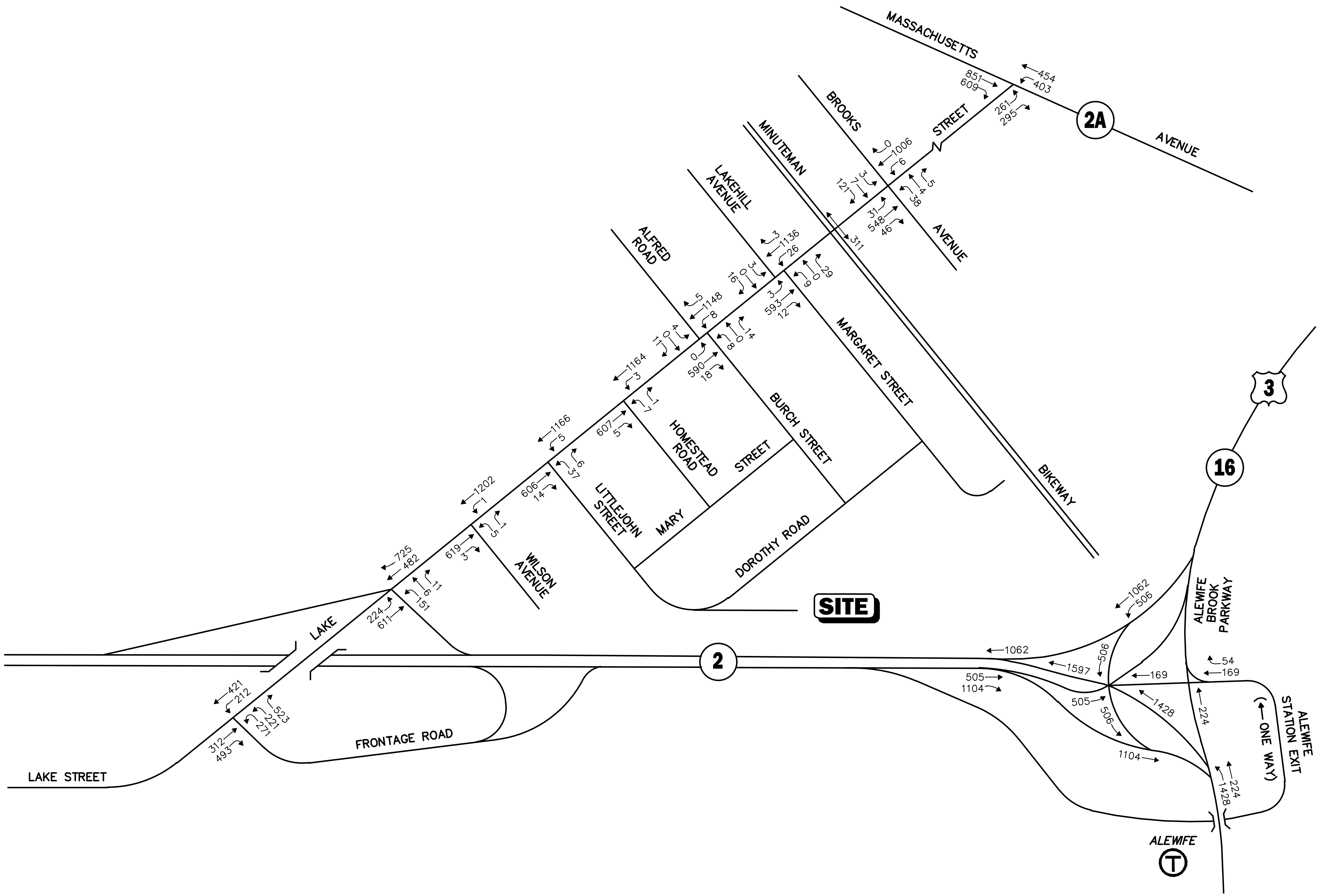


Figure 9R

Site Generated Weekday Evening Peak Hour Traffic Volumes

Vanasse & Associates inc



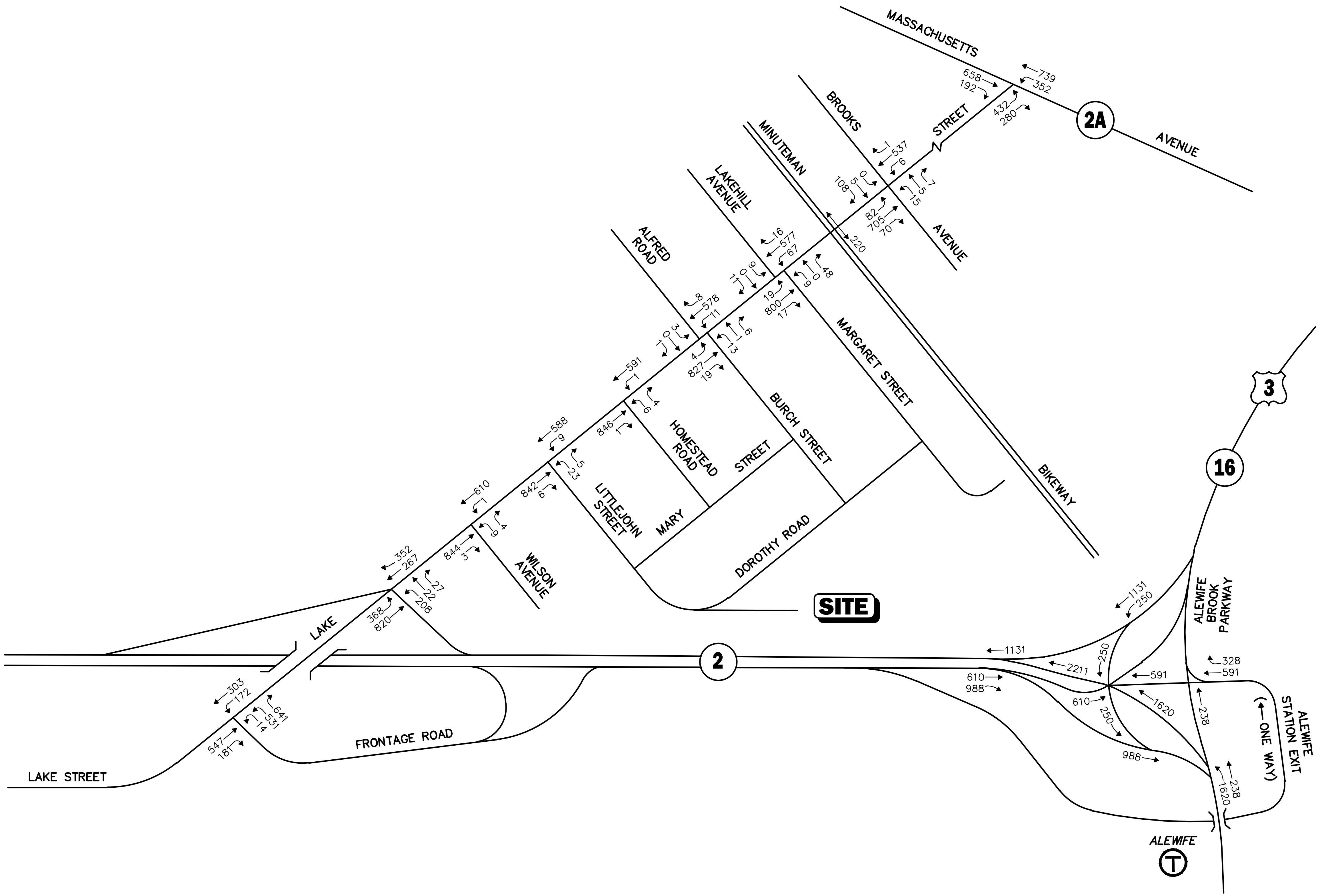
Note: Imbalances exist due to numerous curb cuts and side streets that are not shown.

Not To Scale

Figure 10R

2027 Build
Weekday Morning
Peak Hour Traffic Volumes

Vanasse & Associates inc



Note: Imbalances exist due to numerous curb cuts and side streets that are not shown.

Not To Scale

Figure 11R

2027 Build
Weekday Evening
Peak Hour Traffic Volumes

Vanasse & Associates inc

R:\8451\8451INT4.dwg, 1/4/2021 11:58:41 AM, DWG To PDF.pc3

LAKE STREET AT BROOKS AVENUE TRAFFIC COUNTS

Accurate Counts
978-664-2565

N/S Street : Brooks Road
E/W Street : Lake Street
City/State : Arlington, MA
Weather : Cloudy

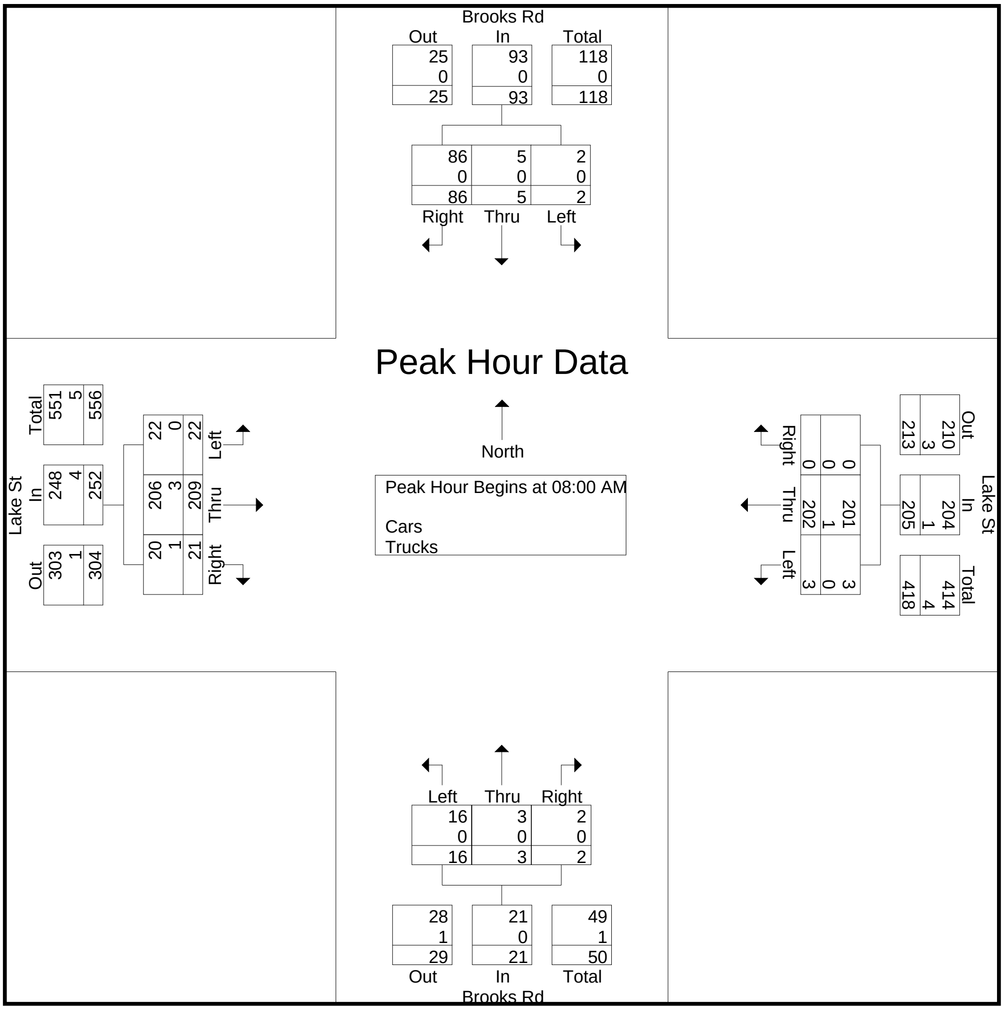
File Name : 84510005
Site Code : 84510005
Start Date : 9/10/2020
Page No : 1

Groups Printed- Cars - Trucks

	Brooks Rd From North			Lake St From East			Brooks Rd From South			Lake St From West			
Start Time	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Int. Total
07:00 AM	1	2	13	1	41	1	3	0	1	6	31	7	107
07:15 AM	0	0	15	2	38	0	7	0	0	4	32	6	104
07:30 AM	0	2	21	0	57	0	3	0	0	1	32	12	128
07:45 AM	0	1	16	0	64	0	2	0	0	3	52	3	141
Total	1	5	65	3	200	1	15	0	1	14	147	28	480
08:00 AM	0	2	28	1	44	0	5	0	1	4	41	6	132
08:15 AM	0	1	23	1	47	0	9	3	0	4	58	11	157
08:30 AM	1	2	15	1	52	0	1	0	1	8	55	1	137
08:45 AM	1	0	20	0	59	0	1	0	0	6	55	3	145
Total	2	5	86	3	202	0	16	3	2	22	209	21	571
Grand Total	3	10	151	6	402	1	31	3	3	36	356	49	1051
Apprch %	1.8	6.1	92.1	1.5	98.3	0.2	83.8	8.1	8.1	8.2	80.7	11.1	
Total %	0.3	1	14.4	0.6	38.2	0.1	2.9	0.3	0.3	3.4	33.9	4.7	
Cars	3	10	151	6	400	1	31	3	3	36	350	48	1042
% Cars	100	100	100	100	99.5	100	100	100	100	100	98.3	98	99.1
Trucks	0	0	0	0	2	0	0	0	0	0	6	1	9
% Trucks	0	0	0	0	0.5	0	0	0	0	0	1.7	2	0.9

	Brooks Rd From North				Lake St From East				Brooks Rd From South				Lake St From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 08:00 AM																	
08:00 AM	0	**2**	**28**	**30**	**1**	44	0	45	5	0	**1**	6	4	41	6	51	132
08:15 AM	0	1	23	24	1	47	0	48	**9**	**3**	0	**12**	4	**58**	**11**	**73**	**157**
08:30 AM	**1**	2	15	18	1	52	0	53	1	0	1	2	**8**	55	1	64	137
08:45 AM	1	0	20	21	0	**59**	0	**59**	1	0	0	1	6	55	3	64	145
Total Volume	2	5	86	93	3	202	0	205	16	3	2	21	22	209	21	252	571
% App. Total	2.2	5.4	92.5		1.5	98.5	0		76.2	14.3	9.5		8.7	82.9	8.3		
PHF	.500	.625	.768	.775	.750	.856	.000	.869	.444	.250	.500	.438	.688	.901	.477	.863	.909
Cars	2	5	86	93	3	201	0	204	16	3	2	21	22	206	20	248	566
% Cars	100	100	100	100	100	99.5	0	99.5	100	100	100	100	100	98.6	95.2	98.4	99.1
Trucks	0	0	0	0	0	1	0	1	0	0	0	0	0	3	1	4	5
% Trucks	0	0	0	0	0	0.5	0	0.5	0	0	0	0	0	1.4	4.8	1.6	0.9

N/S Street : Brooks Road	File Name : 84510005
E/W Street : Lake Street	Site Code : 84510005
City/State : Arlington, MA	Start Date : 9/10/2020
Weather : Cloudy	Page No : 2



Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	07:30 AM				07:30 AM				07:30 AM				08:00 AM			
+0 mins.	0	**2**	21	23	0	57	0	57	3	0	0	3	4	41	6	51
+15 mins.	0	1	16	17	0	**64**	0	**64**	2	0	0	2	4	**58**	**11**	**73**
+30 mins.	0	2	**28**	**30**	**1**	44	0	45	5	0	**1**	6	**8**	55	1	64
+45 mins.	0	1	23	24	1	47	0	48	**9**	**3**	0	**12**	6	55	3	64
Total Volume	0	6	88	94	2	212	0	214	19	3	1	23	22	209	21	252
% App. Total	0	6.4	93.6		0.9	99.1	0		82.6	13	4.3		8.7	82.9	8.3	
PHF	.000	.750	.786	.783	.500	.828	.000	.836	.528	.250	.250	.479	.688	.901	.477	.863
Cars	0	6	88	94	2	212	0	214	19	3	1	23	22	206	20	248
% Cars	0	100	100	100	100	100	0	100	100	100	100	100	100	98.6	95.2	98.4
Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0	3	1	4
% Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0	1.4	4.8	1.6

Accurate Counts
978-664-2565

N/S Street : Brooks Road
E/W Street : Lake Street
City/State : Arlington, MA
Weather : Cloudy

File Name : 84510005
Site Code : 84510005
Start Date : 9/10/2020
Page No : 7

Groups Printed- Trucks

	Brooks Rd From North			Lake St From East			Brooks Rd From South			Lake St From West			
Start Time	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Int. Total
07:00 AM	0	0	0	0	0	0	0	0	0	0	1	0	1
07:15 AM	0	0	0	0	1	0	0	0	0	0	1	0	2
07:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0
07:45 AM	0	0	0	0	0	0	0	0	0	0	1	0	1
Total	0	0	0	0	1	0	0	0	0	0	3	0	4
08:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0
08:15 AM	0	0	0	0	0	0	0	0	0	0	1	1	2
08:30 AM	0	0	0	0	0	0	0	0	0	0	1	0	1
08:45 AM	0	0	0	0	1	0	0	0	0	0	1	0	2
Total	0	0	0	0	1	0	0	0	0	0	3	1	5
Grand Total	0	0	0	0	2	0	0	0	0	0	6	1	9
Apprch %	0	0	0	0	100	0	0	0	0	0	85.7	14.3	
Total %	0	0	0	0	22.2	0	0	0	0	0	66.7	11.1	

	Brooks Rd From North				Lake St From East				Brooks Rd From South				Lake St From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 08:00 AM																	
08:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	**1**	**1**	**2**	**2**
08:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1
08:45 AM	0	0	0	0	0	**1**	0	**1**	0	0	0	0	0	1	0	1	2
Total Volume	0	0	0	0	0	1	0	1	0	0	0	0	0	3	1	4	5
% App. Total	0	0	0		0	100	0		0	0	0		0	75	25		
PHF	.000	.000	.000	.000	.000	.250	.000	.250	.000	.000	.000	.000	.000	.750	.250	.500	.625

N/S Street : Brooks Road
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City/State : Arlington, MA
Weather : Cloudy

File Name : 84510005
Site Code : 84510005
Start Date : 9/10/2020
Page No : 10

Groups Printed- Bikes Peds

	Brooks Rd From North				Lake St From East				Brooks Rd From South				Lake St From West						
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
07:00 AM	0	0	0	2	0	0	0	1	0	0	0	0	0	0	0	2	5	0	5
07:15 AM	0	0	1	4	0	1	0	8	0	0	0	0	0	0	1	1	13	3	16
07:30 AM	0	0	1	2	0	1	0	2	0	0	0	0	0	2	1	3	7	5	12
07:45 AM	0	0	1	1	0	2	0	0	0	0	0	3	0	0	0	3	7	3	10
Total	0	0	3	9	0	4	0	11	0	0	0	3	0	2	2	9	32	11	43
08:00 AM	0	0	0	5	0	1	0	0	0	0	0	6	0	1	1	2	13	3	16
08:15 AM	0	0	0	4	0	3	0	2	0	0	0	1	1	0	1	0	7	5	12
08:30 AM	0	0	0	4	0	2	0	1	0	0	0	7	0	0	2	5	17	4	21
08:45 AM	0	0	0	4	0	1	0	2	0	0	2	0	0	1	0	0	6	4	10
Total	0	0	0	17	0	7	0	5	0	0	2	14	1	2	4	7	43	16	59
Grand Total	0	0	3	26	0	11	0	16	0	0	2	17	1	4	6	16	75	27	102
Apprch %	0	0	100		0	100	0		0	0	100		9.1	36.4	54.5				
Total %	0	0	11.1		0	40.7	0		0	0	7.4		3.7	14.8	22.2		73.5	26.5	

	Brooks Rd From North				Lake St From East				Brooks Rd From South				Lake St From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:30 AM																	
07:30 AM	0	0	**1**	**1**	0	1	0	1	0	0	0	0	0	**2**	**1**	**3**	**5**
07:45 AM	0	0	1	1	0	2	0	2	0	0	0	0	0	0	0	0	3
08:00 AM	0	0	0	0	0	1	0	1	0	0	0	0	0	1	1	2	3
08:15 AM	0	0	0	0	0	**3**	0	**3**	0	0	0	0	**1**	0	1	2	5
Total Volume	0	0	2	2	0	7	0	7	0	0	0	0	1	3	3	7	16
% App. Total	0	0	100		0	100	0		0	0	0		14.3	42.9	42.9		
PHF	.000	.000	.500	.500	.000	.583	.000	.583	.000	.000	.000	.000	.250	.375	.750	.583	.800

Accurate Counts

978-664-2565

N/S Street : Brooks Road
E/W Street : Lake Street
City/State : Arlington, MA
Weather : Cloudy

File Name : 84510005
Site Code : 84510005
Start Date : 9/10/2020
Page No : 1

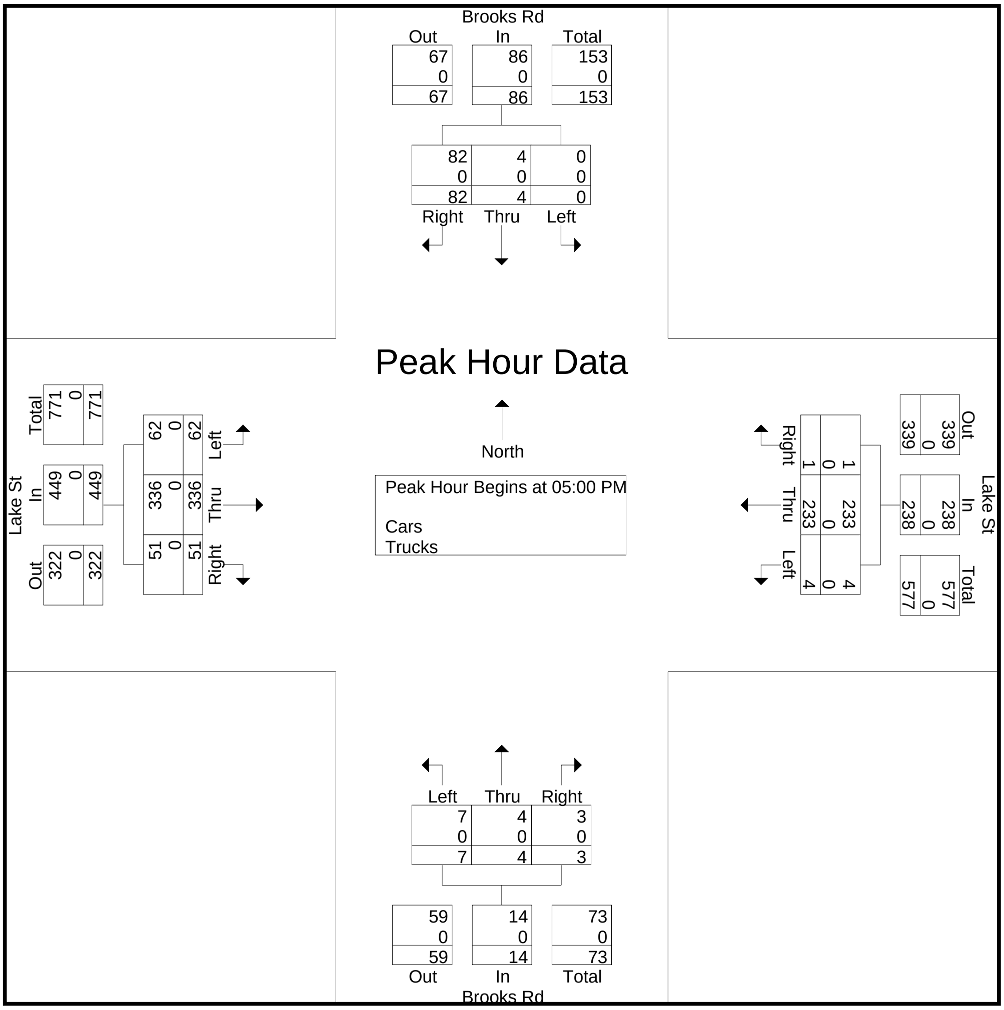
Groups Printed- Cars - Trucks

	Brooks Rd From North			Lake St From East			Brooks Rd From South			Lake St From West			
Start Time	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Int. Total
04:00 PM	0	1	19	0	43	2	5	1	0	26	100	15	212
04:15 PM	0	1	22	0	43	1	3	2	0	13	70	14	169
04:30 PM	0	1	23	1	56	0	3	0	2	15	78	12	191
04:45 PM	0	0	19	0	46	0	5	1	2	9	75	12	169
Total	0	3	83	1	188	3	16	4	4	63	323	53	741
05:00 PM	0	0	16	2	52	0	3	1	2	12	104	12	204
05:15 PM	0	0	23	1	50	0	2	1	0	15	91	13	196
05:30 PM	0	1	18	1	64	0	1	1	0	20	82	14	202
05:45 PM	0	3	25	0	67	1	1	1	1	15	59	12	185
Total	0	4	82	4	233	1	7	4	3	62	336	51	787
Grand Total	0	7	165	5	421	4	23	8	7	125	659	104	1528
Apprch %	0	4.1	95.9	1.2	97.9	0.9	60.5	21.1	18.4	14.1	74.2	11.7	
Total %	0	0.5	10.8	0.3	27.6	0.3	1.5	0.5	0.5	8.2	43.1	6.8	
Cars	0	7	165	5	419	4	23	8	7	125	659	104	1526
% Cars	0	100	100	100	99.5	100	100	100	100	100	100	100	99.9
Trucks	0	0	0	0	2	0	0	0	0	0	0	0	2
% Trucks	0	0	0	0	0.5	0	0	0	0	0	0	0	0.1

	Brooks Rd From North				Lake St From East				Brooks Rd From South				Lake St From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 05:00 PM																	
05:00 PM	0	0	16	16	**2**	52	0	54	**3**	**1**	**2**	**6**	12	**104**	12	**128**	**204**
05:15 PM	0	0	23	23	1	50	0	51	2	1	0	3	15	91	13	119	196
05:30 PM	0	1	18	19	1	64	0	65	1	1	0	2	**20**	82	**14**	116	202
05:45 PM	0	**3**	**25**	**28**	0	**67**	**1**	**68**	1	1	1	3	15	59	12	86	185
Total Volume	0	4	82	86	4	233	1	238	7	4	3	14	62	336	51	449	787
% App. Total	0	4.7	95.3		1.7	97.9	0.4		50	28.6	21.4		13.8	74.8	11.4		
PHF	.000	.333	.820	.768	.500	.869	.250	.875	.583	1.00	.375	.583	.775	.808	.911	.877	.964
Cars	0	4	82	86	4	233	1	238	7	4	3	14	62	336	51	449	787
% Cars	0	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Accurate Counts
978-664-2565

N/S Street : Brooks Road	File Name : 84510005
E/W Street : Lake Street	Site Code : 84510005
City/State : Arlington, MA	Start Date : 9/10/2020
Weather : Cloudy	Page No : 2



Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	04:00 PM				05:00 PM				04:00 PM				04:45 PM			
+0 mins.	0	**1**	19	20	**2**	52	0	54	**5**	1	0	6	9	75	12	96
+15 mins.	0	1	22	23	1	50	0	51	3	**2**	0	5	12	**104**	12	**128**
+30 mins.	0	1	**23**	**24**	1	64	0	65	3	0	**2**	5	15	91	13	119
+45 mins.	0	0	19	19	0	**67**	**1**	**68**	5	1	2	**8**	**20**	82	**14**	116
Total Volume	0	3	83	86	4	233	1	238	16	4	4	24	56	352	51	459
% App. Total	0	3.5	96.5		1.7	97.9	0.4		66.7	16.7	16.7		12.2	76.7	11.1	
PHF	.000	.750	.902	.896	.500	.869	.250	.875	.800	.500	.500	.750	.700	.846	.911	.896
Cars	0	3	83	86	4	233	1	238	16	4	4	24	56	352	51	459
% Cars	0	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

N/S Street : Brooks Road
E/W Street : Lake Street
City/State : Arlington, MA
Weather : Cloudy

File Name : 84510005
Site Code : 84510005
Start Date : 9/10/2020
Page No : 7

Groups Printed- Trucks

	Brooks Rd From North			Lake St From East			Brooks Rd From South			Lake St From West			
Start Time	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Int. Total
04:00 PM	0	0	0	0	1	0	0	0	0	0	0	0	1
04:15 PM	0	0	0	0	1	0	0	0	0	0	0	0	1
04:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0
04:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	2	0	0	0	0	0	0	0	2
05:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0
05:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0
05:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0
05:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0
Grand Total	0	0	0	0	2	0	0	0	0	0	0	0	2
Apprch %	0	0	0	0	100	0	0	0	0	0	0	0	
Total %	0	0	0	0	100	0	0	0	0	0	0	0	

	Brooks Rd From North				Lake St From East				Brooks Rd From South				Lake St From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 04:00 PM																	
04:00 PM	0	0	0	0	0	**1**	0	**1**	0	0	0	0	0	0	0	0	**1**
04:15 PM	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	1
04:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Volume	0	0	0	0	0	2	0	2	0	0	0	0	0	0	0	0	2
% App. Total	0	0	0		0	100	0		0	0	0		0	0	0		
PHF	.000	.000	.000	.000	.000	.500	.000	.500	.000	.000	.000	.000	.000	.000	.000	.000	.500

Accurate Counts
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File Name : 84510005
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Groups Printed- Bikes Peds

	Brooks Rd From North				Lake St From East				Brooks Rd From South				Lake St From West						
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
04:00 PM	0	0	0	1	0	0	0	1	1	0	1	2	0	0	0	1	5	2	7
04:15 PM	0	0	1	0	0	0	0	1	0	0	0	3	0	0	0	3	7	1	8
04:30 PM	0	0	0	1	0	0	0	2	0	0	0	3	0	0	0	4	10	0	10
04:45 PM	0	0	0	5	0	0	0	0	1	0	0	1	0	0	0	0	6	1	7
Total	0	0	1	7	0	0	0	4	2	0	1	9	0	0	0	8	28	4	32
05:00 PM	0	0	1	1	0	1	0	2	0	0	0	6	0	2	1	0	9	5	14
05:15 PM	0	0	0	2	0	0	0	0	0	0	0	2	0	0	0	0	4	0	4
05:30 PM	0	0	0	6	0	3	0	4	0	0	0	0	0	0	0	0	10	3	13
05:45 PM	0	0	0	4	0	0	0	2	0	0	0	3	1	0	0	0	9	1	10
Total	0	0	1	13	0	4	0	8	0	0	0	11	1	2	1	0	32	9	41
Grand Total	0	0	2	20	0	4	0	12	2	0	1	20	1	2	1	8	60	13	73
Apprch %	0	0	100		0	100	0		66.7	0	33.3		25	50	25				
Total %	0	0	15.4		0	30.8	0		15.4	0	7.7		7.7	15.4	7.7		82.2	17.8	

	Brooks Rd From North				Lake St From East				Brooks Rd From South				Lake St From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 04:45 PM																	
04:45 PM	0	0	0	0	0	0	0	0	**1**	0	0	**1**	0	0	0	0	1
05:00 PM	0	0	**1**	**1**	0	1	0	1	0	0	0	0	0	**2**	**1**	**3**	**5**
05:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:30 PM	0	0	0	0	0	**3**	0	**3**	0	0	0	0	0	0	0	0	3
Total Volume	0	0	1	1	0	4	0	4	1	0	0	1	0	2	1	3	9
% App. Total	0	0	100		0	100	0		100	0	0		0	66.7	33.3		
PHF	.000	.000	.250	.250	.000	.333	.000	.333	.250	.000	.000	.250	.000	.250	.250	.250	.450

PEDESTRIAN/BICYCLE COVID ADJUSTMENT CALCULATIONS

From the MassDOT Mobility Dashboard (https://mobility-massdot.hub.arcgis.com/

	Ped/Bike Change Sep 2019 vs Sep 2020		Brooks Avenue Peds Sep 2020	COVID Adjusted Volumes
Arlington	31.53%	AM	43	57
		PM	32	42

	From Mass Ave 2010 FDR Count 2008 Mass Avenue at Lake Street Peds	From Minute Man at Dog Park Data Increase 2010 to 2019	Adjusted Volumes
AM	94	54%	145
PM	67	37%	92

K-FACTOR CALCULATION

massDOT Highway

MS2 Transportation Data Management System

Volume Count Report

LOCATION INFO	
Location ID	4925
Type	SPOT
Fnct'l Class	3
Located On	WAVERLEY OAKS ROAD
Loc On Alias	WAVERLEY OAKS ROAD
WEST OF	BEAVER STREET
Direction	2-WAY
County	Middlesex
Community	Waltham
MPO ID	
HPMS ID	
Agency	MHD

COUNT DATA INFO	
Count Status	Accepted
Start Date	Wed 7/24/2019
End Date	Thu 7/25/2019
Start Time	10:00:00 AM
End Time	10:00:00 AM
Direction	
Notes	
Station	
Study	
Speed Limit	
Description	
Sensor Type	Tube Class
Source	
Latitude,Longitude	

INTERVAL:15-MIN

Time	15-min Interval 1st	2nd	3rd	4th	Hourly Count
0:00-1:00	13	10	15	8	46
1:00-2:00	7	7	9	4	27
2:00-3:00	0	2	6	2	10
3:00-4:00	2	4	2	4	12
4:00-5:00	6	8	6	6	26
5:00-6:00	19	33	30	69	151
6:00-7:00	49	85	100	114	348
7:00-8:00	113	141	117	125	496
8:00-9:00	144	152	130	143	569
9:00-10:00	157	154	137	118	566
10:00-11:00	127	136	100	108	471
11:00-12:00	92	117	123	104	436
12:00-13:00	133	123	109	81	446
13:00-14:00	125	109	110	140	484
14:00-15:00	125	117	131	144	517
15:00-16:00	147	146	174	113	580
16:00-17:00	156	145	156	176	633
17:00-18:00	153	173	166	141	633
18:00-19:00	128	136	143	129	536
19:00-20:00	119	103	100	82	404
20:00-21:00	104	83	80	89	356
21:00-22:00	60	82	73	66	281
22:00-23:00	73	40	39	35	187
23:00-24:00	29	34	12	15	90
Total					8,305
AADT					7,803
AM Peak					08:45-09:45 591
PM Peak					16:45-17:45 668

K Factor = 668/8305 = 0.080

massDOT Highway — MS2 Transportation Data Management System

Volume Count Report

LOCATION INFO	
Location ID	4911
Type	SPOT
Fnct'l Class	3
Located On	WAVERLEY OAKS ROAD
Loc On Alias	WAVERLEY OAKS ROAD
WEST OF	TRAPELO ROAD
Direction	2-WAY
County	Middlesex
Community	Waltham
MPO ID	
HPMS ID	
Agency	MHD

COUNT DATA INFO	
Count Status	Accepted
Start Date	Tue 7/23/2019
End Date	Wed 7/24/2019
Start Time	10:00:00 AM
End Time	10:00:00 AM
Direction	
Notes	
Station	
Study	
Speed Limit	
Description	
Sensor Type	Tube Class
Source	
Latitude,Longitude	

INTERVAL:15-MIN

Time	15-min Interval 1st	2nd	3rd	4th	Hourly Count
0:00-1:00	16	9	18	3	46
1:00-2:00	7	5	12	7	31
2:00-3:00	4	3	9	11	27
3:00-4:00	2	2	6	6	16
4:00-5:00	5	11	14	24	54
5:00-6:00	22	40	67	86	215
6:00-7:00	102	125	181	175	583
7:00-8:00	182	203	210	252	847
8:00-9:00	257	288	293	305	1,143
9:00-10:00	294	219	288	212	1,013
10:00-11:00	227	225	226	240	918
11:00-12:00	184	188	204	218	794
12:00-13:00	222	211	233	214	880
13:00-14:00	203	211	240	227	881
14:00-15:00	214	216	217	265	912
15:00-16:00	224	258	271	257	1,010
16:00-17:00	278	262	284	280	1,104
17:00-18:00	316	292	341	259	1,208
18:00-19:00	278	282	269	218	1,047
19:00-20:00	185	207	161	147	700
20:00-21:00	150	162	124	111	547
21:00-22:00	105	94	108	89	396
22:00-23:00	72	60	42	52	226
23:00-24:00	52	39	28	22	141
Total					14,739
AADT					13,658
AM Peak					08:15-09:15 1,180
PM Peak					16:45-17:45 1,229

K Factor = 1229/14739 = 0.083

VEHICLE OCCUPANCY RATE

COMMUTING CHARACTERISTICS BY SEX

Note: This is a modified view of the original table produced by the U.S. Census Bureau. This download or printed version may have missing information from the original table.

	Census Tract 3561, Middlesex County, Massachusetts		
	Total		Male
Label	Estimate	Margin of Error	Estimate
Workers 16 years and over	2,051	±155	1,048
MEANS OF TRANSPORTATION TO WORK			
Car, truck, or van	54.5%	±7.2	57.7%
Drove alone	42.9%	±7.6	45.8%
Carpooled	11.6%	±4.5	11.9%
In 2-person carpool	9.6%	±4.2	9.9%
In 3-person carpool	1.5%	±1.8	1.0%
In 4-or-more person carpool	0.5%	±0.8	1.0%
Workers per car, truck, or van	1.13	±0.06	1.13
Public transportation (excluding taxicab)	31.6%	±6.4	29.4%
Walked	0.0%	±1.7	0.0%
Bicycle	6.1%	±2.8	7.8%
Taxicab, motorcycle, or other means	1.3%	±2.0	0.0%
Worked at home	6.5%	±3.6	5.1%
PLACE OF WORK			
Worked in state of residence	98.1%	±1.5	97.9%
Worked in county of residence	65.1%	±6.2	61.6%
Worked outside county of residence	33.0%	±6.3	36.3%
Worked outside state of residence	1.9%	±1.5	2.1%
Living in a place	100.0%	±1.7	100.0%
Worked in place of residence	11.2%	±4.0	7.6%
Worked outside place of residence	88.8%	±4.0	92.4%
Not living in a place	0.0%	±1.7	0.0%
Living in 12 selected states	100.0%	±1.7	100.0%
Worked in minor civil division of residence	11.2%	±4.0	7.6%
Worked outside minor civil division of residence	88.8%	±4.0	92.4%
Not living in 12 selected states	0.0%	±1.7	0.0%
Workers 16 years and over who did not work at home	1,918	±178	995
TIME LEAVING HOME TO GO TO WORK			
12:00 a.m. to 4:59 a.m.	0.9%	±1.4	0.0%
5:00 a.m. to 5:29 a.m.	0.4%	±0.7	0.0%
5:30 a.m. to 5:59 a.m.	3.2%	±2.2	1.7%
6:00 a.m. to 6:29 a.m.	2.1%	±1.9	2.8%
6:30 a.m. to 6:59 a.m.	10.5%	±4.2	11.5%
7:00 a.m. to 7:29 a.m.	17.8%	±5.9	21.6%
7:30 a.m. to 7:59 a.m.	21.8%	±6.0	22.6%
8:00 a.m. to 8:29 a.m.	16.1%	±5.0	13.8%

Table Notes

COMMUTING CHARACTERISTICS BY SEX

Survey/Program:
American Community Survey
Year:
2018
Estimates:
5-Year
Table ID:
S0801

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.

Source: U.S. Census Bureau, 2014-2018 American Community Survey 5-Year Estimates

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.

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 discussion of nonsampling variability, see ACS Technical Documentation). The effect of nonsampling error is not represented in these tables.

The 12 selected states are Connecticut, Maine, Massachusetts, Michigan, Minnesota, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont, and Wisconsin.

Workers include members of the Armed Forces and civilians who were at work last week.

While the 2014-2018 American Community Survey (ACS) data generally reflect the February 2013 Office of Management and Budget (OMB) definitions 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 definitions due to differences in the effective dates of the geographic entities.

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 urbanization.

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.
> An "(X)" means that the estimate is not applicable or not available.

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.

MODE SPLIT DATA

If survey indicates more residents are parking off-site, please indicate where they park:

The majority of respondents park on site representing 72 percent of the respondents. Eight percent park on-street (resident parking) and 7 percent park in other off-site facilities.

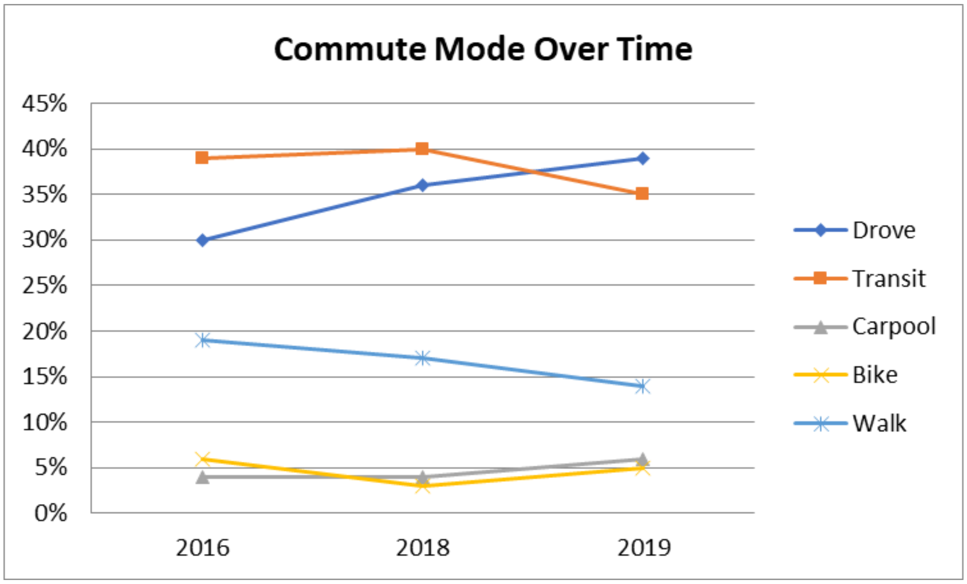
How is the parking facility physically controlled to ensure it is not open to the general public or operated as a commercial facility (as defined above)?

Garage access is by transponder only and is controlled by management office for residential use only.

Anything else you'd like the City to know about this project related to TDM (that was not discussed elsewhere in this report).

Not at this time.

Attach line graph of all modes over time (walk, bike, transit, carpool, drive alone).



Attach driveway counts, car parking counts, and bicycle parking counts, if required this year.

Not required this year.

PEDESTRIAN PATH TO ALEWIFE STATION FIGURE

Vanasse & Associates inc

Pedestrian Walkway Path to Alewife Station

R:\8451\8451PED.dwg, 12/23/2020 10:06:50 AM

CAPACITY ANALYSIS

2020 Baseline Weekday Morning Peak Hour
2020 Baseline Weekday Evening Peak Hour
2027 No-Build Weekday Morning Peak Hour
2027 No-Build Weekday Evening Peak Hour
2027 Build Weekday Morning Peak Hour
2027 Build Weekday Evening Peak Hour

2020 Baseline Weekday Morning Peak Hour

Intersection	
Int Delay, s/veh	0.2

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	574	3	1	1121	5	1
Future Vol, veh/h	574	3	1	1121	5	1
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	75	75	87	87	75	75
Heavy Vehicles, %	2	0	0	1	0	0
Mvmt Flow	765	4	1	1289	7	1

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	769	0	2058	767
Stage 1	-	-	-	-	767	-
Stage 2	-	-	-	-	1291	-
Critical Hdwy	-	-	4.1	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	-	-	2.2	-	3.5	3.3
Pot Cap-1 Maneuver	-	-	854	-	61	405
Stage 1	-	-	-	-	462	-
Stage 2	-	-	-	-	260	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	854	-	61	405
Mov Cap-2 Maneuver	-	-	-	-	61	-
Stage 1	-	-	-	-	462	-
Stage 2	-	-	-	-	259	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0	62
HCM LOS			F

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	71	-	-	854	-
HCM Lane V/C Ratio	0.113	-	-	0.001	-
HCM Control Delay (s)	62	-	-	9.2	0
HCM Lane LOS	F	-	-	A	A
HCM 95th %tile Q(veh)	0.4	-	-	0	-

Intersection	
Int Delay, s/veh	1.6

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	561	14	5	1098	24	6
Future Vol, veh/h	561	14	5	1098	24	6
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	75	75	93	93	75	75
Heavy Vehicles, %	2	0	0	1	0	0
Mvmt Flow	748	19	5	1181	32	8

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	767	0	1949	758
Stage 1	-	-	-	-	758	-
Stage 2	-	-	-	-	1191	-
Critical Hdwy	-	-	4.1	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	-	-	2.2	-	3.5	3.3
Pot Cap-1 Maneuver	-	-	856	-	72	410
Stage 1	-	-	-	-	466	-
Stage 2	-	-	-	-	291	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	856	-	71	410
Mov Cap-2 Maneuver	-	-	-	-	71	-
Stage 1	-	-	-	-	466	-
Stage 2	-	-	-	-	286	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0	80.4
HCM LOS			F

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	85	-	-	856	-
HCM Lane V/C Ratio	0.471	-	-	0.006	-
HCM Control Delay (s)	80.4	-	-	9.2	0
HCM Lane LOS	F	-	-	A	A
HCM 95th %tile Q(veh)	2	-	-	0	-

Intersection						
Int Delay, s/veh	0.3					

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	562	5	3	1096	7	1
Future Vol, veh/h	562	5	3	1096	7	1
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	75	75	93	93	75	75
Heavy Vehicles, %	2	0	0	1	0	0
Mvmt Flow	749	7	3	1178	9	1

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	756	0	1937	753
Stage 1	-	-	-	-	753	-
Stage 2	-	-	-	-	1184	-
Critical Hdwy	-	-	4.1	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	-	-	2.2	-	3.5	3.3
Pot Cap-1 Maneuver	-	-	864	-	73	413
Stage 1	-	-	-	-	469	-
Stage 2	-	-	-	-	293	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	864	-	72	413
Mov Cap-2 Maneuver	-	-	-	-	72	-
Stage 1	-	-	-	-	469	-
Stage 2	-	-	-	-	290	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0	56.8
HCM LOS			F

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	80	-	-	864	-
HCM Lane V/C Ratio	0.133	-	-	0.004	-
HCM Control Delay (s)	56.8	-	-	9.2	0
HCM Lane LOS	F	-	-	A	A
HCM 95th %tile Q(veh)	0.4	-	-	0	-

Intersection	
Int Delay, s/veh	1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	545	18	8	1080	5	8	0	14	4	0	11
Future Vol, veh/h	0	545	18	8	1080	5	8	0	14	4	0	11
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	79	79	79	96	96	96	80	80	80	92	92	92
Heavy Vehicles, %	0	1	0	0	0	0	0	0	10	0	0	0
Mvmt Flow	0	690	23	8	1125	5	10	0	18	4	0	12

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	1130	0	0	713	0	0	1852	1848	702	1855	1857	1128
Stage 1	-	-	-	-	-	-	702	702	-	1144	1144	-
Stage 2	-	-	-	-	-	-	1150	1146	-	711	713	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.1	6.5	6.3	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	3.39	3.5	4	3.3
Pot Cap-1 Maneuver	626	-	-	896	-	-	58	75	425	57	74	251
Stage 1	-	-	-	-	-	-	432	443	-	245	277	-
Stage 2	-	-	-	-	-	-	243	276	-	427	438	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	626	-	-	896	-	-	54	73	425	54	72	251
Mov Cap-2 Maneuver	-	-	-	-	-	-	54	73	-	54	72	-
Stage 1	-	-	-	-	-	-	432	443	-	245	270	-
Stage 2	-	-	-	-	-	-	226	269	-	409	438	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0.1	43.3	37.5
HCM LOS			E	E

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	121	626	-	-	896	-	-	127
HCM Lane V/C Ratio	0.227	-	-	-	0.009	-	-	0.128
HCM Control Delay (s)	43.3	0	-	-	9.1	0	-	37.5
HCM Lane LOS	E	A	-	-	A	A	-	E
HCM 95th %tile Q(veh)	0.8	0	-	-	0	-	-	0.4

Intersection	
Int Delay, s/veh	3.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	3	553	7	24	1069	3	9	0	22	3	0	15
Future Vol, veh/h	3	553	7	24	1069	3	9	0	22	3	0	15
Conflicting Peds, #/hr	0	0	0	304	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	84	84	84	97	97	97	75	75	75	75	75	75
Heavy Vehicles, %	0	2	0	0	0	0	0	0	0	0	0	0
Mvmt Flow	4	658	8	25	1102	3	12	0	29	4	0	20

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	1105	0	0	970	0	0	2138	2129	966	1839	2132	1104
Stage 1	-	-	-	-	-	-	974	974	-	1154	1154	-
Stage 2	-	-	-	-	-	-	1164	1155	-	685	978	-
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	639	-	-	719	-	-	36	50	311	59	50	259
Stage 1	-	-	-	-	-	-	305	333	-	242	274	-
Stage 2	-	-	-	-	-	-	239	274	-	441	331	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	639	-	-	537	-	-	22	33	232	46	33	259
Mov Cap-2 Maneuver	-	-	-	-	-	-	22	33	-	46	33	-
Stage 1	-	-	-	-	-	-	225	246	-	240	241	-
Stage 2	-	-	-	-	-	-	194	241	-	381	245	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.1	0.3	139.9	34.4
HCM LOS			F	D

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	62	639	-	-	537	-	-	146
HCM Lane V/C Ratio	0.667	0.006	-	-	0.046	-	-	0.164
HCM Control Delay (s)	139.9	10.7	0	-	12	0	-	34.4
HCM Lane LOS	F	B	A	-	B	A	-	D
HCM 95th %tile Q(veh)	2.9	0	-	-	0.1	-	-	0.6

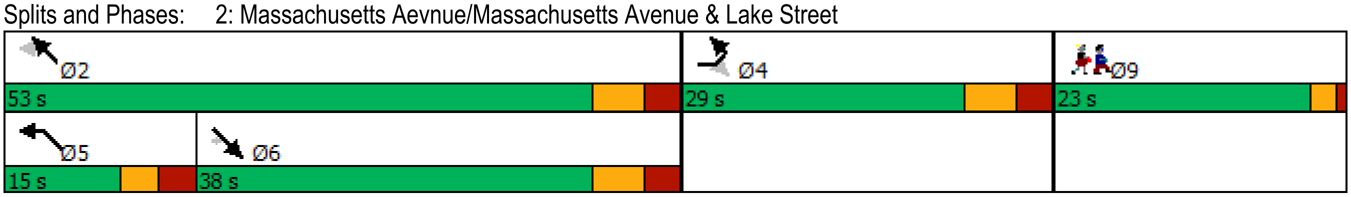
Lane Group	EBL	EBR	SET	SER	NWL	NWT	Ø9
Lane Configurations							
Traffic Volume (vph)	247	279	822	580	381	438	
Future Volume (vph)	247	279	822	580	381	438	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	
Lane Width (ft)	16	16	11	10	11	12	
Storage Length (ft)	0	100		55	150		
Storage Lanes	1	1		1	1		
Taper Length (ft)	25				25		
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	1.00	
Frt		0.850		0.850			
Flt Protected	0.950				0.950		
Satd. Flow (prot)	2025	1812	3421	1492	1728	1863	
Flt Permitted	0.950				0.157		
Satd. Flow (perm)	2025	1812	3421	1492	286	1863	
Right Turn on Red		Yes		Yes			
Satd. Flow (RTOR)		246		209			
Link Speed (mph)	30		30			30	
Link Distance (ft)	1126		640			645	
Travel Time (s)	25.6		14.5			14.7	
Peak Hour Factor	0.91	0.91	0.92	0.92	0.92	0.92	
Heavy Vehicles (%)	1%	1%	2%	1%	1%	2%	
Adj. Flow (vph)	271	307	893	630	414	476	
Shared Lane Traffic (%)							
Lane Group Flow (vph)	271	307	893	630	414	476	
Enter Blocked Intersection	No	No	No	No	No	No	
Lane Alignment	Left	Right	Left	Right	Left	Left	
Median Width(ft)	16		11			11	
Link Offset(ft)	0		0			0	
Crosswalk Width(ft)	16		16			16	
Two way Left Turn Lane							
Headway Factor	0.85	0.85	1.04	1.09	1.04	1.00	
Turning Speed (mph)	15	9		9	15		
Number of Detectors	1	1	2	1	1	2	
Detector Template	Left	Right	Thru	Right	Left	Thru	
Leading Detector (ft)	20	20	100	20	20	100	
Trailing Detector (ft)	0	0	0	0	0	0	
Detector 1 Position(ft)	0	0	0	0	0	0	
Detector 1 Size(ft)	20	20	6	20	20	6	
Detector 1 Type	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	
Detector 1 Queue (s)	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	
Detector 2 Position(ft)			94			94	
Detector 2 Size(ft)			6			6	
Detector 2 Type			Cl+Ex			Cl+Ex	
Detector 2 Channel							
Detector 2 Extend (s)			0.0			0.0	
Turn Type	Prot	Perm	NA	Perm	pm+pt	NA	

Lane Group	EBL	EBR	SET	SER	NWL	NWT	Ø9
Protected Phases	4		6		5	2	9
Permitted Phases		4		6	2		
Detector Phase	4	4	6	6	5	2	
Switch Phase							
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	23.0	23.0	23.0	23.0	10.0	23.0	19.0
Total Split (s)	29.0	29.0	38.0	38.0	15.0	53.0	23.0
Total Split (%)	27.6%	27.6%	36.2%	36.2%	14.3%	50.5%	22%
Maximum Green (s)	22.0	22.0	31.0	31.0	9.0	46.0	20.0
Yellow Time (s)	4.0	4.0	4.0	4.0	3.0	4.0	2.0
All-Red Time (s)	3.0	3.0	3.0	3.0	3.0	3.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	7.0	7.0	7.0	7.0	6.0	7.0	
Lead/Lag			Lag	Lag	Lead		
Lead-Lag Optimize?			Yes	Yes	Yes		
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None	Max	Max	None	Max	None
Walk Time (s)							5.0
Flash Dont Walk (s)							11.0
Pedestrian Calls (#/hr)							35
Act Effct Green (s)	16.6	16.6	31.8	31.8	48.2	47.2	
Actuated g/C Ratio	0.19	0.19	0.36	0.36	0.55	0.53	
v/c Ratio	0.72	0.57	0.72	0.94	1.35	0.48	
Control Delay	46.0	12.9	31.4	44.8	198.8	18.1	
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	
Total Delay	46.0	12.9	31.4	44.8	198.8	18.1	
LOS	D	B	C	D	F	B	
Approach Delay	28.4		36.9			102.1	
Approach LOS	C		D			F	

Intersection Summary

Area Type: Other
Cycle Length: 105
Actuated Cycle Length: 88.3
Natural Cycle: 100
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 1.35
Intersection Signal Delay: 54.7 Intersection LOS: D
Intersection Capacity Utilization 74.2% ICU Level of Service D
Analysis Period (min) 15

Splits and Phases: 2: Massachusetts Aevnue/Massachusetts Avenue & Lake Street



Lane Group	EBL	EBR	SET	SER	NWL	NWT
Lane Group Flow (vph)	271	307	893	630	414	476
v/c Ratio	0.72	0.57	0.72	0.94	1.35	0.48
Control Delay	46.0	12.9	31.4	44.8	198.8	18.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	46.0	12.9	31.4	44.8	198.8	18.1
Queue Length 50th (ft)	159	32	265	~302	~287	200
Queue Length 95th (ft)	245	110	#371	#561	#502	317
Internal Link Dist (ft)	1046		560			565
Turn Bay Length (ft)		100		55	150	
Base Capacity (vph)	517	646	1232	671	307	996
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	0.52	0.48	0.72	0.94	1.35	0.48

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

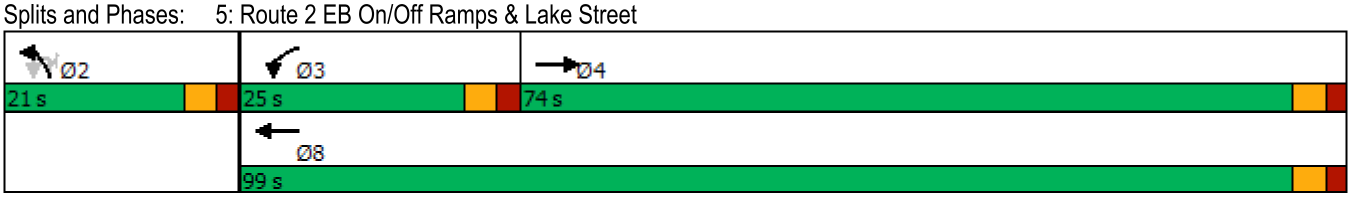
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Lane Group	EBT	EBR	WBL	WBT	NBU	NBL	NBR
Lane Configurations							
Traffic Volume (vph)	284	435	166	390	253	208	493
Future Volume (vph)	284	435	166	390	253	208	493
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	16	16	10	11	12	16	14
Storage Length (ft)		150	110			0	0
Storage Lanes		1	1			1	1
Taper Length (ft)			25			25	
Lane Util. Factor	1.00	1.00	1.00	0.95	1.00	1.00	1.00
Frt		0.850					0.850
Flt Protected			0.950			0.950	
Satd. Flow (prot)	2132	1812	1685	3455	0	2036	1706
Flt Permitted			0.950			0.950	
Satd. Flow (perm)	2132	1812	1685	3455	0	2036	1706
Right Turn on Red		Yes					Yes
Satd. Flow (RTOR)		322					407
Link Speed (mph)	30			30		30	
Link Distance (ft)	239			505		387	
Travel Time (s)	5.4			11.5		8.8	
Peak Hour Factor	0.91	0.91	0.84	0.84	0.91	0.91	0.91
Heavy Vehicles (%)	1%	1%	0%	1%	0%	1%	1%
Adj. Flow (vph)	312	478	198	464	278	229	542
Shared Lane Traffic (%)							
Lane Group Flow (vph)	312	478	198	464	0	507	542
Enter Blocked Intersection	No	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	R NA	Left	Right
Median Width(ft)	12			12		16	
Link Offset(ft)	0			0		0	
Crosswalk Width(ft)	16			16		16	
Two way Left Turn Lane							
Headway Factor	0.85	0.85	1.09	1.04	1.00	0.85	0.92
Turning Speed (mph)		9	15		9	15	9
Number of Detectors	2	1	1	2	1	1	1
Detector Template	Thru	Right	Left	Thru	Left	Left	Right
Leading Detector (ft)	100	20	20	100	20	20	20
Trailing Detector (ft)	0	0	0	0	0	0	0
Detector 1 Position(ft)	0	0	0	0	0	0	0
Detector 1 Size(ft)	6	20	20	6	20	20	20
Detector 1 Type	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
Detector 1 Queue (s)	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
Detector 2 Position(ft)	94			94			
Detector 2 Size(ft)	6			6			
Detector 2 Type	Cl+Ex			Cl+Ex			
Detector 2 Channel							
Detector 2 Extend (s)	0.0			0.0			
Turn Type	NA	Free	Prot	NA	Perm	Prot	Perm

Lane Group	EBT	EBR	WBL	WBT	NBU	NBL	NBR
Protected Phases	4		3	8		2	
Permitted Phases		Free			2		2
Detector Phase	4		3	8	2	2	2
Switch Phase							
Minimum Initial (s)	4.0		4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0		9.0	21.0	21.0	21.0	21.0
Total Split (s)	74.0		25.0	99.0	21.0	21.0	21.0
Total Split (%)	61.7%		20.8%	82.5%	17.5%	17.5%	17.5%
Maximum Green (s)	69.0		20.0	94.0	16.0	16.0	16.0
Yellow Time (s)	3.0		3.0	3.0	3.0	3.0	3.0
All-Red Time (s)	2.0		2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0		0.0	0.0		0.0	0.0
Total Lost Time (s)	5.0		5.0	5.0		5.0	5.0
Lead/Lag	Lag		Lead				
Lead-Lag Optimize?	Yes		Yes				
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0	3.0
Recall Mode	None		None	None	Max	Max	Max
Walk Time (s)	5.0			5.0	5.0	5.0	5.0
Flash Dont Walk (s)	11.0			11.0	11.0	11.0	11.0
Pedestrian Calls (#/hr)	0			0	0	0	0
Act Effct Green (s)	14.3	57.9	12.2	31.6		16.2	16.2
Actuated g/C Ratio	0.25	1.00	0.21	0.55		0.28	0.28
v/c Ratio	0.59	0.26	0.56	0.25		0.89	0.70
Control Delay	24.7	0.4	27.5	7.0		44.0	12.1
Queue Delay	0.0	0.0	0.0	0.0		0.0	0.0
Total Delay	24.7	0.4	27.5	7.0		44.0	12.1
LOS	C	A	C	A		D	B
Approach Delay	10.0			13.1		27.5	
Approach LOS	A			B		C	

Intersection Summary	
Area Type: Other	
Cycle Length: 120	
Actuated Cycle Length: 57.9	
Natural Cycle: 60	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.89	
Intersection Signal Delay: 18.2	Intersection LOS: B
Intersection Capacity Utilization 62.2%	ICU Level of Service B
Analysis Period (min) 15	

Splits and Phases: 5: Route 2 EB On/Off Ramps & Lake Street



Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Group Flow (vph)	312	478	198	464	507	542
v/c Ratio	0.59	0.26	0.56	0.25	0.89	0.70
Control Delay	24.7	0.4	27.5	7.0	44.0	12.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	24.7	0.4	27.5	7.0	44.0	12.1
Queue Length 50th (ft)	95	0	62	39	167	36
Queue Length 95th (ft)	176	0	116	53	#400	#191
Internal Link Dist (ft)	159			425	307	
Turn Bay Length (ft)		150	110			
Base Capacity (vph)	2132	1812	588	3455	568	769
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	0.26	0.34	0.13	0.89	0.70

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Traffic Volume (vph)	210	567	0	0	435	691	0	0	0	121	6	10
Future Volume (vph)	210	567	0	0	435	691	0	0	0	121	6	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	11	10	12	12	12	11	12	16
Storage Length (ft)	250		0	0		75	0		0	100		0
Storage Lanes	1		0	0		1	0		0	1		1
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	0.95	0.95	1.00
Frt						0.850						0.850
Flt Protected	0.950									0.950	0.956	
Satd. Flow (prot)	1805	1881	0	0	1837	1492	0	0	0	1579	1583	1830
Flt Permitted	0.950									0.950	0.956	
Satd. Flow (perm)	1805	1881	0	0	1837	1492	0	0	0	1579	1583	1830
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)						520						136
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		505			380			459			529	
Travel Time (s)		11.5			8.6			10.4			12.0	
Peak Hour Factor	0.88	0.88	0.88	0.92	0.92	0.92	0.92	0.92	0.92	0.81	0.81	0.81
Heavy Vehicles (%)	0%	1%	0%	0%	0%	1%	0%	0%	0%	5%	50%	0%
Adj. Flow (vph)	239	644	0	0	473	751	0	0	0	149	7	12
Shared Lane Traffic (%)										48%		
Lane Group Flow (vph)	239	644	0	0	473	751	0	0	0	77	79	12
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			11			11	
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	1.04	1.09	1.00	1.00	1.00	1.04	1.00	0.85
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2			2	1				1	2	1
Detector Template	Left	Thru			Thru	Right				Left	Thru	Right
Leading Detector (ft)	20	100			100	20				20	100	20
Trailing Detector (ft)	0	0			0	0				0	0	0
Detector 1 Position(ft)	0	0			0	0				0	0	0
Detector 1 Size(ft)	20	6			6	20				20	6	20
Detector 1 Type	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
Detector 1 Queue (s)	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
Detector 2 Position(ft)		94			94						94	
Detector 2 Size(ft)		6			6						6	
Detector 2 Type		Cl+Ex			Cl+Ex						Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0						0.0	
Turn Type	Prot	NA			NA	Perm				Split	NA	Perm

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Protected Phases	7	4			8					2	2	
Permitted Phases						8						2
Detector Phase	7	4			8	8				2	2	2
Switch Phase												
Minimum Initial (s)	4.0	4.0			4.0	4.0				4.0	4.0	4.0
Minimum Split (s)	8.5	22.0			22.0	22.0				22.0	22.0	22.0
Total Split (s)	16.0	38.0			22.0	22.0				22.0	22.0	22.0
Total Split (%)	26.7%	63.3%			36.7%	36.7%				36.7%	36.7%	36.7%
Maximum Green (s)	11.5	32.0			16.0	16.0				16.0	16.0	16.0
Yellow Time (s)	4.0	4.0			4.0	4.0				4.0	4.0	4.0
All-Red Time (s)	0.5	2.0			2.0	2.0				2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0			0.0	0.0				0.0	0.0	0.0
Total Lost Time (s)	4.5	6.0			6.0	6.0				6.0	6.0	6.0
Lead/Lag	Lead				Lag	Lag						
Lead-Lag Optimize?	Yes				Yes	Yes						
Vehicle Extension (s)	3.0	3.0			3.0	3.0				3.0	3.0	3.0
Recall Mode	None	None			None	None				Max	Max	Max
Walk Time (s)		5.0			5.0	5.0				5.0	5.0	5.0
Flash Dont Walk (s)		11.0			11.0	11.0				11.0	11.0	11.0
Pedestrian Calls (#/hr)		0			0	0				0	0	0
Act Effct Green (s)	10.8	31.4			16.0	16.0				16.0	16.0	16.0
Actuated g/C Ratio	0.18	0.53			0.27	0.27				0.27	0.27	0.27
v/c Ratio	0.73	0.65			0.96	0.96				0.18	0.19	0.02
Control Delay	37.8	13.8			56.5	34.1				18.4	18.4	0.1
Queue Delay	0.0	0.0			0.0	0.0				0.0	0.0	0.0
Total Delay	37.8	13.8			56.5	34.1				18.4	18.4	0.1
LOS	D	B			E	C				B	B	A
Approach Delay		20.3			42.7						17.1	
Approach LOS		C			D						B	

Intersection Summary

Area Type: Other

Cycle Length: 60

Actuated Cycle Length: 59.4

Natural Cycle: 70

Control Type: Actuated-Uncoordinated

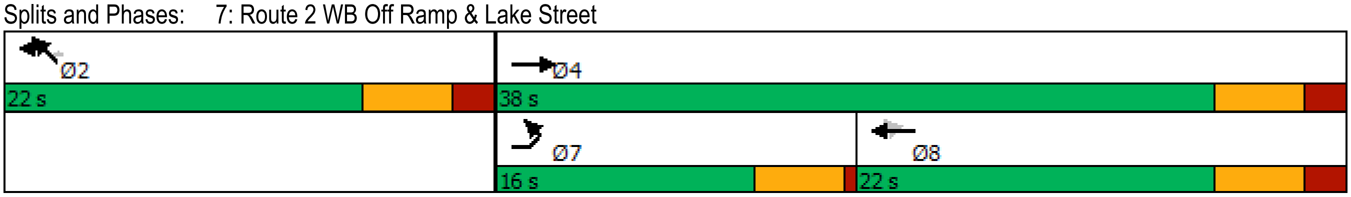
Maximum v/c Ratio: 0.96

Intersection Signal Delay: 32.1 Intersection LOS: C

Intersection Capacity Utilization 71.7% ICU Level of Service C

Analysis Period (min) 15

Splits and Phases: 7: Route 2 WB Off Ramp & Lake Street



Lane Group	EBL	EBT	WBT	WBR	NWL	NWT	NWR
Lane Group Flow (vph)	239	644	473	751	77	79	12
v/c Ratio	0.73	0.65	0.96	0.96	0.18	0.19	0.02
Control Delay	37.8	13.8	56.5	34.1	18.4	18.4	0.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	37.8	13.8	56.5	34.1	18.4	18.4	0.1
Queue Length 50th (ft)	81	150	168	80	22	23	0
Queue Length 95th (ft)	#164	238	#335	#314	47	48	0
Internal Link Dist (ft)		425	300			449	
Turn Bay Length (ft)	250			75	100		
Base Capacity (vph)	349	1014	495	782	426	427	592
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.68	0.64	0.96	0.96	0.18	0.19	0.02

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

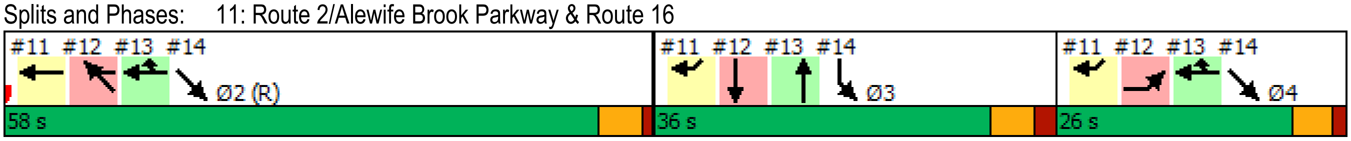
Lane Group	EBL	EBT	WBT	WBR	SWL	SWR	Ø3	Ø4
Lane Configurations			↑↑↑			↱↱		
Traffic Volume (vph)	0	0	1523	0	0	1019		
Future Volume (vph)	0	0	1523	0	0	1019		
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900		
Lane Width (ft)	13	13	13	13	13	13		
Lane Util. Factor	1.00	1.00	0.91	1.00	1.00	0.88		
Frt						0.850		
Flt Protected								
Satd. Flow (prot)	0	0	4729	0	0	2617		
Flt Permitted								
Satd. Flow (perm)	0	0	4729	0	0	2617		
Right Turn on Red				Yes		Yes		
Satd. Flow (RTOR)						9		
Link Speed (mph)		30	30		30			
Link Distance (ft)		201	192		296			
Travel Time (s)		4.6	4.4		6.7			
Peak Hour Factor	0.92	0.92	0.90	0.92	0.92	0.85		
Heavy Vehicles (%)	2%	2%	2%	2%	2%	1%		
Adj. Flow (vph)	0	0	1692	0	0	1199		
Shared Lane Traffic (%)								
Lane Group Flow (vph)	0	0	1692	0	0	1199		
Enter Blocked Intersection	No	No	No	No	No	No		
Lane Alignment	Left	Left	Left	Right	Left	Right		
Median Width(ft)		0	0		0			
Link Offset(ft)		0	0		0			
Crosswalk Width(ft)		16	16		16			
Two way Left Turn Lane								
Headway Factor	1.10	1.10	1.10	1.10	1.10	1.10		
Turning Speed (mph)	15			9	15	30		
Number of Detectors			2			1		
Detector Template			Thru			Right		
Leading Detector (ft)			100			20		
Trailing Detector (ft)			0			0		
Detector 1 Position(ft)			0			0		
Detector 1 Size(ft)			6			20		
Detector 1 Type			Cl+Ex			Cl+Ex		
Detector 1 Channel								
Detector 1 Extend (s)			0.0			0.0		
Detector 1 Queue (s)			0.0			0.0		
Detector 1 Delay (s)			0.0			0.0		
Detector 2 Position(ft)			94					
Detector 2 Size(ft)			6					
Detector 2 Type			Cl+Ex					
Detector 2 Channel								
Detector 2 Extend (s)			0.0					
Turn Type			NA			custom		
Protected Phases			2			3 4	3	4
Permitted Phases								
Detector Phase			2			3 4		

Lane Group	EBL	EBT	WBT	WBR	SWL	SWR	Ø3	Ø4
Switch Phase								
Minimum Initial (s)			10.0				10.0	10.0
Minimum Split (s)			15.0				19.0	15.0
Total Split (s)			58.0				36.0	26.0
Total Split (%)			48.3%				30%	22%
Maximum Green (s)			53.0				30.0	21.0
Yellow Time (s)			4.0				4.0	3.5
All-Red Time (s)			1.0				2.0	1.5
Lost Time Adjust (s)			0.0					
Total Lost Time (s)			5.0					
Lead/Lag							Lead	Lag
Lead-Lag Optimize?								
Vehicle Extension (s)			3.0				3.0	3.0
Recall Mode			C-Max				Max	Max
Walk Time (s)							5.0	
Flash Dont Walk (s)							8.0	
Pedestrian Calls (#/hr)							0	
Act Effct Green (s)			53.0			56.0		
Actuated g/C Ratio			0.44			0.47		
v/c Ratio			0.81			0.98		
Control Delay			5.7			52.6		
Queue Delay			2.3			0.0		
Total Delay			8.0			52.6		
LOS			A			D		
Approach Delay			8.0		52.6			
Approach LOS			A		D			

Intersection Summary

Area Type: CBD
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 16 (13%), Referenced to phase 2:WBT, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 1.04
Intersection Signal Delay: 26.5 Intersection LOS: C
Intersection Capacity Utilization 81.5% ICU Level of Service D
Analysis Period (min) 15

Splits and Phases: 11: Route 2/Alewife Brook Parkway & Route 16



Lane Group	WBT	SWR
Lane Group Flow (vph)	1692	1199
v/c Ratio	0.81	0.98
Control Delay	5.7	52.6
Queue Delay	2.3	0.0
Total Delay	8.0	52.6
Queue Length 50th (ft)	41	502
Queue Length 95th (ft)	m40	#613
Internal Link Dist (ft)	112	
Turn Bay Length (ft)		
Base Capacity (vph)	2088	1226
Starvation Cap Reductn	262	0
Spillback Cap Reductn	0	0
Storage Cap Reductn	0	0
Reduced v/c Ratio	0.93	0.98

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

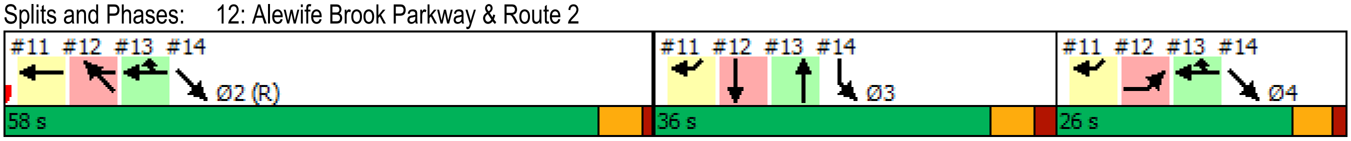
Lane Group	EBL	WBR	SBT	NWT
Lane Configurations				
Traffic Volume (vph)	486	163	489	1360
Future Volume (vph)	486	163	489	1360
Ideal Flow (vphpl)	1900	1900	1900	1900
Lane Width (ft)	13	16	13	13
Lane Util. Factor	0.97	1.00	0.95	0.95
Frt		0.865		
Flt Protected	0.950			
Satd. Flow (prot)	3224	1581	3291	3291
Flt Permitted	0.950			
Satd. Flow (perm)	3224	1581	3291	3291
Right Turn on Red				
Satd. Flow (RTOR)				
Link Speed (mph)			30	30
Link Distance (ft)			202	278
Travel Time (s)			4.6	6.3
Peak Hour Factor	0.97	0.94	0.85	0.90
Heavy Vehicles (%)	1%	6%	2%	2%
Adj. Flow (vph)	501	173	575	1511
Shared Lane Traffic (%)				
Lane Group Flow (vph)	501	173	575	1511
Enter Blocked Intersection	No	No	No	No
Lane Alignment	Left	R NA	Left	L NA
Median Width(ft)			0	0
Link Offset(ft)			0	0
Crosswalk Width(ft)			16	16
Two way Left Turn Lane				
Headway Factor	1.10	0.97	1.10	1.10
Turning Speed (mph)	15	30		
Number of Detectors	1	1	2	2
Detector Template	Left	Right	Thru	Thru
Leading Detector (ft)	20	20	100	100
Trailing Detector (ft)	0	0	0	0
Detector 1 Position(ft)	0	0	0	0
Detector 1 Size(ft)	20	20	6	6
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel				
Detector 1 Extend (s)	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0
Detector 2 Position(ft)			94	94
Detector 2 Size(ft)			6	6
Detector 2 Type			Cl+Ex	Cl+Ex
Detector 2 Channel				
Detector 2 Extend (s)			0.0	0.0
Turn Type	Prot	Prot	NA	NA
Protected Phases	4	2!	3	2!
Permitted Phases				
Detector Phase	4	2	3	2

Lane Group	EBL	WBR	SBT	NWT
Switch Phase				
Minimum Initial (s)	10.0	10.0	10.0	10.0
Minimum Split (s)	15.0	15.0	19.0	15.0
Total Split (s)	26.0	58.0	36.0	58.0
Total Split (%)	21.7%	48.3%	30.0%	48.3%
Maximum Green (s)	21.0	53.0	30.0	53.0
Yellow Time (s)	3.5	4.0	4.0	4.0
All-Red Time (s)	1.5	1.0	2.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	6.0	5.0
Lead/Lag	Lag		Lead	
Lead-Lag Optimize?				
Vehicle Extension (s)	3.0	3.0	3.0	3.0
Recall Mode	Max	C-Max	Max	C-Max
Walk Time (s)			5.0	
Flash Dont Walk (s)			8.0	
Pedestrian Calls (#/hr)			0	
Act Effct Green (s)	21.0	53.0	30.0	53.0
Actuated g/C Ratio	0.18	0.44	0.25	0.44
v/c Ratio	0.89	0.25	0.70	1.04
Control Delay	67.3	14.2	46.2	68.0
Queue Delay	0.0	2.4	0.0	0.8
Total Delay	67.3	16.6	46.2	68.8
LOS	E	B	D	E
Approach Delay			46.2	68.8
Approach LOS			D	E

Intersection Summary

Area Type: CBD
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 16 (13%), Referenced to phase 2:WBT, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 1.04
Intersection Signal Delay: 60.6 Intersection LOS: E
Intersection Capacity Utilization 100.1% ICU Level of Service G
Analysis Period (min) 15
! Phase conflict between lane groups.

Splits and Phases: 12: Alewife Brook Parkway & Route 2



Lane Group	EBL	WBR	SBT	NWT
Lane Group Flow (vph)	501	173	575	1511
v/c Ratio	0.89	0.25	0.70	1.04
Control Delay	67.3	14.2	46.2	68.0
Queue Delay	0.0	2.4	0.0	0.8
Total Delay	67.3	16.6	46.2	68.8
Queue Length 50th (ft)	197	82	213	~665
Queue Length 95th (ft)	#291	134	259	#804
Internal Link Dist (ft)			122	198
Turn Bay Length (ft)				
Base Capacity (vph)	564	698	822	1453
Starvation Cap Reductn	0	405	0	0
Spillback Cap Reductn	0	1	0	3
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.89	0.59	0.70	1.04

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

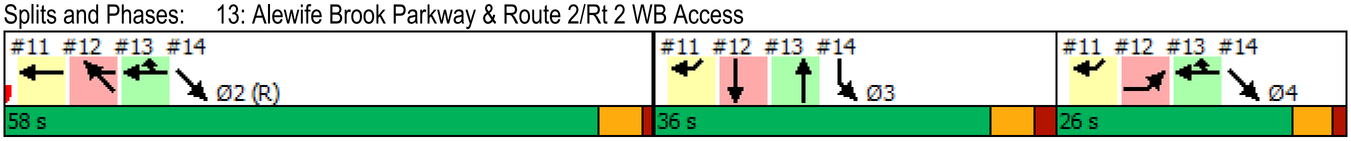
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	0	163	52	0	216	0	0	0	0
Future Volume (vph)	0	0	0	0	163	52	0	216	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		200	0		0	0		0
Storage Lanes	0		0	0		1	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	0.95	1.00	1.00	1.00	1.00
Ped Bike Factor												
Frt						0.850						
Flt Protected												
Satd. Flow (prot)	0	0	0	0	1613	1333	0	3154	0	0	0	0
Flt Permitted												
Satd. Flow (perm)	0	0	0	0	1613	1333	0	3154	0	0	0	0
Right Turn on Red			No			No	No		No			No
Satd. Flow (RTOR)												
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		161			1225			227			185	
Travel Time (s)		3.7			27.8			5.2			4.2	
Confl. Peds. (#/hr)						2						
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.90	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	2%	2%	2%	0%	6%	9%	2%	3%	2%	2%	2%	2%
Adj. Flow (vph)	0	0	0	0	177	57	0	240	0	0	0	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	0	0	0	177	57	0	240	0	0	0	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)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors					2	1		2				
Detector Template					Thru	Right		Thru				
Leading Detector (ft)					100	20		100				
Trailing Detector (ft)					0	0		0				
Detector 1 Position(ft)					0	0		0				
Detector 1 Size(ft)					6	20		6				
Detector 1 Type					Cl+Ex	Cl+Ex		Cl+Ex				
Detector 1 Channel												
Detector 1 Extend (s)					0.0	0.0		0.0				
Detector 1 Queue (s)					0.0	0.0		0.0				
Detector 1 Delay (s)					0.0	0.0		0.0				
Detector 2 Position(ft)					94			94				
Detector 2 Size(ft)					6			6				
Detector 2 Type					Cl+Ex			Cl+Ex				
Detector 2 Channel												
Detector 2 Extend (s)					0.0			0.0				

Lane Group	Ø2	Ø4
Lane Configurations		
Traffic Volume (vph)		
Future Volume (vph)		
Ideal Flow (vphpl)		
Storage Length (ft)		
Storage Lanes		
Taper Length (ft)		
Lane Util. Factor		
Ped Bike Factor		
Frt		
Flt Protected		
Satd. Flow (prot)		
Flt Permitted		
Satd. Flow (perm)		
Right Turn on Red		
Satd. Flow (RTOR)		
Link Speed (mph)		
Link Distance (ft)		
Travel Time (s)		
Confl. Peds. (#/hr)		
Peak Hour Factor		
Heavy Vehicles (%)		
Adj. Flow (vph)		
Shared Lane Traffic (%)		
Lane Group Flow (vph)		
Enter Blocked Intersection		
Lane Alignment		
Median Width(ft)		
Link Offset(ft)		
Crosswalk Width(ft)		
Two way Left Turn Lane		
Headway Factor		
Turning Speed (mph)		
Number of Detectors		
Detector Template		
Leading Detector (ft)		
Trailing Detector (ft)		
Detector 1 Position(ft)		
Detector 1 Size(ft)		
Detector 1 Type		
Detector 1 Channel		
Detector 1 Extend (s)		
Detector 1 Queue (s)		
Detector 1 Delay (s)		
Detector 2 Position(ft)		
Detector 2 Size(ft)		
Detector 2 Type		
Detector 2 Channel		
Detector 2 Extend (s)		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Turn Type					NA	Prot		NA				
Protected Phases					2 4	2 4		3				
Permitted Phases												
Detector Phase					2 4	2 4		3				
Switch Phase												
Minimum Initial (s)								10.0				
Minimum Split (s)								19.0				
Total Split (s)								36.0				
Total Split (%)								30.0%				
Maximum Green (s)								30.0				
Yellow Time (s)								4.0				
All-Red Time (s)								2.0				
Lost Time Adjust (s)								0.0				
Total Lost Time (s)								6.0				
Lead/Lag								Lead				
Lead-Lag Optimize?												
Vehicle Extension (s)								3.0				
Recall Mode								Max				
Walk Time (s)								5.0				
Flash Dont Walk (s)								8.0				
Pedestrian Calls (#/hr)								0				
Act Effct Green (s)					79.0	79.0		30.0				
Actuated g/C Ratio					0.66	0.66		0.25				
v/c Ratio					0.17	0.06		0.30				
Control Delay					8.3	7.6		37.8				
Queue Delay					0.1	0.0		0.0				
Total Delay					8.4	7.6		37.8				
LOS					A	A		D				
Approach Delay					8.2			37.8				
Approach LOS					A			D				

Intersection Summary	
Area Type: CBD	
Cycle Length: 120	
Actuated Cycle Length: 120	
Offset: 16 (13%), Referenced to phase 2:WBT, Start of Green	
Natural Cycle: 90	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 1.04	
Intersection Signal Delay: 23.2	Intersection LOS: C
Intersection Capacity Utilization 27.0%	ICU Level of Service A
Analysis Period (min) 15	

Splits and Phases: 13: Alewife Brook Parkway & Route 2/Rt 2 WB Access



Lane Group	Ø2	Ø4
Turn Type		
Protected Phases	2	4
Permitted Phases		
Detector Phase		
Switch Phase		
Minimum Initial (s)	10.0	10.0
Minimum Split (s)	15.0	15.0
Total Split (s)	58.0	26.0
Total Split (%)	48%	22%
Maximum Green (s)	53.0	21.0
Yellow Time (s)	4.0	3.5
All-Red Time (s)	1.0	1.5
Lost Time Adjust (s)		
Total Lost Time (s)		
Lead/Lag		Lag
Lead-Lag Optimize?		
Vehicle Extension (s)	3.0	3.0
Recall Mode	C-Max	Max
Walk Time (s)		
Flash Dont Walk (s)		
Pedestrian Calls (#/hr)		
Act Effct Green (s)		
Actuated g/C Ratio		
v/c Ratio		
Control Delay		
Queue Delay		
Total Delay		
LOS		
Approach Delay		
Approach LOS		

Intersection Summary

Lane Group	WBT	WBR	NBT
Lane Group Flow (vph)	177	57	240
v/c Ratio	0.17	0.06	0.30
Control Delay	8.3	7.6	37.8
Queue Delay	0.1	0.0	0.0
Total Delay	8.4	7.6	37.8
Queue Length 50th (ft)	48	15	80
Queue Length 95th (ft)	78	30	117
Internal Link Dist (ft)	1145		147
Turn Bay Length (ft)		200	
Base Capacity (vph)	1061	877	788
Starvation Cap Reductn	0	0	0
Spillback Cap Reductn	203	0	0
Storage Cap Reductn	0	0	0
Reduced v/c Ratio	0.21	0.06	0.30

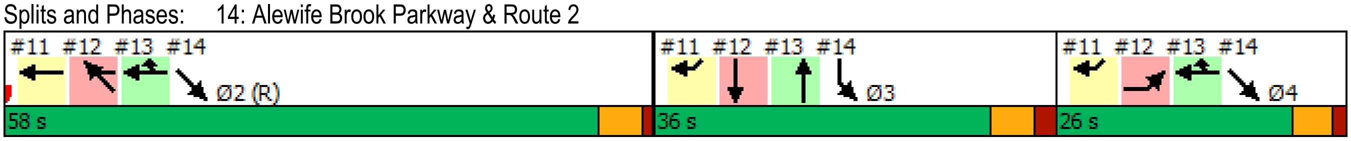
Intersection Summary

Lane Group	SBL	SBR	SEL	SET	NWT	NWR	Ø2	Ø4
Lane Configurations								
Traffic Volume (vph)	489	0	0	1064	0	0		
Future Volume (vph)	489	0	0	1064	0	0		
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900		
Lane Width (ft)	13	13	13	13	13	13		
Lane Util. Factor	0.97	1.00	1.00	0.95	1.00	1.00		
Frt								
Flt Protected	0.950							
Satd. Flow (prot)	3193	0	0	3324	0	0		
Flt Permitted	0.950							
Satd. Flow (perm)	3193	0	0	3324	0	0		
Right Turn on Red	Yes	Yes				Yes		
Satd. Flow (RTOR)	234							
Link Speed (mph)	30			30	30			
Link Distance (ft)	155			297	139			
Travel Time (s)	3.5			6.8	3.2			
Peak Hour Factor	0.85	0.92	0.92	0.97	0.92	0.92		
Heavy Vehicles (%)	2%	2%	2%	1%	2%	2%		
Adj. Flow (vph)	575	0	0	1097	0	0		
Shared Lane Traffic (%)								
Lane Group Flow (vph)	575	0	0	1097	0	0		
Enter Blocked Intersection	No	No	No	No	No	No		
Lane Alignment	Left	Right	Left	Left	Left	Right		
Median Width(ft)	26			0	0			
Link Offset(ft)	0			0	0			
Crosswalk Width(ft)	16			16	16			
Two way Left Turn Lane								
Headway Factor	1.10	1.10	1.10	1.10	1.10	1.10		
Turning Speed (mph)	30	9	15			9		
Number of Detectors	1			2				
Detector Template	Left			Thru				
Leading Detector (ft)	20			100				
Trailing Detector (ft)	0			0				
Detector 1 Position(ft)	0			0				
Detector 1 Size(ft)	20			6				
Detector 1 Type	Cl+Ex			Cl+Ex				
Detector 1 Channel								
Detector 1 Extend (s)	0.0			0.0				
Detector 1 Queue (s)	0.0			0.0				
Detector 1 Delay (s)	0.0			0.0				
Detector 2 Position(ft)				94				
Detector 2 Size(ft)				6				
Detector 2 Type				Cl+Ex				
Detector 2 Channel								
Detector 2 Extend (s)				0.0				
Turn Type	Prot			NA				
Protected Phases	3			2 4			2	4
Permitted Phases								
Detector Phase	3			2 4				

Lane Group	SBL	SBR	SEL	SET	NWT	NWR	Ø2	Ø4
Switch Phase								
Minimum Initial (s)	10.0						10.0	10.0
Minimum Split (s)	19.0						15.0	15.0
Total Split (s)	36.0						58.0	26.0
Total Split (%)	30.0%						48%	22%
Maximum Green (s)	30.0						53.0	21.0
Yellow Time (s)	4.0						4.0	3.5
All-Red Time (s)	2.0						1.0	1.5
Lost Time Adjust (s)	0.0							
Total Lost Time (s)	6.0							
Lead/Lag	Lead							Lag
Lead-Lag Optimize?								
Vehicle Extension (s)	3.0						3.0	3.0
Recall Mode	Max						C-Max	Max
Walk Time (s)	5.0							
Flash Dont Walk (s)	8.0							
Pedestrian Calls (#/hr)	0							
Act Effct Green (s)	30.0			79.0				
Actuated g/C Ratio	0.25			0.66				
v/c Ratio	0.59			0.50				
Control Delay	2.3			11.4				
Queue Delay	0.9			0.0				
Total Delay	3.2			11.4				
LOS	A			B				
Approach Delay	3.2			11.4				
Approach LOS	A			B				

Intersection Summary	
Area Type: CBD	
Cycle Length: 120	
Actuated Cycle Length: 120	
Offset: 16 (13%), Referenced to phase 2:WBT, Start of Green	
Natural Cycle: 90	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 1.04	
Intersection Signal Delay: 8.6	Intersection LOS: A
Intersection Capacity Utilization 57.3%	ICU Level of Service B
Analysis Period (min) 15	

Splits and Phases: 14: Alewife Brook Parkway & Route 2



Lane Group	SBL	SET
Lane Group Flow (vph)	575	1097
v/c Ratio	0.59	0.50
Control Delay	2.3	11.4
Queue Delay	0.9	0.0
Total Delay	3.2	11.4
Queue Length 50th (ft)	5	209
Queue Length 95th (ft)	0	258
Internal Link Dist (ft)	75	217
Turn Bay Length (ft)		
Base Capacity (vph)	973	2188
Starvation Cap Reductn	168	0
Spillback Cap Reductn	0	0
Storage Cap Reductn	0	0
Reduced v/c Ratio	0.71	0.50

Intersection Summary

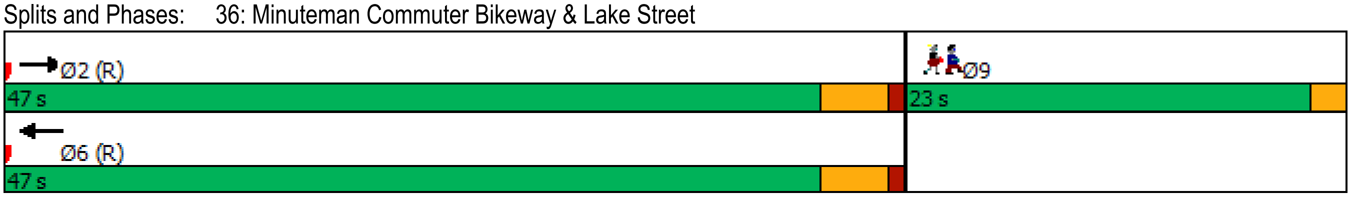
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	578	0	0	1096	0	0	0	0	0	0	0
Future Volume (vph)	0	578	0	0	1096	0	0	0	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	15	15	15	16	16	16	12	12	12	12	12	12
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												
Flt Protected												
Satd. Flow (prot)	0	2049	0	0	2153	0	0	0	0	0	0	0
Flt Permitted												
Satd. Flow (perm)	0	2049	0	0	2153	0	0	0	0	0	0	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)												
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		135			215			175			206	
Travel Time (s)		3.1			4.9			4.0			4.7	
Peak Hour Factor	0.84	0.84	0.84	0.97	0.97	0.97	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	2%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Adj. Flow (vph)	0	688	0	0	1130	0	0	0	0	0	0	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	688	0	0	1130	0	0	0	0	0	0	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)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	0.88	0.88	0.88	0.85	0.85	0.85	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		2			2							
Detector Template		Thru			Thru							
Leading Detector (ft)		100			100							
Trailing Detector (ft)		0			0							
Detector 1 Position(ft)		0			0							
Detector 1 Size(ft)		6			6							
Detector 1 Type		Cl+Ex			Cl+Ex							
Detector 1 Channel												
Detector 1 Extend (s)		0.0			0.0							
Detector 1 Queue (s)		0.0			0.0							
Detector 1 Delay (s)		0.0			0.0							
Detector 2 Position(ft)		94			94							
Detector 2 Size(ft)		6			6							
Detector 2 Type		Cl+Ex			Cl+Ex							
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0							
Turn Type		NA			NA							
Protected Phases		2			6							
Permitted Phases												
Detector Phase		2			6							

Lane Group	Ø9
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Ideal Flow (vphpl)	
Lane Width (ft)	
Lane Util. Factor	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (mph)	
Link Distance (ft)	
Travel Time (s)	
Peak Hour Factor	
Heavy Vehicles (%)	
Adj. Flow (vph)	
Shared Lane Traffic (%)	
Lane Group Flow (vph)	
Enter Blocked Intersection	
Lane Alignment	
Median Width(ft)	
Link Offset(ft)	
Crosswalk Width(ft)	
Two way Left Turn Lane	
Headway Factor	
Turning Speed (mph)	
Number of Detectors	
Detector Template	
Leading Detector (ft)	
Trailing Detector (ft)	
Detector 1 Position(ft)	
Detector 1 Size(ft)	
Detector 1 Type	
Detector 1 Channel	
Detector 1 Extend (s)	
Detector 1 Queue (s)	
Detector 1 Delay (s)	
Detector 2 Position(ft)	
Detector 2 Size(ft)	
Detector 2 Type	
Detector 2 Channel	
Detector 2 Extend (s)	
Turn Type	
Protected Phases	9
Permitted Phases	
Detector Phase	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Switch Phase												
Minimum Initial (s)		4.0			4.0							
Minimum Split (s)		20.5			20.5							
Total Split (s)		47.0			47.0							
Total Split (%)		67.1%			67.1%							
Maximum Green (s)		42.5			42.5							
Yellow Time (s)		3.5			3.5							
All-Red Time (s)		1.0			1.0							
Lost Time Adjust (s)		0.0			0.0							
Total Lost Time (s)		4.5			4.5							
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)		3.0			3.0							
Recall Mode		C-Max			C-Max							
Walk Time (s)												
Flash Dont Walk (s)												
Pedestrian Calls (#/hr)												
Act Effct Green (s)		47.5			47.5							
Actuated g/C Ratio		0.68			0.68							
v/c Ratio		0.49			0.77							
Control Delay		6.9			17.0							
Queue Delay		37.8			51.3							
Total Delay		44.8			68.2							
LOS		D			E							
Approach Delay		44.8			68.2							
Approach LOS		D			E							

Intersection Summary	
Area Type: Other	
Cycle Length: 70	
Actuated Cycle Length: 70	
Offset: 16 (23%), Referenced to phase 2:EBT and 6:WBT, Start of Green	
Natural Cycle: 60	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.77	
Intersection Signal Delay: 59.3	Intersection LOS: E
Intersection Capacity Utilization 61.4%	ICU Level of Service B
Analysis Period (min) 15	

Splits and Phases: 36: Minuteman Commuter Bikeway & Lake Street



Lane Group	Ø9
Switch Phase	
Minimum Initial (s)	4.0
Minimum Split (s)	18.0
Total Split (s)	23.0
Total Split (%)	33%
Maximum Green (s)	21.0
Yellow Time (s)	2.0
All-Red Time (s)	0.0
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	
Lead-Lag Optimize?	
Vehicle Extension (s)	3.0
Recall Mode	None
Walk Time (s)	5.0
Flash Dont Walk (s)	11.0
Pedestrian Calls (#/hr)	304
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	

Intersection Summary

Lane Group	EBT	WBT
Lane Group Flow (vph)	688	1130
v/c Ratio	0.49	0.77
Control Delay	6.9	17.0
Queue Delay	37.8	51.3
Total Delay	44.8	68.2
Queue Length 50th (ft)	119	535
Queue Length 95th (ft)	162	m591
Internal Link Dist (ft)	55	135
Turn Bay Length (ft)		
Base Capacity (vph)	1390	1460
Starvation Cap Reductn	0	783
Spillback Cap Reductn	742	0
Storage Cap Reductn	0	0
Reduced v/c Ratio	1.06	1.67

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	30	520	28	4	957	0	22	4	3	3	7	117
Future Volume (vph)	30	520	28	4	957	0	22	4	3	3	7	117
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	14	14	14	13	13	13	12	12	12	12	12	12
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		0.993						0.986			0.876	
Flt Protected		0.997						0.963			0.999	
Satd. Flow (prot)	0	1984	0	0	1944	0	0	1804	0	0	1663	0
Flt Permitted		0.918			0.998			0.464			0.992	
Satd. Flow (perm)	0	1827	0	0	1940	0	0	869	0	0	1651	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		4						4			150	
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		215			1126			206			208	
Travel Time (s)		4.9			25.6			4.7			4.7	
Peak Hour Factor	0.91	0.91	0.91	0.87	0.87	0.87	0.75	0.75	0.75	0.78	0.78	0.78
Heavy Vehicles (%)	0%	1%	5%	0%	1%	0%	0%	0%	0%	0%	0%	0%
Adj. Flow (vph)	33	571	31	5	1100	0	29	5	4	4	9	150
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	635	0	0	1105	0	0	38	0	0	163	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)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	0.92	0.92	0.92	0.96	0.96	0.96	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	Perm	NA		Perm	NA		pm+pt	NA		Perm	NA	
Protected Phases		2			6		3	8			4	
Permitted Phases	2			6			8			4		
Detector Phase	2	2		6	6		3	8		4	4	

Lane Group	Ø9
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Ideal Flow (vphpl)	
Lane Width (ft)	
Lane Util. Factor	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (mph)	
Link Distance (ft)	
Travel Time (s)	
Peak Hour Factor	
Heavy Vehicles (%)	
Adj. Flow (vph)	
Shared Lane Traffic (%)	
Lane Group Flow (vph)	
Enter Blocked Intersection	
Lane Alignment	
Median Width(ft)	
Link Offset(ft)	
Crosswalk Width(ft)	
Two way Left Turn Lane	
Headway Factor	
Turning Speed (mph)	
Number of Detectors	
Detector Template	
Leading Detector (ft)	
Trailing Detector (ft)	
Detector 1 Position(ft)	
Detector 1 Size(ft)	
Detector 1 Type	
Detector 1 Channel	
Detector 1 Extend (s)	
Detector 1 Queue (s)	
Detector 1 Delay (s)	
Detector 2 Position(ft)	
Detector 2 Size(ft)	
Detector 2 Type	
Detector 2 Channel	
Detector 2 Extend (s)	
Turn Type	
Protected Phases	9
Permitted Phases	
Detector Phase	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Switch Phase												
Minimum Initial (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Minimum Split (s)	21.0	21.0		21.0	21.0		9.0	21.0		13.0	13.0	
Total Split (s)	27.0	27.0		27.0	27.0		10.0	23.0		13.0	13.0	
Total Split (%)	38.6%	38.6%		38.6%	38.6%		14.3%	32.9%		18.6%	18.6%	
Maximum Green (s)	22.5	22.5		22.5	22.5		5.5	18.5		8.5	8.5	
Yellow Time (s)	3.5	3.5		3.5	3.5		3.0	3.0		3.0	3.0	
All-Red Time (s)	1.0	1.0		1.0	1.0		1.5	1.5		1.5	1.5	
Lost Time Adjust (s)		0.0			0.0			0.0			0.0	
Total Lost Time (s)		4.5			4.5			4.5			4.5	
Lead/Lag							Lead			Lag	Lag	
Lead-Lag Optimize?							Yes			Yes	Yes	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	C-Max	C-Max		C-Max	C-Max		None	Min		Min	Min	
Walk Time (s)												
Flash Dont Walk (s)												
Pedestrian Calls (#/hr)												
Act Effct Green (s)		42.6			42.6			7.6			7.6	
Actuated g/C Ratio		0.61			0.61			0.11			0.11	
v/c Ratio		0.57			0.94			0.39			0.52	
Control Delay		19.6			34.8			37.7			13.0	
Queue Delay		16.1			47.0			0.0			0.6	
Total Delay		35.6			81.8			37.7			13.6	
LOS		D			F			D			B	
Approach Delay		35.6			81.8			37.7			13.6	
Approach LOS		D			F			D			B	

Intersection Summary

Area Type: Other

Cycle Length: 70

Actuated Cycle Length: 70

Offset: 0 (0%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green, Master Intersection

Natural Cycle: 100

Control Type: Actuated-Coordinated

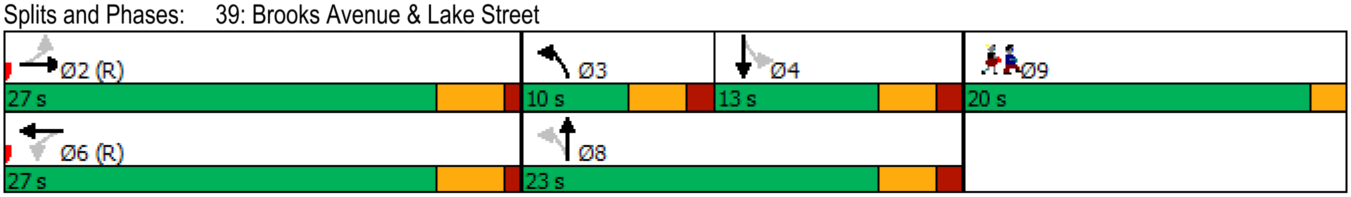
Maximum v/c Ratio: 0.94

Intersection Signal Delay: 60.1 Intersection LOS: E

Intersection Capacity Utilization 73.4% ICU Level of Service D

Analysis Period (min) 15

Splits and Phases: 39: Brooks Avenue & Lake Street



Lane Group	Ø9
Switch Phase	
Minimum Initial (s)	4.0
Minimum Split (s)	20.0
Total Split (s)	20.0
Total Split (%)	29%
Maximum Green (s)	18.0
Yellow Time (s)	2.0
All-Red Time (s)	0.0
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	
Lead-Lag Optimize?	
Vehicle Extension (s)	3.0
Recall Mode	None
Walk Time (s)	5.0
Flash Dont Walk (s)	11.0
Pedestrian Calls (#/hr)	50
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	
Intersection Summary	

Lane Group	EBT	WBT	NBT	SBT
Lane Group Flow (vph)	635	1105	38	163
v/c Ratio	0.57	0.94	0.39	0.52
Control Delay	19.6	34.8	37.7	13.0
Queue Delay	16.1	47.0	0.0	0.6
Total Delay	35.6	81.8	37.7	13.6
Queue Length 50th (ft)	224	~557	14	5
Queue Length 95th (ft)	#326	#790	32	37
Internal Link Dist (ft)	135	1046	126	128
Turn Bay Length (ft)				
Base Capacity (vph)	1113	1180	232	344
Starvation Cap Reductn	470	0	0	0
Spillback Cap Reductn	0	517	1	39
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.99	1.67	0.16	0.53

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

2020 Baseline Weekday Evening Peak Hour

Intersection	
Int Delay, s/veh	0.4

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	786	3	1	573	9	4
Future Vol, veh/h	786	3	1	573	9	4
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	83	83	94	94	75	75
Heavy Vehicles, %	0	0	0	0	29	0
Mvmt Flow	947	4	1	610	12	5

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	951	0	1561	949
Stage 1	-	-	-	-	949	-
Stage 2	-	-	-	-	612	-
Critical Hdwy	-	-	4.1	-	6.69	6.2
Critical Hdwy Stg 1	-	-	-	-	5.69	-
Critical Hdwy Stg 2	-	-	-	-	5.69	-
Follow-up Hdwy	-	-	2.2	-	3.761	3.3
Pot Cap-1 Maneuver	-	-	730	-	107	319
Stage 1	-	-	-	-	337	-
Stage 2	-	-	-	-	492	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	730	-	107	319
Mov Cap-2 Maneuver	-	-	-	-	107	-
Stage 1	-	-	-	-	337	-
Stage 2	-	-	-	-	491	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0	35.6
HCM LOS			E

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	135	-	-	730	-
HCM Lane V/C Ratio	0.128	-	-	0.001	-
HCM Control Delay (s)	35.6	-	-	9.9	0
HCM Lane LOS	E	-	-	A	A
HCM 95th %tile Q(veh)	0.4	-	-	0	-

Intersection	
Int Delay, s/veh	0.7

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	784	6	9	559	15	5
Future Vol, veh/h	784	6	9	559	15	5
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	87	87	89	89	75	75
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	901	7	10	628	20	7

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	908	0	1553	905
Stage 1	-	-	-	-	905	-
Stage 2	-	-	-	-	648	-
Critical Hdwy	-	-	4.1	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	-	-	2.2	-	3.5	3.3
Pot Cap-1 Maneuver	-	-	758	-	126	338
Stage 1	-	-	-	-	398	-
Stage 2	-	-	-	-	524	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	758	-	123	338
Mov Cap-2 Maneuver	-	-	-	-	123	-
Stage 1	-	-	-	-	398	-
Stage 2	-	-	-	-	514	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.2	35.1
HCM LOS			E

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	146	-	-	758	-
HCM Lane V/C Ratio	0.183	-	-	0.013	-
HCM Control Delay (s)	35.1	-	-	9.8	0
HCM Lane LOS	E	-	-	A	A
HCM 95th %tile Q(veh)	0.6	-	-	0	-

Intersection	
Int Delay, s/veh	0.2

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	788	1	1	562	6	4
Future Vol, veh/h	788	1	1	562	6	4
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	87	87	89	89	75	75
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	906	1	1	631	8	5

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	907	0	1540	907
Stage 1	-	-	-	-	907	-
Stage 2	-	-	-	-	633	-
Critical Hdwy	-	-	4.1	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	-	-	2.2	-	3.5	3.3
Pot Cap-1 Maneuver	-	-	759	-	128	337
Stage 1	-	-	-	-	397	-
Stage 2	-	-	-	-	533	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	759	-	128	337
Mov Cap-2 Maneuver	-	-	-	-	128	-
Stage 1	-	-	-	-	397	-
Stage 2	-	-	-	-	532	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0	28
HCM LOS			D

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	170	-	-	759	-
HCM Lane V/C Ratio	0.078	-	-	0.001	-
HCM Control Delay (s)	28	-	-	9.8	0
HCM Lane LOS	D	-	-	A	A
HCM 95th %tile Q(veh)	0.3	-	-	0	-

Intersection	
Int Delay, s/veh	1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	4	769	19	11	549	8	13	1	6	3	0	1
Future Vol, veh/h	4	769	19	11	549	8	13	1	6	3	0	1
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	86	86	86	86	86	86	75	75	75	75	75	75
Heavy Vehicles, %	0	0	0	0	0	0	0	0	0	0	0	0
Mvmt Flow	5	894	22	13	638	9	17	1	8	4	0	1

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	647	0	0	916	0	0	1584	1588	905	1589	1595	643
Stage 1	-	-	-	-	-	-	915	915	-	669	669	-
Stage 2	-	-	-	-	-	-	669	673	-	920	926	-
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	948	-	-	753	-	-	89	109	338	88	108	477
Stage 1	-	-	-	-	-	-	329	354	-	450	459	-
Stage 2	-	-	-	-	-	-	450	457	-	327	350	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	948	-	-	753	-	-	86	105	338	83	104	477
Mov Cap-2 Maneuver	-	-	-	-	-	-	86	105	-	83	104	-
Stage 1	-	-	-	-	-	-	325	350	-	445	447	-
Stage 2	-	-	-	-	-	-	437	445	-	315	346	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0.2	46.9	41.1
HCM LOS			E	E

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	112	948	-	-	753	-	-	105
HCM Lane V/C Ratio	0.238	0.005	-	-	0.017	-	-	0.051
HCM Control Delay (s)	46.9	8.8	0	-	9.9	0	-	41.1
HCM Lane LOS	E	A	A	-	A	A	-	E
HCM 95th %tile Q(veh)	0.9	0	-	-	0.1	-	-	0.2

Intersection	
Int Delay, s/veh	6.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✣			✣			✣			✣	
Traffic Vol, veh/h	18	756	4	60	548	15	9	0	43	9	0	11
Future Vol, veh/h	18	756	4	60	548	15	9	0	43	9	0	11
Conflicting Peds, #/hr	0	0	0	304	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	83	83	83	88	88	88	81	81	81	80	80	80
Heavy Vehicles, %	0	0	0	0	0	0	0	0	0	0	0	0
Mvmt Flow	22	911	5	68	623	17	11	0	53	11	0	14

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	640	0	0	1220	0	0	2037	2038	1218	1752	2032	632
Stage 1	-	-	-	-	-	-	1262	1262	-	768	768	-
Stage 2	-	-	-	-	-	-	775	776	-	984	1264	-
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	954	-	-	579	-	-	43	57	222	68	58	484
Stage 1	-	-	-	-	-	-	210	243	-	397	414	-
Stage 2	-	-	-	-	-	-	394	410	-	302	243	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	954	-	-	432	-	-	24	31	166	36	31	484
Mov Cap-2 Maneuver	-	-	-	-	-	-	24	31	-	36	31	-
Stage 1	-	-	-	-	-	-	150	173	-	378	313	-
Stage 2	-	-	-	-	-	-	289	310	-	196	173	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.2	1.4	133.7	78.1
HCM LOS			F	F

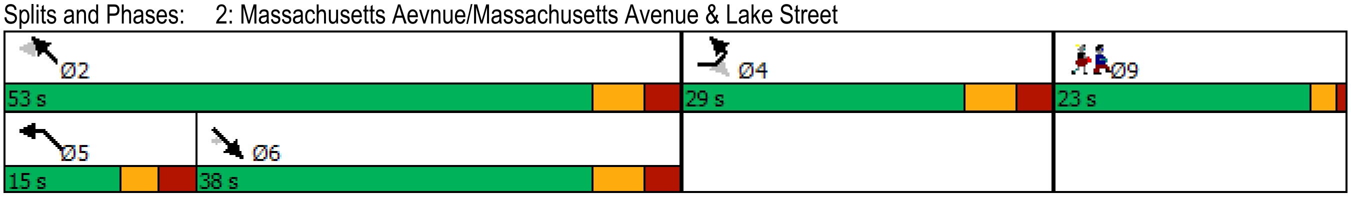
Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	82	954	-	-	432	-	-	73
HCM Lane V/C Ratio	0.783	0.023	-	-	0.158	-	-	0.342
HCM Control Delay (s)	133.7	8.9	0	-	14.9	0	-	78.1
HCM Lane LOS	F	A	A	-	B	A	-	F
HCM 95th %tile Q(veh)	3.9	0.1	-	-	0.6	-	-	1.3

Lane Group	EBL	EBR	SET	SER	NWL	NWT	Ø9
Lane Configurations							
Traffic Volume (vph)	407	261	635	181	335	714	
Future Volume (vph)	407	261	635	181	335	714	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	
Lane Width (ft)	16	16	11	10	11	12	
Storage Length (ft)	0	100		55	150		
Storage Lanes	1	1		1	1		
Taper Length (ft)	25				25		
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	1.00	
Frt		0.850		0.850			
Flt Protected	0.950				0.950		
Satd. Flow (prot)	2046	1830	3421	1507	1745	1863	
Flt Permitted	0.950				0.233		
Satd. Flow (perm)	2046	1830	3421	1507	428	1863	
Right Turn on Red		Yes		Yes			
Satd. Flow (RTOR)		139		84			
Link Speed (mph)	30		30			30	
Link Distance (ft)	1126		640			645	
Travel Time (s)	25.6		14.5			14.7	
Peak Hour Factor	0.88	0.88	0.92	0.92	0.92	0.92	
Heavy Vehicles (%)	0%	0%	2%	0%	0%	2%	
Adj. Flow (vph)	463	297	690	197	364	776	
Shared Lane Traffic (%)							
Lane Group Flow (vph)	463	297	690	197	364	776	
Enter Blocked Intersection	No	No	No	No	No	No	
Lane Alignment	Left	Right	Left	Right	Left	Left	
Median Width(ft)	16		11			11	
Link Offset(ft)	0		0			0	
Crosswalk Width(ft)	16		16			16	
Two way Left Turn Lane							
Headway Factor	0.85	0.85	1.04	1.09	1.04	1.00	
Turning Speed (mph)	15	9		9	15		
Number of Detectors	1	1	2	1	1	2	
Detector Template	Left	Right	Thru	Right	Left	Thru	
Leading Detector (ft)	20	20	100	20	20	100	
Trailing Detector (ft)	0	0	0	0	0	0	
Detector 1 Position(ft)	0	0	0	0	0	0	
Detector 1 Size(ft)	20	20	6	20	20	6	
Detector 1 Type	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	
Detector 1 Queue (s)	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	
Detector 2 Position(ft)			94			94	
Detector 2 Size(ft)			6			6	
Detector 2 Type			Cl+Ex			Cl+Ex	
Detector 2 Channel							
Detector 2 Extend (s)			0.0			0.0	
Turn Type	Prot	Perm	NA	Perm	pm+pt	NA	

Lane Group	EBL	EBR	SET	SER	NWL	NWT	Ø9
Protected Phases	4		6		5	2	9
Permitted Phases		4		6	2		
Detector Phase	4	4	6	6	5	2	
Switch Phase							
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	23.0	23.0	23.0	23.0	10.0	23.0	19.0
Total Split (s)	29.0	29.0	38.0	38.0	15.0	53.0	23.0
Total Split (%)	27.6%	27.6%	36.2%	36.2%	14.3%	50.5%	22%
Maximum Green (s)	22.0	22.0	31.0	31.0	9.0	46.0	20.0
Yellow Time (s)	4.0	4.0	4.0	4.0	3.0	4.0	2.0
All-Red Time (s)	3.0	3.0	3.0	3.0	3.0	3.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	7.0	7.0	7.0	7.0	6.0	7.0	
Lead/Lag			Lag	Lag	Lead		
Lead-Lag Optimize?			Yes	Yes	Yes		
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None	Max	Max	None	Max	None
Walk Time (s)							5.0
Flash Dont Walk (s)							11.0
Pedestrian Calls (#/hr)							35
Act Effct Green (s)	22.2	22.2	31.3	31.3	47.5	46.5	
Actuated g/C Ratio	0.24	0.24	0.34	0.34	0.51	0.50	
v/c Ratio	0.95	0.55	0.60	0.35	1.06	0.84	
Control Delay	68.7	21.9	30.0	16.8	86.8	32.4	
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	
Total Delay	68.7	21.9	30.0	16.8	86.8	32.4	
LOS	E	C	C	B	F	C	
Approach Delay	50.4		27.0			49.8	
Approach LOS	D		C			D	

Intersection Summary	
Area Type: Other	
Cycle Length: 105	
Actuated Cycle Length: 93.4	
Natural Cycle: 90	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 1.06	
Intersection Signal Delay: 42.7	Intersection LOS: D
Intersection Capacity Utilization 75.3%	ICU Level of Service D
Analysis Period (min) 15	

Splits and Phases: 2: Massachusetts Aevnue/Massachusetts Avenue & Lake Street



Lane Group	EBL	EBR	SET	SER	NWL	NWT
Lane Group Flow (vph)	463	297	690	197	364	776
v/c Ratio	0.95	0.55	0.60	0.35	1.06	0.84
Control Delay	68.7	21.9	30.0	16.8	86.8	32.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	68.7	21.9	30.0	16.8	86.8	32.4
Queue Length 50th (ft)	~324	89	202	54	~191	453
Queue Length 95th (ft)	#499	170	265	117	#388	#702
Internal Link Dist (ft)	1046		560			565
Turn Bay Length (ft)		100		55	150	
Base Capacity (vph)	486	541	1147	560	345	927
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	0.95	0.55	0.60	0.35	1.06	0.84

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

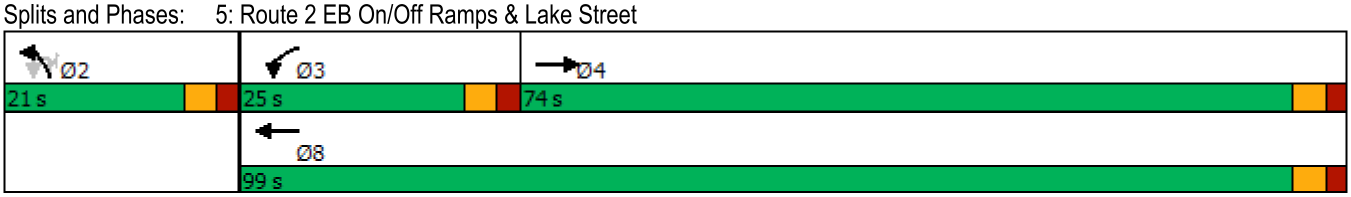
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Lane Group	EBT	EBR	WBL	WBT	NBU	NBL	NBR
Lane Configurations							
Traffic Volume (vph)	521	171	159	286	14	488	571
Future Volume (vph)	521	171	159	286	14	488	571
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	16	16	10	11	12	16	14
Storage Length (ft)		150	110			0	0
Storage Lanes		1	1			1	1
Taper Length (ft)			25			25	
Lane Util. Factor	1.00	1.00	1.00	0.95	1.00	1.00	1.00
Frt		0.850					0.850
Flt Protected			0.950			0.950	
Satd. Flow (prot)	2153	1664	1652	3490	0	2046	1723
Flt Permitted			0.950			0.950	
Satd. Flow (perm)	2153	1664	1652	3490	0	2046	1723
Right Turn on Red		Yes					Yes
Satd. Flow (RTOR)		69					433
Link Speed (mph)	30			30		30	
Link Distance (ft)	239			505		387	
Travel Time (s)	5.4			11.5		8.8	
Peak Hour Factor	0.94	0.94	0.87	0.87	0.96	0.96	0.96
Heavy Vehicles (%)	0%	10%	2%	0%	0%	0%	0%
Adj. Flow (vph)	554	182	183	329	15	508	595
Shared Lane Traffic (%)							
Lane Group Flow (vph)	554	182	183	329	0	523	595
Enter Blocked Intersection	No	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	R NA	Left	Right
Median Width(ft)	12			12		16	
Link Offset(ft)	0			0		0	
Crosswalk Width(ft)	16			16		16	
Two way Left Turn Lane							
Headway Factor	0.85	0.85	1.09	1.04	1.00	0.85	0.92
Turning Speed (mph)		9	15		9	15	9
Number of Detectors	2	1	1	2	1	1	1
Detector Template	Thru	Right	Left	Thru	Left	Left	Right
Leading Detector (ft)	100	20	20	100	20	20	20
Trailing Detector (ft)	0	0	0	0	0	0	0
Detector 1 Position(ft)	0	0	0	0	0	0	0
Detector 1 Size(ft)	6	20	20	6	20	20	20
Detector 1 Type	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
Detector 1 Queue (s)	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
Detector 2 Position(ft)	94			94			
Detector 2 Size(ft)	6			6			
Detector 2 Type	Cl+Ex			Cl+Ex			
Detector 2 Channel							
Detector 2 Extend (s)	0.0			0.0			
Turn Type	NA	Free	Prot	NA	Perm	Prot	Perm

Lane Group	EBT	EBR	WBL	WBT	NBU	NBL	NBR
Protected Phases	4		3	8		2	
Permitted Phases		Free			2		2
Detector Phase	4		3	8	2	2	2
Switch Phase							
Minimum Initial (s)	4.0		4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0		9.0	21.0	21.0	21.0	21.0
Total Split (s)	74.0		25.0	99.0	21.0	21.0	21.0
Total Split (%)	61.7%		20.8%	82.5%	17.5%	17.5%	17.5%
Maximum Green (s)	69.0		20.0	94.0	16.0	16.0	16.0
Yellow Time (s)	3.0		3.0	3.0	3.0	3.0	3.0
All-Red Time (s)	2.0		2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0		0.0	0.0		0.0	0.0
Total Lost Time (s)	5.0		5.0	5.0		5.0	5.0
Lead/Lag	Lag		Lead				
Lead-Lag Optimize?	Yes		Yes				
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0	3.0
Recall Mode	None		None	None	Max	Max	Max
Walk Time (s)	5.0			5.0	5.0	5.0	5.0
Flash Dont Walk (s)	11.0			11.0	11.0	11.0	11.0
Pedestrian Calls (#/hr)	0			0	0	0	0
Act Effct Green (s)	24.1	68.8	13.0	42.2		16.3	16.3
Actuated g/C Ratio	0.35	1.00	0.19	0.61		0.24	0.24
v/c Ratio	0.73	0.11	0.59	0.15		1.08	0.81
Control Delay	26.1	0.1	35.0	5.4		93.9	18.6
Queue Delay	0.0	0.0	0.0	0.0		0.0	0.0
Total Delay	26.1	0.1	35.0	5.4		93.9	18.6
LOS	C	A	C	A		F	B
Approach Delay	19.7			16.0		53.8	
Approach LOS	B			B		D	

Intersection Summary	
Area Type: Other	
Cycle Length: 120	
Actuated Cycle Length: 68.8	
Natural Cycle: 60	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 1.08	
Intersection Signal Delay: 35.0	Intersection LOS: D
Intersection Capacity Utilization 76.5%	ICU Level of Service D
Analysis Period (min) 15	

Splits and Phases: 5: Route 2 EB On/Off Ramps & Lake Street



Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Group Flow (vph)	554	182	183	329	523	595
v/c Ratio	0.73	0.11	0.59	0.15	1.08	0.81
Control Delay	26.1	0.1	35.0	5.4	93.9	18.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	26.1	0.1	35.0	5.4	93.9	18.6
Queue Length 50th (ft)	196	0	71	26	~253	57
Queue Length 95th (ft)	337	0	142	38	#558	#280
Internal Link Dist (ft)	159			425	307	
Turn Bay Length (ft)		150	110			
Base Capacity (vph)	2043	1664	490	3490	486	739
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	0.27	0.11	0.37	0.09	1.08	0.81

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

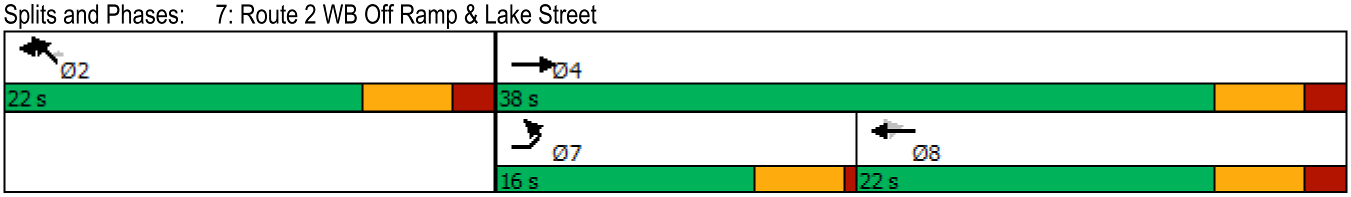
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Traffic Volume (vph)	327	765	0	0	248	334	0	0	0	197	21	24
Future Volume (vph)	327	765	0	0	248	334	0	0	0	197	21	24
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	11	10	12	12	12	11	12	16
Storage Length (ft)	250		0	0		75	0		0	100		0
Storage Lanes	1		0	0		1	0		0	1		1
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	0.95	0.95	1.00
Frt						0.850						0.850
Flt Protected	0.950									0.950	0.961	
Satd. Flow (prot)	1805	1881	0	0	1801	1463	0	0	0	1641	1705	1830
Flt Permitted	0.950									0.950	0.961	
Satd. Flow (perm)	1805	1881	0	0	1801	1463	0	0	0	1641	1705	1830
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)						367						136
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		505			380			459			529	
Travel Time (s)		11.5			8.6			10.4			12.0	
Peak Hour Factor	0.88	0.88	0.88	0.91	0.91	0.91	0.92	0.92	0.92	0.95	0.95	0.95
Heavy Vehicles (%)	0%	1%	0%	0%	2%	3%	0%	0%	0%	1%	5%	0%
Adj. Flow (vph)	372	869	0	0	273	367	0	0	0	207	22	25
Shared Lane Traffic (%)										45%		
Lane Group Flow (vph)	372	869	0	0	273	367	0	0	0	114	115	25
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			11			11	
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	1.04	1.09	1.00	1.00	1.00	1.04	1.00	0.85
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2			2	1				1	2	1
Detector Template	Left	Thru			Thru	Right				Left	Thru	Right
Leading Detector (ft)	20	100			100	20				20	100	20
Trailing Detector (ft)	0	0			0	0				0	0	0
Detector 1 Position(ft)	0	0			0	0				0	0	0
Detector 1 Size(ft)	20	6			6	20				20	6	20
Detector 1 Type	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
Detector 1 Queue (s)	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
Detector 2 Position(ft)		94			94						94	
Detector 2 Size(ft)		6			6						6	
Detector 2 Type		Cl+Ex			Cl+Ex						Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0						0.0	
Turn Type	Prot	NA			NA	Perm				Split	NA	Perm

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Protected Phases	7	4			8					2	2	
Permitted Phases						8						2
Detector Phase	7	4			8	8				2	2	2
Switch Phase												
Minimum Initial (s)	4.0	4.0			4.0	4.0				4.0	4.0	4.0
Minimum Split (s)	8.5	22.0			22.0	22.0				22.0	22.0	22.0
Total Split (s)	16.0	38.0			22.0	22.0				22.0	22.0	22.0
Total Split (%)	26.7%	63.3%			36.7%	36.7%				36.7%	36.7%	36.7%
Maximum Green (s)	11.5	32.0			16.0	16.0				16.0	16.0	16.0
Yellow Time (s)	4.0	4.0			4.0	4.0				4.0	4.0	4.0
All-Red Time (s)	0.5	2.0			2.0	2.0				2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0			0.0	0.0				0.0	0.0	0.0
Total Lost Time (s)	4.5	6.0			6.0	6.0				6.0	6.0	6.0
Lead/Lag	Lead				Lag	Lag						
Lead-Lag Optimize?	Yes				Yes	Yes						
Vehicle Extension (s)	3.0	3.0			3.0	3.0				3.0	3.0	3.0
Recall Mode	None	None			None	None				Max	Max	Max
Walk Time (s)		5.0			5.0	5.0				5.0	5.0	5.0
Flash Dont Walk (s)		11.0			11.0	11.0				11.0	11.0	11.0
Pedestrian Calls (#/hr)		0			0	0				0	0	0
Act Effct Green (s)	11.5	30.0			14.0	14.0				16.0	16.0	16.0
Actuated g/C Ratio	0.20	0.52			0.24	0.24				0.28	0.28	0.28
v/c Ratio	1.04	0.89			0.63	0.58				0.25	0.24	0.04
Control Delay	87.6	26.7			26.7	6.7				19.1	19.0	0.1
Queue Delay	0.0	0.0			0.0	0.0				0.0	0.0	0.0
Total Delay	87.6	26.7			26.7	6.7				19.1	19.0	0.1
LOS	F	C			C	A				B	B	A
Approach Delay		45.0			15.2						17.2	
Approach LOS		D			B						B	

Intersection Summary	
Area Type: Other	
Cycle Length: 60	
Actuated Cycle Length: 58.1	
Natural Cycle: 65	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 1.04	
Intersection Signal Delay: 32.7	Intersection LOS: C
Intersection Capacity Utilization 58.6%	ICU Level of Service B
Analysis Period (min) 15	

Splits and Phases: 7: Route 2 WB Off Ramp & Lake Street



Lane Group	EBL	EBT	WBT	WBR	NWL	NWT	NWR
Lane Group Flow (vph)	372	869	273	367	114	115	25
v/c Ratio	1.04	0.89	0.63	0.58	0.25	0.24	0.04
Control Delay	87.6	26.7	26.7	6.7	19.1	19.0	0.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	87.6	26.7	26.7	6.7	19.1	19.0	0.1
Queue Length 50th (ft)	~155	247	85	0	33	34	0
Queue Length 95th (ft)	#289	#463	152	55	72	72	0
Internal Link Dist (ft)		425	300			449	
Turn Bay Length (ft)	250			75	100		
Base Capacity (vph)	357	1038	497	669	453	470	603
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	1.04	0.84	0.55	0.55	0.25	0.24	0.04

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

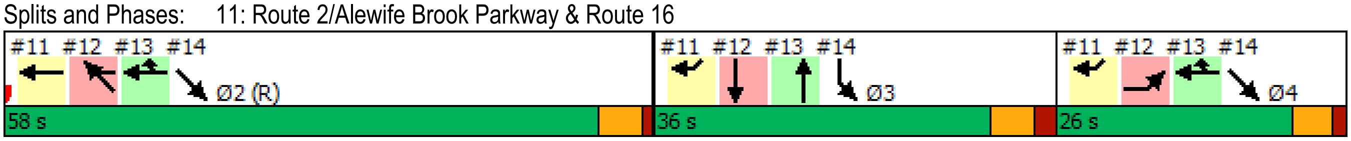
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Lane Group	EBL	EBT	WBT	WBR	SWL	SWR	Ø3	Ø4
Lane Configurations								
Traffic Volume (vph)	0	0	2131	0	0	1091		
Future Volume (vph)	0	0	2131	0	0	1091		
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900		
Lane Width (ft)	13	13	13	13	13	13		
Lane Util. Factor	1.00	1.00	0.91	1.00	1.00	0.88		
Frt						0.850		
Flt Protected								
Satd. Flow (prot)	0	0	4776	0	0	2617		
Flt Permitted								
Satd. Flow (perm)	0	0	4776	0	0	2617		
Right Turn on Red				Yes		Yes		
Satd. Flow (RTOR)						2		
Link Speed (mph)		30	30		30			
Link Distance (ft)		201	192		296			
Travel Time (s)		4.6	4.4		6.7			
Peak Hour Factor	0.92	0.92	0.97	0.97	0.98	0.98		
Heavy Vehicles (%)	2%	2%	1%	0%	0%	1%		
Adj. Flow (vph)	0	0	2197	0	0	1113		
Shared Lane Traffic (%)								
Lane Group Flow (vph)	0	0	2197	0	0	1113		
Enter Blocked Intersection	No	No	No	No	No	No		
Lane Alignment	Left	Left	Left	Right	Left	Right		
Median Width(ft)		0	0		0			
Link Offset(ft)		0	0		0			
Crosswalk Width(ft)		16	16		16			
Two way Left Turn Lane								
Headway Factor	1.10	1.10	1.10	1.10	1.10	1.10		
Turning Speed (mph)	15			9	15	30		
Number of Detectors			2			1		
Detector Template			Thru			Right		
Leading Detector (ft)			100			20		
Trailing Detector (ft)			0			0		
Detector 1 Position(ft)			0			0		
Detector 1 Size(ft)			6			20		
Detector 1 Type			Cl+Ex			Cl+Ex		
Detector 1 Channel								
Detector 1 Extend (s)			0.0			0.0		
Detector 1 Queue (s)			0.0			0.0		
Detector 1 Delay (s)			0.0			0.0		
Detector 2 Position(ft)			94					
Detector 2 Size(ft)			6					
Detector 2 Type			Cl+Ex					
Detector 2 Channel								
Detector 2 Extend (s)			0.0					
Turn Type			NA			custom		
Protected Phases			2			3 4	3	4
Permitted Phases								
Detector Phase			2			3 4		

Lane Group	EBL	EBT	WBT	WBR	SWL	SWR	Ø3	Ø4
Switch Phase								
Minimum Initial (s)			10.0				10.0	10.0
Minimum Split (s)			15.0				19.0	15.0
Total Split (s)			58.0				36.0	26.0
Total Split (%)			48.3%				30%	22%
Maximum Green (s)			53.0				30.0	21.0
Yellow Time (s)			4.0				4.0	3.5
All-Red Time (s)			1.0				2.0	1.5
Lost Time Adjust (s)			0.0					
Total Lost Time (s)			5.0					
Lead/Lag							Lead	Lag
Lead-Lag Optimize?								
Vehicle Extension (s)			3.0				3.0	3.0
Recall Mode			C-Max				Max	Max
Walk Time (s)							5.0	
Flash Dont Walk (s)							8.0	
Pedestrian Calls (#/hr)							0	
Act Effct Green (s)			53.0			56.0		
Actuated g/C Ratio			0.44			0.47		
v/c Ratio			1.04			0.91		
Control Delay			29.4			41.9		
Queue Delay			1.5			0.0		
Total Delay			30.9			41.9		
LOS			C			D		
Approach Delay			30.9		41.9			
Approach LOS			C		D			

Intersection Summary	
Area Type: CBD	
Cycle Length: 120	
Actuated Cycle Length: 120	
Offset: 16 (13%), Referenced to phase 2:WBT, Start of Green	
Natural Cycle: 110	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 1.14	
Intersection Signal Delay: 34.6	Intersection LOS: C
Intersection Capacity Utilization 97.3%	ICU Level of Service F
Analysis Period (min) 15	

Splits and Phases: 11: Route 2/Alewife Brook Parkway & Route 16



Lane Group	WBT	SWR
Lane Group Flow (vph)	2197	1113
v/c Ratio	1.04	0.91
Control Delay	29.4	41.9
Queue Delay	1.5	0.0
Total Delay	30.9	41.9
Queue Length 50th (ft)	~656	442
Queue Length 95th (ft)	m52	#606
Internal Link Dist (ft)	112	
Turn Bay Length (ft)		
Base Capacity (vph)	2109	1222
Starvation Cap Reductn	8	0
Spillback Cap Reductn	0	0
Storage Cap Reductn	0	0
Reduced v/c Ratio	1.05	0.91

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

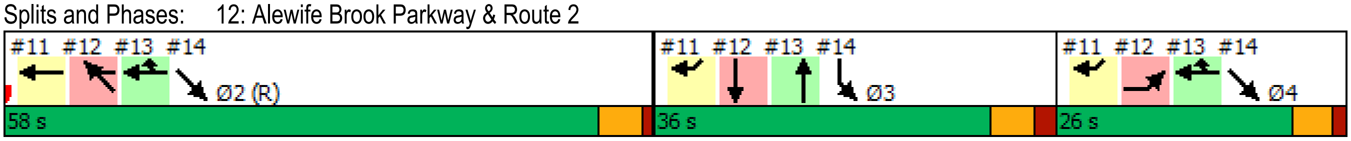
Lane Group	EBL	WBR	SBT	NWT
Lane Configurations				
Traffic Volume (vph)	581	571	241	1560
Future Volume (vph)	581	571	241	1560
Ideal Flow (vphpl)	1900	1900	1900	1900
Lane Width (ft)	13	16	13	13
Lane Util. Factor	0.97	1.00	0.95	0.95
Frt		0.865		
Flt Protected	0.950			
Satd. Flow (prot)	3257	1660	3291	3324
Flt Permitted	0.950			
Satd. Flow (perm)	3257	1660	3291	3324
Right Turn on Red				
Satd. Flow (RTOR)				
Link Speed (mph)			30	30
Link Distance (ft)			202	278
Travel Time (s)			4.6	6.3
Peak Hour Factor	0.90	0.95	0.98	0.97
Heavy Vehicles (%)	0%	1%	2%	1%
Adj. Flow (vph)	646	601	246	1608
Shared Lane Traffic (%)				
Lane Group Flow (vph)	646	601	246	1608
Enter Blocked Intersection	No	No	No	No
Lane Alignment	Left	R NA	Left	L NA
Median Width(ft)			0	0
Link Offset(ft)			0	0
Crosswalk Width(ft)			16	16
Two way Left Turn Lane				
Headway Factor	1.10	0.97	1.10	1.10
Turning Speed (mph)	15	30		
Number of Detectors	1	1	2	2
Detector Template	Left	Right	Thru	Thru
Leading Detector (ft)	20	20	100	100
Trailing Detector (ft)	0	0	0	0
Detector 1 Position(ft)	0	0	0	0
Detector 1 Size(ft)	20	20	6	6
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel				
Detector 1 Extend (s)	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0
Detector 2 Position(ft)			94	94
Detector 2 Size(ft)			6	6
Detector 2 Type			Cl+Ex	Cl+Ex
Detector 2 Channel				
Detector 2 Extend (s)			0.0	0.0
Turn Type	Prot	Prot	NA	NA
Protected Phases	4	2!	3	2!
Permitted Phases				
Detector Phase	4	2	3	2

Lane Group	EBL	WBR	SBT	NWT
Switch Phase				
Minimum Initial (s)	10.0	10.0	10.0	10.0
Minimum Split (s)	15.0	15.0	19.0	15.0
Total Split (s)	26.0	58.0	36.0	58.0
Total Split (%)	21.7%	48.3%	30.0%	48.3%
Maximum Green (s)	21.0	53.0	30.0	53.0
Yellow Time (s)	3.5	4.0	4.0	4.0
All-Red Time (s)	1.5	1.0	2.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	6.0	5.0
Lead/Lag	Lag		Lead	
Lead-Lag Optimize?				
Vehicle Extension (s)	3.0	3.0	3.0	3.0
Recall Mode	Max	C-Max	Max	C-Max
Walk Time (s)			5.0	
Flash Dont Walk (s)			8.0	
Pedestrian Calls (#/hr)			0	
Act Effct Green (s)	21.0	53.0	30.0	53.0
Actuated g/C Ratio	0.18	0.44	0.25	0.44
v/c Ratio	1.14	0.82	0.30	1.10
Control Delay	125.6	27.9	37.7	86.8
Queue Delay	0.0	1.3	0.0	2.1
Total Delay	125.6	29.2	37.7	89.0
LOS	F	C	D	F
Approach Delay			37.7	89.0
Approach LOS			D	F

Intersection Summary

Area Type: CBD
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 16 (13%), Referenced to phase 2:WBT, Start of Green
Natural Cycle: 110
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 1.14
Intersection Signal Delay: 80.9 Intersection LOS: F
Intersection Capacity Utilization 130.6% ICU Level of Service H
Analysis Period (min) 15
! Phase conflict between lane groups.

Splits and Phases: 12: Alewife Brook Parkway & Route 2



Lane Group	EBL	WBR	SBT	NWT
Lane Group Flow (vph)	646	601	246	1608
v/c Ratio	1.14	0.82	0.30	1.10
Control Delay	125.6	27.9	37.7	86.8
Queue Delay	0.0	1.3	0.0	2.1
Total Delay	125.6	29.2	37.7	89.0
Queue Length 50th (ft)	~300	399	81	~741
Queue Length 95th (ft)	#418	#578	119	#880
Internal Link Dist (ft)			122	198
Turn Bay Length (ft)				
Base Capacity (vph)	569	733	822	1468
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	36	0	73
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	1.14	0.86	0.30	1.15

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

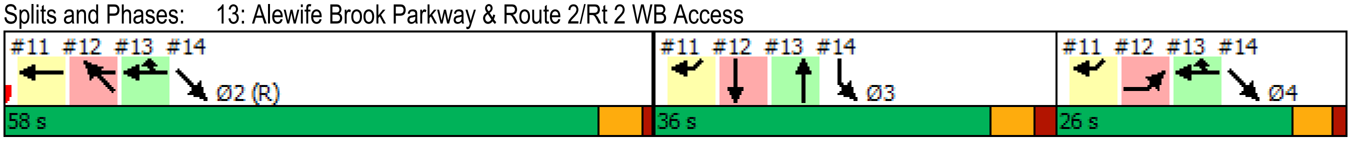
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	0	571	317	0	230	0	0	0	0
Future Volume (vph)	0	0	0	0	571	317	0	230	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		200	0		0	0		0
Storage Lanes	0		0	0		1	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	0.95	1.00	1.00	1.00	1.00
Ped Bike Factor												
Frt						0.850						
Flt Protected												
Satd. Flow (prot)	0	0	0	0	1693	1439	0	3217	0	0	0	0
Flt Permitted												
Satd. Flow (perm)	0	0	0	0	1693	1439	0	3217	0	0	0	0
Right Turn on Red			No			No	No		No			No
Satd. Flow (RTOR)												
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		161			1225			227			185	
Travel Time (s)		3.7			27.8			5.2			4.2	
Confl. Peds. (#/hr)						2						
Peak Hour Factor	0.92	0.92	0.92	0.95	0.95	0.95	0.97	0.97	0.97	0.92	0.92	0.92
Heavy Vehicles (%)	2%	2%	2%	0%	1%	1%	0%	1%	0%	2%	2%	2%
Adj. Flow (vph)	0	0	0	0	601	334	0	237	0	0	0	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	0	0	0	601	334	0	237	0	0	0	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)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors					2	1		2				
Detector Template					Thru	Right		Thru				
Leading Detector (ft)					100	20		100				
Trailing Detector (ft)					0	0		0				
Detector 1 Position(ft)					0	0		0				
Detector 1 Size(ft)					6	20		6				
Detector 1 Type					Cl+Ex	Cl+Ex		Cl+Ex				
Detector 1 Channel												
Detector 1 Extend (s)					0.0	0.0		0.0				
Detector 1 Queue (s)					0.0	0.0		0.0				
Detector 1 Delay (s)					0.0	0.0		0.0				
Detector 2 Position(ft)					94			94				
Detector 2 Size(ft)					6			6				
Detector 2 Type					Cl+Ex			Cl+Ex				
Detector 2 Channel												
Detector 2 Extend (s)					0.0			0.0				

Lane Group	Ø2	Ø4
Lane Configurations		
Traffic Volume (vph)		
Future Volume (vph)		
Ideal Flow (vphpl)		
Storage Length (ft)		
Storage Lanes		
Taper Length (ft)		
Lane Util. Factor		
Ped Bike Factor		
Frt		
Flt Protected		
Satd. Flow (prot)		
Flt Permitted		
Satd. Flow (perm)		
Right Turn on Red		
Satd. Flow (RTOR)		
Link Speed (mph)		
Link Distance (ft)		
Travel Time (s)		
Confl. Peds. (#/hr)		
Peak Hour Factor		
Heavy Vehicles (%)		
Adj. Flow (vph)		
Shared Lane Traffic (%)		
Lane Group Flow (vph)		
Enter Blocked Intersection		
Lane Alignment		
Median Width(ft)		
Link Offset(ft)		
Crosswalk Width(ft)		
Two way Left Turn Lane		
Headway Factor		
Turning Speed (mph)		
Number of Detectors		
Detector Template		
Leading Detector (ft)		
Trailing Detector (ft)		
Detector 1 Position(ft)		
Detector 1 Size(ft)		
Detector 1 Type		
Detector 1 Channel		
Detector 1 Extend (s)		
Detector 1 Queue (s)		
Detector 1 Delay (s)		
Detector 2 Position(ft)		
Detector 2 Size(ft)		
Detector 2 Type		
Detector 2 Channel		
Detector 2 Extend (s)		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Turn Type					NA	Prot		NA				
Protected Phases					2 4	2 4		3				
Permitted Phases												
Detector Phase					2 4	2 4		3				
Switch Phase												
Minimum Initial (s)								10.0				
Minimum Split (s)								19.0				
Total Split (s)								36.0				
Total Split (%)								30.0%				
Maximum Green (s)								30.0				
Yellow Time (s)								4.0				
All-Red Time (s)								2.0				
Lost Time Adjust (s)								0.0				
Total Lost Time (s)								6.0				
Lead/Lag								Lead				
Lead-Lag Optimize?												
Vehicle Extension (s)								3.0				
Recall Mode								Max				
Walk Time (s)								5.0				
Flash Dont Walk (s)								8.0				
Pedestrian Calls (#/hr)								0				
Act Effct Green (s)					79.0	79.0		30.0				
Actuated g/C Ratio					0.66	0.66		0.25				
v/c Ratio					0.54	0.35		0.29				
Control Delay					13.1	10.4		37.7				
Queue Delay					1.7	0.0		0.0				
Total Delay					14.8	10.4		37.7				
LOS					B	B		D				
Approach Delay					13.2			37.7				
Approach LOS					B			D				

Intersection Summary	
Area Type: CBD	
Cycle Length: 120	
Actuated Cycle Length: 120	
Offset: 16 (13%), Referenced to phase 2:WBT, Start of Green	
Natural Cycle: 110	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 1.14	
Intersection Signal Delay: 18.2	Intersection LOS: B
Intersection Capacity Utilization 50.9%	ICU Level of Service A
Analysis Period (min) 15	

Splits and Phases: 13: Alewife Brook Parkway & Route 2/Rt 2 WB Access



Lane Group	Ø2	Ø4
Turn Type		
Protected Phases	2	4
Permitted Phases		
Detector Phase		
Switch Phase		
Minimum Initial (s)	10.0	10.0
Minimum Split (s)	15.0	15.0
Total Split (s)	58.0	26.0
Total Split (%)	48%	22%
Maximum Green (s)	53.0	21.0
Yellow Time (s)	4.0	3.5
All-Red Time (s)	1.0	1.5
Lost Time Adjust (s)		
Total Lost Time (s)		
Lead/Lag		Lag
Lead-Lag Optimize?		
Vehicle Extension (s)	3.0	3.0
Recall Mode	C-Max	Max
Walk Time (s)		
Flash Dont Walk (s)		
Pedestrian Calls (#/hr)		
Act Effct Green (s)		
Actuated g/C Ratio		
v/c Ratio		
Control Delay		
Queue Delay		
Total Delay		
LOS		
Approach Delay		
Approach LOS		

Intersection Summary

Lane Group	WBT	WBR	NBT
Lane Group Flow (vph)	601	334	237
v/c Ratio	0.54	0.35	0.29
Control Delay	13.1	10.4	37.7
Queue Delay	1.7	0.0	0.0
Total Delay	14.8	10.4	37.7
Queue Length 50th (ft)	227	106	78
Queue Length 95th (ft)	320	159	115
Internal Link Dist (ft)	1145		147
Turn Bay Length (ft)		200	
Base Capacity (vph)	1114	947	804
Starvation Cap Reductn	0	0	0
Spillback Cap Reductn	336	0	0
Storage Cap Reductn	0	0	0
Reduced v/c Ratio	0.77	0.35	0.29

Intersection Summary

Lane Group	SBL	SBR	SEL	SET	NWT	NWR	Ø2	Ø4
Lane Configurations								
Traffic Volume (vph)	241	0	0	952	0	0		
Future Volume (vph)	241	0	0	952	0	0		
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900		
Lane Width (ft)	13	13	13	13	13	13		
Lane Util. Factor	0.97	1.00	1.00	0.95	1.00	1.00		
Frt								
Flt Protected	0.950							
Satd. Flow (prot)	3193	0	0	3324	0	0		
Flt Permitted	0.950							
Satd. Flow (perm)	3193	0	0	3324	0	0		
Right Turn on Red	Yes	Yes				Yes		
Satd. Flow (RTOR)	254							
Link Speed (mph)	30			30	30			
Link Distance (ft)	155			297	139			
Travel Time (s)	3.5			6.8	3.2			
Peak Hour Factor	0.98	0.98	0.90	0.90	0.92	0.92		
Heavy Vehicles (%)	2%	0%	0%	1%	2%	2%		
Adj. Flow (vph)	246	0	0	1058	0	0		
Shared Lane Traffic (%)								
Lane Group Flow (vph)	246	0	0	1058	0	0		
Enter Blocked Intersection	No	No	No	No	No	No		
Lane Alignment	Left	Right	Left	Left	Left	Right		
Median Width(ft)	26			0	0			
Link Offset(ft)	0			0	0			
Crosswalk Width(ft)	16			16	16			
Two way Left Turn Lane								
Headway Factor	1.10	1.10	1.10	1.10	1.10	1.10		
Turning Speed (mph)	30	9	15			9		
Number of Detectors	1			2				
Detector Template	Left			Thru				
Leading Detector (ft)	20			100				
Trailing Detector (ft)	0			0				
Detector 1 Position(ft)	0			0				
Detector 1 Size(ft)	20			6				
Detector 1 Type	Cl+Ex			Cl+Ex				
Detector 1 Channel								
Detector 1 Extend (s)	0.0			0.0				
Detector 1 Queue (s)	0.0			0.0				
Detector 1 Delay (s)	0.0			0.0				
Detector 2 Position(ft)				94				
Detector 2 Size(ft)				6				
Detector 2 Type				Cl+Ex				
Detector 2 Channel								
Detector 2 Extend (s)				0.0				
Turn Type	Prot			NA				
Protected Phases	3			2 4			2	4
Permitted Phases								
Detector Phase	3			2 4				

Lane Group	SBL	SBR	SEL	SET	NWT	NWR	Ø2	Ø4
Switch Phase								
Minimum Initial (s)	10.0						10.0	10.0
Minimum Split (s)	19.0						15.0	15.0
Total Split (s)	36.0						58.0	26.0
Total Split (%)	30.0%						48%	22%
Maximum Green (s)	30.0						53.0	21.0
Yellow Time (s)	4.0						4.0	3.5
All-Red Time (s)	2.0						1.0	1.5
Lost Time Adjust (s)	0.0							
Total Lost Time (s)	6.0							
Lead/Lag	Lead							Lag
Lead-Lag Optimize?								
Vehicle Extension (s)	3.0						3.0	3.0
Recall Mode	Max						C-Max	Max
Walk Time (s)	5.0							
Flash Dont Walk (s)	8.0							
Pedestrian Calls (#/hr)	0							
Act Effct Green (s)	30.0			79.0				
Actuated g/C Ratio	0.25			0.66				
v/c Ratio	0.25			0.48				
Control Delay	0.7			11.2				
Queue Delay	0.5			0.0				
Total Delay	1.3			11.2				
LOS	A			B				
Approach Delay	1.3			11.2				
Approach LOS	A			B				

Intersection Summary

Area Type: CBD

Cycle Length: 120

Actuated Cycle Length: 120

Offset: 16 (13%), Referenced to phase 2:WBT, Start of Green

Natural Cycle: 110

Control Type: Actuated-Coordinated

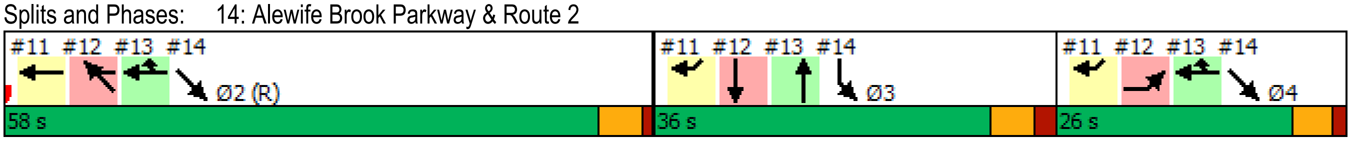
Maximum v/c Ratio: 1.14

Intersection Signal Delay: 9.3 Intersection LOS: A

Intersection Capacity Utilization 46.7% ICU Level of Service A

Analysis Period (min) 15

Splits and Phases: 14: Alewife Brook Parkway & Route 2



Lane Group	SBL	SET
Lane Group Flow (vph)	246	1058
v/c Ratio	0.25	0.48
Control Delay	0.7	11.2
Queue Delay	0.5	0.0
Total Delay	1.3	11.2
Queue Length 50th (ft)	0	198
Queue Length 95th (ft)	0	245
Internal Link Dist (ft)	75	217
Turn Bay Length (ft)		
Base Capacity (vph)	988	2188
Starvation Cap Reductn	419	0
Spillback Cap Reductn	0	0
Storage Cap Reductn	0	0
Reduced v/c Ratio	0.43	0.48

Intersection Summary

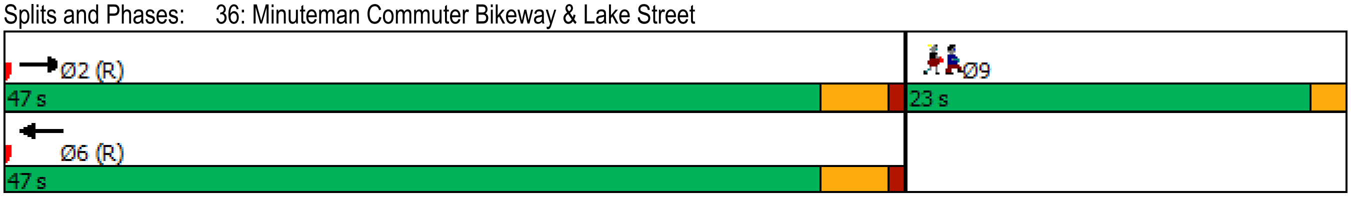
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑			↑							
Traffic Volume (vph)	0	808	0	0	623	0	0	0	0	0	0	0
Future Volume (vph)	0	808	0	0	623	0	0	0	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	15	15	15	16	16	16	12	12	12	12	12	12
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												
Flt Protected												
Satd. Flow (prot)	0	2049	0	0	2153	0	0	0	0	0	0	0
Flt Permitted												
Satd. Flow (perm)	0	2049	0	0	2153	0	0	0	0	0	0	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)												
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		135			215			175			206	
Travel Time (s)		3.1			4.9			4.0			4.7	
Peak Hour Factor	0.84	0.84	0.84	0.97	0.97	0.97	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	2%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Adj. Flow (vph)	0	962	0	0	642	0	0	0	0	0	0	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	962	0	0	642	0	0	0	0	0	0	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)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	0.88	0.88	0.88	0.85	0.85	0.85	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		2			2							
Detector Template		Thru			Thru							
Leading Detector (ft)		100			100							
Trailing Detector (ft)		0			0							
Detector 1 Position(ft)		0			0							
Detector 1 Size(ft)		6			6							
Detector 1 Type		Cl+Ex			Cl+Ex							
Detector 1 Channel												
Detector 1 Extend (s)		0.0			0.0							
Detector 1 Queue (s)		0.0			0.0							
Detector 1 Delay (s)		0.0			0.0							
Detector 2 Position(ft)		94			94							
Detector 2 Size(ft)		6			6							
Detector 2 Type		Cl+Ex			Cl+Ex							
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0							
Turn Type		NA			NA							
Protected Phases		2			6							
Permitted Phases												
Detector Phase		2			6							

Lane Group	Ø9
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Ideal Flow (vphpl)	
Lane Width (ft)	
Lane Util. Factor	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (mph)	
Link Distance (ft)	
Travel Time (s)	
Peak Hour Factor	
Heavy Vehicles (%)	
Adj. Flow (vph)	
Shared Lane Traffic (%)	
Lane Group Flow (vph)	
Enter Blocked Intersection	
Lane Alignment	
Median Width(ft)	
Link Offset(ft)	
Crosswalk Width(ft)	
Two way Left Turn Lane	
Headway Factor	
Turning Speed (mph)	
Number of Detectors	
Detector Template	
Leading Detector (ft)	
Trailing Detector (ft)	
Detector 1 Position(ft)	
Detector 1 Size(ft)	
Detector 1 Type	
Detector 1 Channel	
Detector 1 Extend (s)	
Detector 1 Queue (s)	
Detector 1 Delay (s)	
Detector 2 Position(ft)	
Detector 2 Size(ft)	
Detector 2 Type	
Detector 2 Channel	
Detector 2 Extend (s)	
Turn Type	
Protected Phases	9
Permitted Phases	
Detector Phase	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Switch Phase												
Minimum Initial (s)		4.0			4.0							
Minimum Split (s)		20.5			20.5							
Total Split (s)		47.0			47.0							
Total Split (%)		67.1%			67.1%							
Maximum Green (s)		42.5			42.5							
Yellow Time (s)		3.5			3.5							
All-Red Time (s)		1.0			1.0							
Lost Time Adjust (s)		0.0			0.0							
Total Lost Time (s)		4.5			4.5							
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)		3.0			3.0							
Recall Mode		C-Max			C-Max							
Walk Time (s)												
Flash Dont Walk (s)												
Pedestrian Calls (#/hr)												
Act Effct Green (s)		47.5			47.5							
Actuated g/C Ratio		0.68			0.68							
v/c Ratio		0.69			0.44							
Control Delay		10.2			6.8							
Queue Delay		50.7			1.6							
Total Delay		60.9			8.3							
LOS		E			A							
Approach Delay		60.9			8.3							
Approach LOS		E			A							

Intersection Summary	
Area Type: Other	
Cycle Length: 70	
Actuated Cycle Length: 70	
Offset: 16 (23%), Referenced to phase 2:EBT and 6:WBT, Start of Green	
Natural Cycle: 60	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.69	
Intersection Signal Delay: 39.8	Intersection LOS: D
Intersection Capacity Utilization 46.3%	ICU Level of Service A
Analysis Period (min) 15	

Splits and Phases: 36: Minuteman Commuter Bikeway & Lake Street



Lane Group	Ø9
Switch Phase	
Minimum Initial (s)	4.0
Minimum Split (s)	18.0
Total Split (s)	23.0
Total Split (%)	33%
Maximum Green (s)	21.0
Yellow Time (s)	2.0
All-Red Time (s)	0.0
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	
Lead-Lag Optimize?	
Vehicle Extension (s)	3.0
Recall Mode	None
Walk Time (s)	5.0
Flash Dont Walk (s)	11.0
Pedestrian Calls (#/hr)	211
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	

Intersection Summary

Lane Group	EBT	WBT
Lane Group Flow (vph)	962	642
v/c Ratio	0.69	0.44
Control Delay	10.2	6.8
Queue Delay	50.7	1.6
Total Delay	60.9	8.3
Queue Length 50th (ft)	208	213
Queue Length 95th (ft)	282	169
Internal Link Dist (ft)	55	135
Turn Bay Length (ft)		
Base Capacity (vph)	1390	1460
Starvation Cap Reductn	0	603
Spillback Cap Reductn	602	0
Storage Cap Reductn	0	0
Reduced v/c Ratio	1.22	0.75

Intersection Summary

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	79	664	65	5	510	1	9	5	4	0	5	104
Future Volume (vph)	79	664	65	5	510	1	9	5	4	0	5	104
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	14	14	14	13	13	13	12	12	12	12	12	12
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		0.989						0.972			0.871	
Flt Protected		0.995			0.999			0.976				
Satd. Flow (prot)	0	1994	0	0	1961	0	0	1802	0	0	1655	0
Flt Permitted		0.896			0.993			0.730				
Satd. Flow (perm)	0	1796	0	0	1950	0	0	1348	0	0	1655	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		8						5			135	
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		215			1126			206			208	
Travel Time (s)		4.9			25.6			4.7			4.7	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.75	0.75	0.75	0.77	0.77	0.77
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Adj. Flow (vph)	90	755	74	6	580	1	12	7	5	0	6	135
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	919	0	0	587	0	0	24	0	0	141	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)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	0.92	0.92	0.92	0.96	0.96	0.96	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	Perm	NA		Perm	NA		Perm	NA			NA	
Protected Phases		2			6			8			4	
Permitted Phases	2			6			8			4		
Detector Phase	2	2		6	6		8	8		4	4	

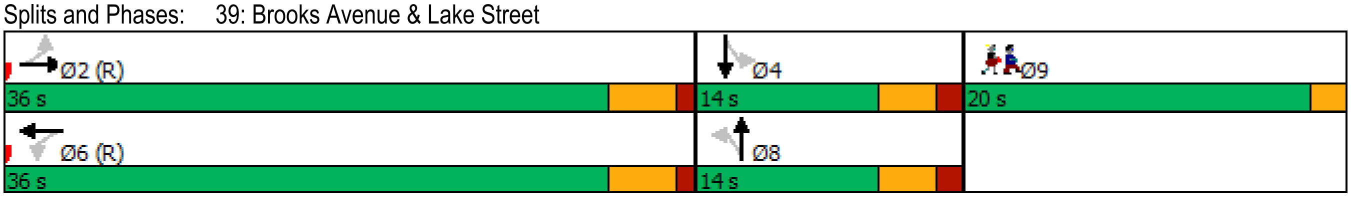
Lane Group	Ø9
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Ideal Flow (vphpl)	
Lane Width (ft)	
Lane Util. Factor	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (mph)	
Link Distance (ft)	
Travel Time (s)	
Peak Hour Factor	
Heavy Vehicles (%)	
Adj. Flow (vph)	
Shared Lane Traffic (%)	
Lane Group Flow (vph)	
Enter Blocked Intersection	
Lane Alignment	
Median Width(ft)	
Link Offset(ft)	
Crosswalk Width(ft)	
Two way Left Turn Lane	
Headway Factor	
Turning Speed (mph)	
Number of Detectors	
Detector Template	
Leading Detector (ft)	
Trailing Detector (ft)	
Detector 1 Position(ft)	
Detector 1 Size(ft)	
Detector 1 Type	
Detector 1 Channel	
Detector 1 Extend (s)	
Detector 1 Queue (s)	
Detector 1 Delay (s)	
Detector 2 Position(ft)	
Detector 2 Size(ft)	
Detector 2 Type	
Detector 2 Channel	
Detector 2 Extend (s)	
Turn Type	
Protected Phases	9
Permitted Phases	
Detector Phase	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Switch Phase												
Minimum Initial (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Minimum Split (s)	21.0	21.0		21.0	21.0		14.0	14.0		14.0	14.0	
Total Split (s)	36.0	36.0		36.0	36.0		14.0	14.0		14.0	14.0	
Total Split (%)	51.4%	51.4%		51.4%	51.4%		20.0%	20.0%		20.0%	20.0%	
Maximum Green (s)	31.5	31.5		31.5	31.5		9.5	9.5		9.5	9.5	
Yellow Time (s)	3.5	3.5		3.5	3.5		3.0	3.0		3.0	3.0	
All-Red Time (s)	1.0	1.0		1.0	1.0		1.5	1.5		1.5	1.5	
Lost Time Adjust (s)		0.0			0.0			0.0			0.0	
Total Lost Time (s)		4.5			4.5			4.5			4.5	
Lead/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	C-Max	C-Max		C-Max	C-Max		Min	Min		Min	Min	
Walk Time (s)												
Flash Dont Walk (s)												
Pedestrian Calls (#/hr)												
Act Effct Green (s)		43.3			43.3			6.9			6.9	
Actuated g/C Ratio		0.62			0.62			0.10			0.10	
v/c Ratio		0.83			0.49			0.18			0.50	
Control Delay		23.2			11.8			26.9			13.0	
Queue Delay		38.9			0.5			0.0			0.2	
Total Delay		62.1			12.3			26.9			13.2	
LOS		E			B			C			B	
Approach Delay		62.1			12.3			26.9			13.2	
Approach LOS		E			B			C			B	

Intersection Summary

Area Type: Other
Cycle Length: 70
Actuated Cycle Length: 70
Offset: 0 (0%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green, Master Intersection
Natural Cycle: 80
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.83
Intersection Signal Delay: 40.0 Intersection LOS: D
Intersection Capacity Utilization 89.4% ICU Level of Service E
Analysis Period (min) 15

Splits and Phases: 39: Brooks Avenue & Lake Street



Lane Group	Ø9
Switch Phase	
Minimum Initial (s)	4.0
Minimum Split (s)	20.0
Total Split (s)	20.0
Total Split (%)	29%
Maximum Green (s)	18.0
Yellow Time (s)	2.0
All-Red Time (s)	0.0
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	
Lead-Lag Optimize?	
Vehicle Extension (s)	3.0
Recall Mode	None
Walk Time (s)	5.0
Flash Dont Walk (s)	11.0
Pedestrian Calls (#/hr)	42
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	
Intersection Summary	

	→	←	↑	↓
Lane Group	EBT	WBT	NBT	SBT
Lane Group Flow (vph)	919	587	24	141
v/c Ratio	0.83	0.49	0.18	0.50
Control Delay	23.2	11.8	26.9	13.0
Queue Delay	38.9	0.5	0.0	0.2
Total Delay	62.1	12.3	26.9	13.2
Queue Length 50th (ft)	251	159	8	2
Queue Length 95th (ft)	#620	269	23	32
Internal Link Dist (ft)	135	1046	126	128
Turn Bay Length (ft)				
Base Capacity (vph)	1113	1206	187	341
Starvation Cap Reductn	258	0	0	0
Spillback Cap Reductn	0	257	0	17
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	1.07	0.62	0.13	0.44

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

2027 No-Build Weekday Morning Peak Hour

Intersection						
Int Delay, s/veh	0.3					

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	614	3	1	1189	5	1
Future Vol, veh/h	614	3	1	1189	5	1
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	75	75	87	87	75	75
Heavy Vehicles, %	2	0	0	1	0	0
Mvmt Flow	819	4	1	1367	7	1

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	823	0	2190	821
Stage 1	-	-	-	-	821	-
Stage 2	-	-	-	-	1369	-
Critical Hdwy	-	-	4.1	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	-	-	2.2	-	3.5	3.3
Pot Cap-1 Maneuver	-	-	816	-	51	378
Stage 1	-	-	-	-	436	-
Stage 2	-	-	-	-	239	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	816	-	51	378
Mov Cap-2 Maneuver	-	-	-	-	51	-
Stage 1	-	-	-	-	436	-
Stage 2	-	-	-	-	238	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0	74
HCM LOS			F

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	60	-	-	816	-
HCM Lane V/C Ratio	0.133	-	-	0.001	-
HCM Control Delay (s)	74	-	-	9.4	0
HCM Lane LOS	F	-	-	A	A
HCM 95th %tile Q(veh)	0.4	-	-	0	-

Intersection	
Int Delay, s/veh	2

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	601	14	5	1166	24	6
Future Vol, veh/h	601	14	5	1166	24	6
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	75	75	93	93	75	75
Heavy Vehicles, %	2	0	0	1	0	0
Mvmt Flow	801	19	5	1254	32	8

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	820	0	2075	811
Stage 1	-	-	-	-	811	-
Stage 2	-	-	-	-	1264	-
Critical Hdwy	-	-	4.1	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	-	-	2.2	-	3.5	3.3
Pot Cap-1 Maneuver	-	-	818	-	60	383
Stage 1	-	-	-	-	440	-
Stage 2	-	-	-	-	268	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	818	-	59	383
Mov Cap-2 Maneuver	-	-	-	-	59	-
Stage 1	-	-	-	-	440	-
Stage 2	-	-	-	-	263	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0	107.5
HCM LOS			F

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	71	-	-	818	-
HCM Lane V/C Ratio	0.563	-	-	0.007	-
HCM Control Delay (s)	107.5	-	-	9.4	0
HCM Lane LOS	F	-	-	A	A
HCM 95th %tile Q(veh)	2.4	-	-	0	-

Intersection	
Int Delay, s/veh	0.4

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	605	5	3	1164	7	1
Future Vol, veh/h	605	5	3	1164	7	1
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	75	75	93	93	75	75
Heavy Vehicles, %	2	0	0	1	0	0
Mvmt Flow	807	7	3	1252	9	1

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	814	0	2069	811
Stage 1	-	-	-	-	811	-
Stage 2	-	-	-	-	1258	-
Critical Hdwy	-	-	4.1	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	-	-	2.2	-	3.5	3.3
Pot Cap-1 Maneuver	-	-	822	-	60	383
Stage 1	-	-	-	-	440	-
Stage 2	-	-	-	-	270	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	822	-	59	383
Mov Cap-2 Maneuver	-	-	-	-	59	-
Stage 1	-	-	-	-	440	-
Stage 2	-	-	-	-	267	-

Approach	EB		WB		NB	
HCM Control Delay, s	0		0		69.8	
HCM LOS					F	

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	66	-	-	822	-
HCM Lane V/C Ratio	0.162	-	-	0.004	-
HCM Control Delay (s)	69.8	-	-	9.4	0
HCM Lane LOS	F	-	-	A	A
HCM 95th %tile Q(veh)	0.5	-	-	0	-

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	0	585	18	8	1148	5	8	0	14	4	0	11
Future Vol, veh/h	0	585	18	8	1148	5	8	0	14	4	0	11
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	79	79	79	96	96	96	80	80	80	92	92	92
Heavy Vehicles, %	0	1	0	0	0	0	0	0	10	0	0	0
Mvmt Flow	0	741	23	8	1196	5	10	0	18	4	0	12

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	1201	0	0	764	0	0	1974	1970	753	1977	1979	1199
Stage 1	-	-	-	-	-	-	753	753	-	1215	1215	-
Stage 2	-	-	-	-	-	-	1221	1217	-	762	764	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.1	6.5	6.3	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	3.39	3.5	4	3.3
Pot Cap-1 Maneuver	588	-	-	858	-	-	47	63	397	47	62	228
Stage 1	-	-	-	-	-	-	405	420	-	224	256	-
Stage 2	-	-	-	-	-	-	222	256	-	400	416	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	588	-	-	858	-	-	44	61	397	44	60	228
Mov Cap-2 Maneuver	-	-	-	-	-	-	44	61	-	44	60	-
Stage 1	-	-	-	-	-	-	405	420	-	224	249	-
Stage 2	-	-	-	-	-	-	204	249	-	382	416	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0.1	53.5	44.2
HCM LOS			F	E

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	101	588	-	-	858	-	-	108
HCM Lane V/C Ratio	0.272	-	-	-	0.01	-	-	0.151
HCM Control Delay (s)	53.5	0	-	-	9.2	0	-	44.2
HCM Lane LOS	F	A	-	-	A	A	-	E
HCM 95th %tile Q(veh)	1	0	-	-	0	-	-	0.5

Intersection	
Int Delay, s/veh	4.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	3	593	7	24	1136	3	9	0	22	3	0	16
Future Vol, veh/h	3	593	7	24	1136	3	9	0	22	3	0	16
Conflicting Peds, #/hr	0	0	0	304	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	84	84	84	97	97	97	75	75	75	75	75	75
Heavy Vehicles, %	0	2	0	0	0	0	0	0	0	0	0	0
Mvmt Flow	4	706	8	25	1171	3	12	0	29	4	0	21

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	1174	0	0	1018	0	0	2255	2246	1014	1956	2249	1173
Stage 1	-	-	-	-	-	-	1022	1022	-	1223	1223	-
Stage 2	-	-	-	-	-	-	1233	1224	-	733	1026	-
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	602	-	-	689	-	-	30	42	292	49	42	236
Stage 1	-	-	-	-	-	-	287	316	-	221	254	-
Stage 2	-	-	-	-	-	-	219	254	-	415	315	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	602	-	-	514	-	-	18	27	218	38	27	236
Mov Cap-2 Maneuver	-	-	-	-	-	-	18	27	-	38	27	-
Stage 1	-	-	-	-	-	-	212	234	-	219	218	-
Stage 2	-	-	-	-	-	-	171	218	-	355	233	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.1	0.3	192.1	39.6
HCM LOS			F	E

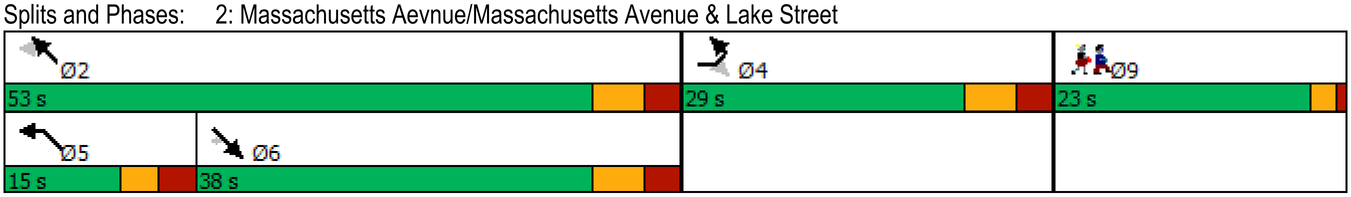
Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	52	602	-	-	514	-	-	129
HCM Lane V/C Ratio	0.795	0.006	-	-	0.048	-	-	0.196
HCM Control Delay (s)	192.1	11	0	-	12.4	0	-	39.6
HCM Lane LOS	F	B	A	-	B	A	-	E
HCM 95th %tile Q(veh)	3.3	0	-	-	0.2	-	-	0.7

Lane Group	EBL	EBR	SET	SER	NWL	NWT	Ø9
Lane Configurations							
Traffic Volume (vph)	258	291	851	608	402	454	
Future Volume (vph)	258	291	851	608	402	454	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	
Lane Width (ft)	16	16	11	10	11	12	
Storage Length (ft)	0	100		55	150		
Storage Lanes	1	1		1	1		
Taper Length (ft)	25				25		
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	1.00	
Frt		0.850		0.850			
Flt Protected	0.950				0.950		
Satd. Flow (prot)	2025	1812	3421	1492	1728	1863	
Flt Permitted	0.950				0.143		
Satd. Flow (perm)	2025	1812	3421	1492	260	1863	
Right Turn on Red		Yes		Yes			
Satd. Flow (RTOR)		244		211			
Link Speed (mph)	30		30			30	
Link Distance (ft)	1126		640			645	
Travel Time (s)	25.6		14.5			14.7	
Peak Hour Factor	0.91	0.91	0.92	0.92	0.92	0.92	
Heavy Vehicles (%)	1%	1%	2%	1%	1%	2%	
Adj. Flow (vph)	284	320	925	661	437	493	
Shared Lane Traffic (%)							
Lane Group Flow (vph)	284	320	925	661	437	493	
Enter Blocked Intersection	No	No	No	No	No	No	
Lane Alignment	Left	Right	Left	Right	Left	Left	
Median Width(ft)	16		11			11	
Link Offset(ft)	0		0			0	
Crosswalk Width(ft)	16		16			16	
Two way Left Turn Lane							
Headway Factor	0.85	0.85	1.04	1.09	1.04	1.00	
Turning Speed (mph)	15	9		9	15		
Number of Detectors	1	1	2	1	1	2	
Detector Template	Left	Right	Thru	Right	Left	Thru	
Leading Detector (ft)	20	20	100	20	20	100	
Trailing Detector (ft)	0	0	0	0	0	0	
Detector 1 Position(ft)	0	0	0	0	0	0	
Detector 1 Size(ft)	20	20	6	20	20	6	
Detector 1 Type	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	
Detector 1 Queue (s)	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	
Detector 2 Position(ft)			94			94	
Detector 2 Size(ft)			6			6	
Detector 2 Type			Cl+Ex			Cl+Ex	
Detector 2 Channel							
Detector 2 Extend (s)			0.0			0.0	
Turn Type	Prot	Perm	NA	Perm	pm+pt	NA	

Lane Group	EBL	EBR	SET	SER	NWL	NWT	Ø9
Protected Phases	4		6		5	2	9
Permitted Phases		4		6	2		
Detector Phase	4	4	6	6	5	2	
Switch Phase							
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	23.0	23.0	23.0	23.0	10.0	23.0	19.0
Total Split (s)	29.0	29.0	38.0	38.0	15.0	53.0	23.0
Total Split (%)	27.6%	27.6%	36.2%	36.2%	14.3%	50.5%	22%
Maximum Green (s)	22.0	22.0	31.0	31.0	9.0	46.0	20.0
Yellow Time (s)	4.0	4.0	4.0	4.0	3.0	4.0	2.0
All-Red Time (s)	3.0	3.0	3.0	3.0	3.0	3.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	7.0	7.0	7.0	7.0	6.0	7.0	
Lead/Lag			Lag	Lag	Lead		
Lead-Lag Optimize?			Yes	Yes	Yes		
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None	Max	Max	None	Max	None
Walk Time (s)							5.0
Flash Dont Walk (s)							11.0
Pedestrian Calls (#/hr)							35
Act Effct Green (s)	17.1	17.1	31.8	31.8	48.2	47.2	
Actuated g/C Ratio	0.19	0.19	0.36	0.36	0.54	0.53	
v/c Ratio	0.73	0.59	0.76	0.99	1.49	0.50	
Control Delay	46.5	14.1	32.7	55.2	258.1	18.7	
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	
Total Delay	46.5	14.1	32.7	55.2	258.1	18.7	
LOS	D	B	C	E	F	B	
Approach Delay	29.3		42.1			131.2	
Approach LOS	C		D			F	

Intersection Summary	
Area Type: Other	
Cycle Length: 105	
Actuated Cycle Length: 88.8	
Natural Cycle: 120	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 1.49	
Intersection Signal Delay: 66.2	Intersection LOS: E
Intersection Capacity Utilization 76.8%	ICU Level of Service D
Analysis Period (min) 15	

Splits and Phases: 2: Massachusetts Aevnue/Massachusetts Avenue & Lake Street



Lane Group	EBL	EBR	SET	SER	NWL	NWT
Lane Group Flow (vph)	284	320	925	661	437	493
v/c Ratio	0.73	0.59	0.76	0.99	1.49	0.50
Control Delay	46.5	14.1	32.7	55.2	258.1	18.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	46.5	14.1	32.7	55.2	258.1	18.7
Queue Length 50th (ft)	167	40	281	~362	~336	213
Queue Length 95th (ft)	257	122	#409	#604	#550	332
Internal Link Dist (ft)	1046		560			565
Turn Bay Length (ft)		100		55	150	
Base Capacity (vph)	515	642	1225	670	293	990
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	0.55	0.50	0.76	0.99	1.49	0.50

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

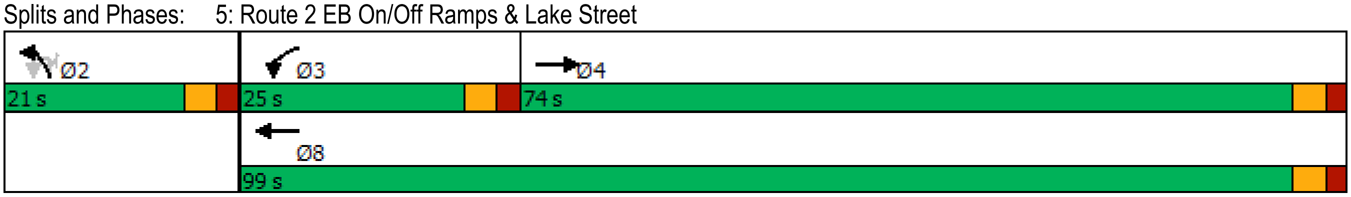
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Lane Group	EBT	EBR	WBL	WBT	NBU	NBL	NBR
Lane Configurations							
Traffic Volume (vph)	311	493	210	419	271	221	520
Future Volume (vph)	311	493	210	419	271	221	520
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	16	16	10	11	12	16	14
Storage Length (ft)		150	110			0	0
Storage Lanes		1	1			1	1
Taper Length (ft)			25			25	
Lane Util. Factor	1.00	1.00	1.00	0.95	1.00	1.00	1.00
Frt		0.850					0.850
Flt Protected			0.950			0.950	
Satd. Flow (prot)	2132	1812	1685	3455	0	2037	1706
Flt Permitted			0.950			0.950	
Satd. Flow (perm)	2132	1812	1685	3455	0	2037	1706
Right Turn on Red		Yes					Yes
Satd. Flow (RTOR)		333					402
Link Speed (mph)	30			30		30	
Link Distance (ft)	239			505		387	
Travel Time (s)	5.4			11.5		8.8	
Peak Hour Factor	0.91	0.91	0.84	0.84	0.91	0.91	0.91
Heavy Vehicles (%)	1%	1%	0%	1%	0%	1%	1%
Adj. Flow (vph)	342	542	250	499	298	243	571
Shared Lane Traffic (%)							
Lane Group Flow (vph)	342	542	250	499	0	541	571
Enter Blocked Intersection	No	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	R NA	Left	Right
Median Width(ft)	12			12		16	
Link Offset(ft)	0			0		0	
Crosswalk Width(ft)	16			16		16	
Two way Left Turn Lane							
Headway Factor	0.85	0.85	1.09	1.04	1.00	0.85	0.92
Turning Speed (mph)		9	15		9	15	9
Number of Detectors	2	1	1	2	1	1	1
Detector Template	Thru	Right	Left	Thru	Left	Left	Right
Leading Detector (ft)	100	20	20	100	20	20	20
Trailing Detector (ft)	0	0	0	0	0	0	0
Detector 1 Position(ft)	0	0	0	0	0	0	0
Detector 1 Size(ft)	6	20	20	6	20	20	20
Detector 1 Type	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
Detector 1 Queue (s)	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
Detector 2 Position(ft)	94			94			
Detector 2 Size(ft)	6			6			
Detector 2 Type	Cl+Ex			Cl+Ex			
Detector 2 Channel							
Detector 2 Extend (s)	0.0			0.0			
Turn Type	NA	Free	Prot	NA	Perm	Prot	Perm

Lane Group	EBT	EBR	WBL	WBT	NBU	NBL	NBR
Protected Phases	4		3	8		2	
Permitted Phases		Free			2		2
Detector Phase	4		3	8	2	2	2
Switch Phase							
Minimum Initial (s)	4.0		4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0		9.0	21.0	21.0	21.0	21.0
Total Split (s)	74.0		25.0	99.0	21.0	21.0	21.0
Total Split (%)	61.7%		20.8%	82.5%	17.5%	17.5%	17.5%
Maximum Green (s)	69.0		20.0	94.0	16.0	16.0	16.0
Yellow Time (s)	3.0		3.0	3.0	3.0	3.0	3.0
All-Red Time (s)	2.0		2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0		0.0	0.0		0.0	0.0
Total Lost Time (s)	5.0		5.0	5.0		5.0	5.0
Lead/Lag	Lag		Lead				
Lead-Lag Optimize?	Yes		Yes				
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0	3.0
Recall Mode	None		None	None	Max	Max	Max
Walk Time (s)	5.0			5.0	5.0	5.0	5.0
Flash Dont Walk (s)	11.0			11.0	11.0	11.0	11.0
Pedestrian Calls (#/hr)	0			0	0	0	0
Act Effct Green (s)	15.7	63.2	16.2	37.0		16.2	16.2
Actuated g/C Ratio	0.25	1.00	0.26	0.59		0.26	0.26
v/c Ratio	0.64	0.30	0.58	0.25		1.04	0.78
Control Delay	27.7	0.4	27.3	6.5		78.8	16.8
Queue Delay	0.0	0.0	0.0	0.0		0.0	0.0
Total Delay	27.7	0.4	27.3	6.5		78.8	16.8
LOS	C	A	C	A		E	B
Approach Delay	11.0			13.4		47.0	
Approach LOS	B			B		D	

Intersection Summary	
Area Type: Other	
Cycle Length: 120	
Actuated Cycle Length: 63.2	
Natural Cycle: 60	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 1.04	
Intersection Signal Delay: 26.2	Intersection LOS: C
Intersection Capacity Utilization 67.8%	ICU Level of Service C
Analysis Period (min) 15	

Splits and Phases: 5: Route 2 EB On/Off Ramps & Lake Street



Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Group Flow (vph)	342	542	250	499	541	571
v/c Ratio	0.64	0.30	0.58	0.25	1.04	0.78
Control Delay	27.7	0.4	27.3	6.5	78.8	16.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	27.7	0.4	27.3	6.5	78.8	16.8
Queue Length 50th (ft)	118	0	83	42	~234	54
Queue Length 95th (ft)	204	0	151	57	#482	#243
Internal Link Dist (ft)	159			425	307	
Turn Bay Length (ft)		150	110			
Base Capacity (vph)	2110	1812	538	3455	520	735
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	0.16	0.30	0.46	0.14	1.04	0.78

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

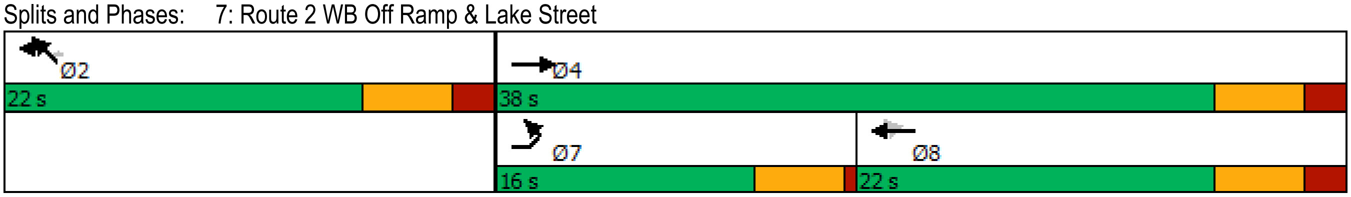
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Traffic Volume (vph)	224	607	0	0	478	716	0	0	0	151	6	10
Future Volume (vph)	224	607	0	0	478	716	0	0	0	151	6	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	11	10	12	12	12	11	12	16
Storage Length (ft)	250		0	0		75	0		0	100		0
Storage Lanes	1		0	0		1	0		0	1		1
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	0.95	0.95	1.00
Frt						0.850						0.850
Flt Protected	0.950									0.950	0.956	
Satd. Flow (prot)	1805	1881	0	0	1837	1492	0	0	0	1579	1594	1830
Flt Permitted	0.950									0.950	0.956	
Satd. Flow (perm)	1805	1881	0	0	1837	1492	0	0	0	1579	1594	1830
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)						490						136
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		505			380			459			529	
Travel Time (s)		11.5			8.6			10.4			12.0	
Peak Hour Factor	0.88	0.88	0.88	0.92	0.92	0.92	0.92	0.92	0.92	0.81	0.81	0.81
Heavy Vehicles (%)	0%	1%	0%	0%	0%	1%	0%	0%	0%	5%	50%	0%
Adj. Flow (vph)	255	690	0	0	520	778	0	0	0	186	7	12
Shared Lane Traffic (%)										48%		
Lane Group Flow (vph)	255	690	0	0	520	778	0	0	0	97	96	12
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			11			11	
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	1.04	1.09	1.00	1.00	1.00	1.04	1.00	0.85
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2			2	1				1	2	1
Detector Template	Left	Thru			Thru	Right				Left	Thru	Right
Leading Detector (ft)	20	100			100	20				20	100	20
Trailing Detector (ft)	0	0			0	0				0	0	0
Detector 1 Position(ft)	0	0			0	0				0	0	0
Detector 1 Size(ft)	20	6			6	20				20	6	20
Detector 1 Type	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
Detector 1 Queue (s)	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
Detector 2 Position(ft)		94			94						94	
Detector 2 Size(ft)		6			6						6	
Detector 2 Type		Cl+Ex			Cl+Ex						Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0						0.0	
Turn Type	Prot	NA			NA	Perm				Split	NA	Perm

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Protected Phases	7	4			8					2	2	
Permitted Phases						8						2
Detector Phase	7	4			8	8				2	2	2
Switch Phase												
Minimum Initial (s)	4.0	4.0			4.0	4.0				4.0	4.0	4.0
Minimum Split (s)	8.5	22.0			22.0	22.0				22.0	22.0	22.0
Total Split (s)	16.0	38.0			22.0	22.0				22.0	22.0	22.0
Total Split (%)	26.7%	63.3%			36.7%	36.7%				36.7%	36.7%	36.7%
Maximum Green (s)	11.5	32.0			16.0	16.0				16.0	16.0	16.0
Yellow Time (s)	4.0	4.0			4.0	4.0				4.0	4.0	4.0
All-Red Time (s)	0.5	2.0			2.0	2.0				2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0			0.0	0.0				0.0	0.0	0.0
Total Lost Time (s)	4.5	6.0			6.0	6.0				6.0	6.0	6.0
Lead/Lag	Lead				Lag	Lag						
Lead-Lag Optimize?	Yes				Yes	Yes						
Vehicle Extension (s)	3.0	3.0			3.0	3.0				3.0	3.0	3.0
Recall Mode	None	None			None	None				Max	Max	Max
Walk Time (s)		5.0			5.0	5.0				5.0	5.0	5.0
Flash Dont Walk (s)		11.0			11.0	11.0				11.0	11.0	11.0
Pedestrian Calls (#/hr)		0			0	0				0	0	0
Act Effct Green (s)	11.0	31.5			16.0	16.0				16.0	16.0	16.0
Actuated g/C Ratio	0.18	0.53			0.27	0.27				0.27	0.27	0.27
v/c Ratio	0.77	0.69			1.05	1.03				0.23	0.22	0.02
Control Delay	40.9	15.0			81.3	51.2				19.0	18.9	0.1
Queue Delay	0.0	0.0			0.0	0.0				0.0	0.0	0.0
Total Delay	40.9	15.0			81.3	51.2				19.0	18.9	0.1
LOS	D	B			F	D				B	B	A
Approach Delay		22.0			63.2						17.8	
Approach LOS		C			E						B	

Intersection Summary

Area Type: Other
Cycle Length: 60
Actuated Cycle Length: 59.5
Natural Cycle: 80
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 1.05
Intersection Signal Delay: 43.5 Intersection LOS: D
Intersection Capacity Utilization 74.8% ICU Level of Service D
Analysis Period (min) 15

Splits and Phases: 7: Route 2 WB Off Ramp & Lake Street



Lane Group	EBL	EBT	WBT	WBR	NWL	NWT	NWR
Lane Group Flow (vph)	255	690	520	778	97	96	12
v/c Ratio	0.77	0.69	1.05	1.03	0.23	0.22	0.02
Control Delay	40.9	15.0	81.3	51.2	19.0	18.9	0.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	40.9	15.0	81.3	51.2	19.0	18.9	0.1
Queue Length 50th (ft)	88	167	~214	~135	28	28	0
Queue Length 95th (ft)	#179	265	#378	#357	56	55	0
Internal Link Dist (ft)		425	300			449	
Turn Bay Length (ft)	250			75	100		
Base Capacity (vph)	348	1012	494	759	425	429	591
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.73	0.68	1.05	1.03	0.23	0.22	0.02

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

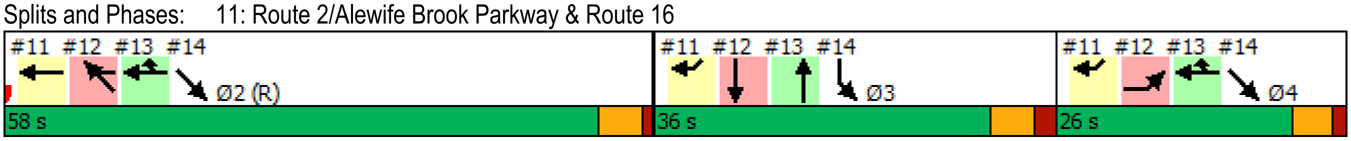
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Lane Group	EBL	EBT	WBT	WBR	SWL	SWR	Ø3	Ø4
Lane Configurations								
Traffic Volume (vph)	0	0	1596	0	0	1062		
Future Volume (vph)	0	0	1596	0	0	1062		
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900		
Lane Width (ft)	13	13	13	13	13	13		
Lane Util. Factor	1.00	1.00	0.91	1.00	1.00	0.88		
Frt						0.850		
Flt Protected								
Satd. Flow (prot)	0	0	4729	0	0	2617		
Flt Permitted								
Satd. Flow (perm)	0	0	4729	0	0	2617		
Right Turn on Red				Yes		Yes		
Satd. Flow (RTOR)						7		
Link Speed (mph)		30	30		30			
Link Distance (ft)		201	192		296			
Travel Time (s)		4.6	4.4		6.7			
Peak Hour Factor	0.92	0.92	0.90	0.92	0.92	0.85		
Heavy Vehicles (%)	2%	2%	2%	2%	2%	1%		
Adj. Flow (vph)	0	0	1773	0	0	1249		
Shared Lane Traffic (%)								
Lane Group Flow (vph)	0	0	1773	0	0	1249		
Enter Blocked Intersection	No	No	No	No	No	No		
Lane Alignment	Left	Left	Left	Right	Left	Right		
Median Width(ft)		0	0		0			
Link Offset(ft)		0	0		0			
Crosswalk Width(ft)		16	16		16			
Two way Left Turn Lane								
Headway Factor	1.10	1.10	1.10	1.10	1.10	1.10		
Turning Speed (mph)	15			9	15	30		
Number of Detectors			2			1		
Detector Template			Thru			Right		
Leading Detector (ft)			100			20		
Trailing Detector (ft)			0			0		
Detector 1 Position(ft)			0			0		
Detector 1 Size(ft)			6			20		
Detector 1 Type			Cl+Ex			Cl+Ex		
Detector 1 Channel								
Detector 1 Extend (s)			0.0			0.0		
Detector 1 Queue (s)			0.0			0.0		
Detector 1 Delay (s)			0.0			0.0		
Detector 2 Position(ft)			94					
Detector 2 Size(ft)			6					
Detector 2 Type			Cl+Ex					
Detector 2 Channel								
Detector 2 Extend (s)			0.0					
Turn Type			NA			custom		
Protected Phases			2			3 4	3	4
Permitted Phases								
Detector Phase			2			3 4		

Lane Group	EBL	EBT	WBT	WBR	SWL	SWR	Ø3	Ø4
Switch Phase								
Minimum Initial (s)			10.0				10.0	10.0
Minimum Split (s)			15.0				19.0	15.0
Total Split (s)			58.0				36.0	26.0
Total Split (%)			48.3%				30%	22%
Maximum Green (s)			53.0				30.0	21.0
Yellow Time (s)			4.0				4.0	3.5
All-Red Time (s)			1.0				2.0	1.5
Lost Time Adjust (s)			0.0					
Total Lost Time (s)			5.0					
Lead/Lag							Lead	Lag
Lead-Lag Optimize?								
Vehicle Extension (s)			3.0				3.0	3.0
Recall Mode			C-Max				Max	Max
Walk Time (s)							5.0	
Flash Dont Walk (s)							8.0	
Pedestrian Calls (#/hr)							0	
Act Effct Green (s)			53.0			56.0		
Actuated g/C Ratio			0.44			0.47		
v/c Ratio			0.85			1.02		
Control Delay			5.6			62.8		
Queue Delay			4.5			0.0		
Total Delay			10.1			62.8		
LOS			B			E		
Approach Delay			10.1		62.8			
Approach LOS			B		E			

Intersection Summary	
Area Type: CBD	
Cycle Length: 120	
Actuated Cycle Length: 120	
Offset: 16 (13%), Referenced to phase 2:WBT, Start of Green	
Natural Cycle: 110	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 1.09	
Intersection Signal Delay: 31.9	Intersection LOS: C
Intersection Capacity Utilization 84.7%	ICU Level of Service E
Analysis Period (min) 15	

Splits and Phases: 11: Route 2/Alewife Brook Parkway & Route 16



Lane Group	WBT	SWR
Lane Group Flow (vph)	1773	1249
v/c Ratio	0.85	1.02
Control Delay	5.6	62.8
Queue Delay	4.5	0.0
Total Delay	10.1	62.8
Queue Length 50th (ft)	43	~581
Queue Length 95th (ft)	m40	#659
Internal Link Dist (ft)	112	
Turn Bay Length (ft)		
Base Capacity (vph)	2088	1225
Starvation Cap Reductn	252	0
Spillback Cap Reductn	0	0
Storage Cap Reductn	0	0
Reduced v/c Ratio	0.97	1.02

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

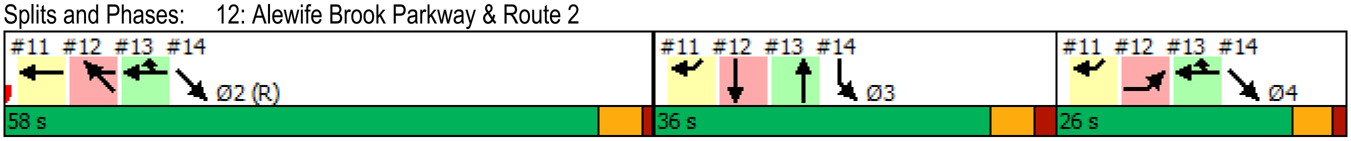
Lane Group	EBL	WBR	SBT	NWT
Lane Configurations				
Traffic Volume (vph)	505	169	506	1427
Future Volume (vph)	505	169	506	1427
Ideal Flow (vphpl)	1900	1900	1900	1900
Lane Width (ft)	13	16	13	13
Lane Util. Factor	0.97	1.00	0.95	0.95
Frt		0.865		
Flt Protected	0.950			
Satd. Flow (prot)	3224	1581	3291	3291
Flt Permitted	0.950			
Satd. Flow (perm)	3224	1581	3291	3291
Right Turn on Red				
Satd. Flow (RTOR)				
Link Speed (mph)			30	30
Link Distance (ft)			202	278
Travel Time (s)			4.6	6.3
Peak Hour Factor	0.97	0.94	0.85	0.90
Heavy Vehicles (%)	1%	6%	2%	2%
Adj. Flow (vph)	521	180	595	1586
Shared Lane Traffic (%)				
Lane Group Flow (vph)	521	180	595	1586
Enter Blocked Intersection	No	No	No	No
Lane Alignment	Left	R NA	Left	L NA
Median Width(ft)			0	0
Link Offset(ft)			0	0
Crosswalk Width(ft)			16	16
Two way Left Turn Lane				
Headway Factor	1.10	0.97	1.10	1.10
Turning Speed (mph)	15	30		
Number of Detectors	1	1	2	2
Detector Template	Left	Right	Thru	Thru
Leading Detector (ft)	20	20	100	100
Trailing Detector (ft)	0	0	0	0
Detector 1 Position(ft)	0	0	0	0
Detector 1 Size(ft)	20	20	6	6
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel				
Detector 1 Extend (s)	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0
Detector 2 Position(ft)			94	94
Detector 2 Size(ft)			6	6
Detector 2 Type			Cl+Ex	Cl+Ex
Detector 2 Channel				
Detector 2 Extend (s)			0.0	0.0
Turn Type	Prot	Prot	NA	NA
Protected Phases	4	2!	3	2!
Permitted Phases				
Detector Phase	4	2	3	2

Lane Group	EBL	WBR	SBT	NWT
Switch Phase				
Minimum Initial (s)	10.0	10.0	10.0	10.0
Minimum Split (s)	15.0	15.0	19.0	15.0
Total Split (s)	26.0	58.0	36.0	58.0
Total Split (%)	21.7%	48.3%	30.0%	48.3%
Maximum Green (s)	21.0	53.0	30.0	53.0
Yellow Time (s)	3.5	4.0	4.0	4.0
All-Red Time (s)	1.5	1.0	2.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	6.0	5.0
Lead/Lag	Lag		Lead	
Lead-Lag Optimize?				
Vehicle Extension (s)	3.0	3.0	3.0	3.0
Recall Mode	Max	C-Max	Max	C-Max
Walk Time (s)			5.0	
Flash Dont Walk (s)			8.0	
Pedestrian Calls (#/hr)			0	
Act Effct Green (s)	21.0	53.0	30.0	53.0
Actuated g/C Ratio	0.18	0.44	0.25	0.44
v/c Ratio	0.92	0.26	0.72	1.09
Control Delay	72.2	14.3	47.1	85.5
Queue Delay	0.0	2.4	0.0	3.6
Total Delay	72.2	16.7	47.1	89.1
LOS	E	B	D	F
Approach Delay			47.1	89.1
Approach LOS			D	F

Intersection Summary

Area Type: CBD
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 16 (13%), Referenced to phase 2:WBT, Start of Green
Natural Cycle: 110
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 1.09
Intersection Signal Delay: 72.8 Intersection LOS: E
Intersection Capacity Utilization 103.7% ICU Level of Service G
Analysis Period (min) 15
! Phase conflict between lane groups.

Splits and Phases: 12: Alewife Brook Parkway & Route 2



Lane Group	EBL	WBR	SBT	NWT
Lane Group Flow (vph)	521	180	595	1586
v/c Ratio	0.92	0.26	0.72	1.09
Control Delay	72.2	14.3	47.1	85.5
Queue Delay	0.0	2.4	0.0	3.6
Total Delay	72.2	16.7	47.1	89.1
Queue Length 50th (ft)	206	86	223	~728
Queue Length 95th (ft)	#308	138	269	#868
Internal Link Dist (ft)			122	198
Turn Bay Length (ft)				
Base Capacity (vph)	564	698	822	1453
Starvation Cap Reductn	0	397	0	0
Spillback Cap Reductn	0	6	0	13
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.92	0.60	0.72	1.10

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

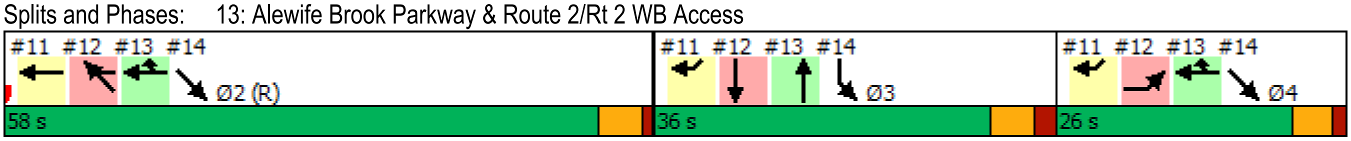
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↑	↱		↑↑				
Traffic Volume (vph)	0	0	0	0	169	54	0	224	0	0	0	0
Future Volume (vph)	0	0	0	0	169	54	0	224	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		200	0		0	0		0
Storage Lanes	0		0	0		1	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	0.95	1.00	1.00	1.00	1.00
Ped Bike Factor												
Frt						0.850						
Flt Protected												
Satd. Flow (prot)	0	0	0	0	1613	1333	0	3154	0	0	0	0
Flt Permitted												
Satd. Flow (perm)	0	0	0	0	1613	1333	0	3154	0	0	0	0
Right Turn on Red			No			No	No		No			No
Satd. Flow (RTOR)												
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		161			1225			227			185	
Travel Time (s)		3.7			27.8			5.2			4.2	
Confl. Peds. (#/hr)						2						
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.90	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	2%	2%	2%	0%	6%	9%	2%	3%	2%	2%	2%	2%
Adj. Flow (vph)	0	0	0	0	184	59	0	249	0	0	0	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	0	0	0	184	59	0	249	0	0	0	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)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors					2	1		2				
Detector Template					Thru	Right		Thru				
Leading Detector (ft)					100	20		100				
Trailing Detector (ft)					0	0		0				
Detector 1 Position(ft)					0	0		0				
Detector 1 Size(ft)					6	20		6				
Detector 1 Type					Cl+Ex	Cl+Ex		Cl+Ex				
Detector 1 Channel												
Detector 1 Extend (s)					0.0	0.0		0.0				
Detector 1 Queue (s)					0.0	0.0		0.0				
Detector 1 Delay (s)					0.0	0.0		0.0				
Detector 2 Position(ft)					94			94				
Detector 2 Size(ft)					6			6				
Detector 2 Type					Cl+Ex			Cl+Ex				
Detector 2 Channel												
Detector 2 Extend (s)					0.0			0.0				

Lane Group	Ø2	Ø4
Lane Configurations		
Traffic Volume (vph)		
Future Volume (vph)		
Ideal Flow (vphpl)		
Storage Length (ft)		
Storage Lanes		
Taper Length (ft)		
Lane Util. Factor		
Ped Bike Factor		
Frt		
Flt Protected		
Satd. Flow (prot)		
Flt Permitted		
Satd. Flow (perm)		
Right Turn on Red		
Satd. Flow (RTOR)		
Link Speed (mph)		
Link Distance (ft)		
Travel Time (s)		
Confl. Peds. (#/hr)		
Peak Hour Factor		
Heavy Vehicles (%)		
Adj. Flow (vph)		
Shared Lane Traffic (%)		
Lane Group Flow (vph)		
Enter Blocked Intersection		
Lane Alignment		
Median Width(ft)		
Link Offset(ft)		
Crosswalk Width(ft)		
Two way Left Turn Lane		
Headway Factor		
Turning Speed (mph)		
Number of Detectors		
Detector Template		
Leading Detector (ft)		
Trailing Detector (ft)		
Detector 1 Position(ft)		
Detector 1 Size(ft)		
Detector 1 Type		
Detector 1 Channel		
Detector 1 Extend (s)		
Detector 1 Queue (s)		
Detector 1 Delay (s)		
Detector 2 Position(ft)		
Detector 2 Size(ft)		
Detector 2 Type		
Detector 2 Channel		
Detector 2 Extend (s)		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Turn Type					NA	Prot		NA				
Protected Phases					2 4	2 4		3				
Permitted Phases												
Detector Phase					2 4	2 4		3				
Switch Phase												
Minimum Initial (s)								10.0				
Minimum Split (s)								19.0				
Total Split (s)								36.0				
Total Split (%)								30.0%				
Maximum Green (s)								30.0				
Yellow Time (s)								4.0				
All-Red Time (s)								2.0				
Lost Time Adjust (s)								0.0				
Total Lost Time (s)								6.0				
Lead/Lag								Lead				
Lead-Lag Optimize?												
Vehicle Extension (s)								3.0				
Recall Mode								Max				
Walk Time (s)								5.0				
Flash Dont Walk (s)								8.0				
Pedestrian Calls (#/hr)								0				
Act Effct Green (s)					79.0	79.0		30.0				
Actuated g/C Ratio					0.66	0.66		0.25				
v/c Ratio					0.17	0.07		0.32				
Control Delay					8.4	7.6		38.0				
Queue Delay					0.1	0.0		0.0				
Total Delay					8.5	7.6		38.0				
LOS					A	A		D				
Approach Delay					8.3			38.0				
Approach LOS					A			D				

Intersection Summary	
Area Type: CBD	
Cycle Length: 120	
Actuated Cycle Length: 120	
Offset: 16 (13%), Referenced to phase 2:WBT, Start of Green	
Natural Cycle: 110	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 1.09	
Intersection Signal Delay: 23.3	Intersection LOS: C
Intersection Capacity Utilization 27.4%	ICU Level of Service A
Analysis Period (min) 15	

Splits and Phases: 13: Alewife Brook Parkway & Route 2/Rt 2 WB Access



Lane Group	Ø2	Ø4
Turn Type		
Protected Phases	2	4
Permitted Phases		
Detector Phase		
Switch Phase		
Minimum Initial (s)	10.0	10.0
Minimum Split (s)	15.0	15.0
Total Split (s)	58.0	26.0
Total Split (%)	48%	22%
Maximum Green (s)	53.0	21.0
Yellow Time (s)	4.0	3.5
All-Red Time (s)	1.0	1.5
Lost Time Adjust (s)		
Total Lost Time (s)		
Lead/Lag		Lag
Lead-Lag Optimize?		
Vehicle Extension (s)	3.0	3.0
Recall Mode	C-Max	Max
Walk Time (s)		
Flash Dont Walk (s)		
Pedestrian Calls (#/hr)		
Act Effct Green (s)		
Actuated g/C Ratio		
v/c Ratio		
Control Delay		
Queue Delay		
Total Delay		
LOS		
Approach Delay		
Approach LOS		

Intersection Summary

Lane Group	WBT	WBR	NBT
Lane Group Flow (vph)	184	59	249
v/c Ratio	0.17	0.07	0.32
Control Delay	8.4	7.6	38.0
Queue Delay	0.1	0.0	0.0
Total Delay	8.5	7.6	38.0
Queue Length 50th (ft)	50	15	83
Queue Length 95th (ft)	81	31	121
Internal Link Dist (ft)	1145		147
Turn Bay Length (ft)		200	
Base Capacity (vph)	1061	877	788
Starvation Cap Reductn	0	0	0
Spillback Cap Reductn	223	0	0
Storage Cap Reductn	0	0	0
Reduced v/c Ratio	0.22	0.07	0.32

Intersection Summary

Lane Group	SBL	SBR	SEL	SET	NWT	NWR	Ø2	Ø4
Lane Configurations								
Traffic Volume (vph)	506	0	0	1102	0	0		
Future Volume (vph)	506	0	0	1102	0	0		
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900		
Lane Width (ft)	13	13	13	13	13	13		
Lane Util. Factor	0.97	1.00	1.00	0.95	1.00	1.00		
Frt								
Flt Protected	0.950							
Satd. Flow (prot)	3193	0	0	3324	0	0		
Flt Permitted	0.950							
Satd. Flow (perm)	3193	0	0	3324	0	0		
Right Turn on Red	Yes	Yes				Yes		
Satd. Flow (RTOR)	216							
Link Speed (mph)	30			30	30			
Link Distance (ft)	155			297	139			
Travel Time (s)	3.5			6.8	3.2			
Peak Hour Factor	0.85	0.92	0.92	0.97	0.92	0.92		
Heavy Vehicles (%)	2%	2%	2%	1%	2%	2%		
Adj. Flow (vph)	595	0	0	1136	0	0		
Shared Lane Traffic (%)								
Lane Group Flow (vph)	595	0	0	1136	0	0		
Enter Blocked Intersection	No	No	No	No	No	No		
Lane Alignment	Left	Right	Left	Left	Left	Right		
Median Width(ft)	26			0	0			
Link Offset(ft)	0			0	0			
Crosswalk Width(ft)	16			16	16			
Two way Left Turn Lane								
Headway Factor	1.10	1.10	1.10	1.10	1.10	1.10		
Turning Speed (mph)	30	9	15			9		
Number of Detectors	1			2				
Detector Template	Left			Thru				
Leading Detector (ft)	20			100				
Trailing Detector (ft)	0			0				
Detector 1 Position(ft)	0			0				
Detector 1 Size(ft)	20			6				
Detector 1 Type	Cl+Ex			Cl+Ex				
Detector 1 Channel								
Detector 1 Extend (s)	0.0			0.0				
Detector 1 Queue (s)	0.0			0.0				
Detector 1 Delay (s)	0.0			0.0				
Detector 2 Position(ft)				94				
Detector 2 Size(ft)				6				
Detector 2 Type				Cl+Ex				
Detector 2 Channel								
Detector 2 Extend (s)				0.0				
Turn Type	Prot			NA				
Protected Phases	3			2 4			2	4
Permitted Phases								
Detector Phase	3			2 4				

Lane Group	SBL	SBR	SEL	SET	NWT	NWR	Ø2	Ø4
Switch Phase								
Minimum Initial (s)	10.0						10.0	10.0
Minimum Split (s)	19.0						15.0	15.0
Total Split (s)	36.0						58.0	26.0
Total Split (%)	30.0%						48%	22%
Maximum Green (s)	30.0						53.0	21.0
Yellow Time (s)	4.0						4.0	3.5
All-Red Time (s)	2.0						1.0	1.5
Lost Time Adjust (s)	0.0							
Total Lost Time (s)	6.0							
Lead/Lag	Lead							Lag
Lead-Lag Optimize?								
Vehicle Extension (s)	3.0						3.0	3.0
Recall Mode	Max						C-Max	Max
Walk Time (s)	5.0							
Flash Dont Walk (s)	8.0							
Pedestrian Calls (#/hr)	0							
Act Effct Green (s)	30.0			79.0				
Actuated g/C Ratio	0.25			0.66				
v/c Ratio	0.62			0.52				
Control Delay	2.8			11.7				
Queue Delay	1.0			0.0				
Total Delay	3.7			11.7				
LOS	A			B				
Approach Delay	3.7			11.7				
Approach LOS	A			B				

Intersection Summary

Area Type: CBD

Cycle Length: 120

Actuated Cycle Length: 120

Offset: 16 (13%), Referenced to phase 2:WBT, Start of Green

Natural Cycle: 110

Control Type: Actuated-Coordinated

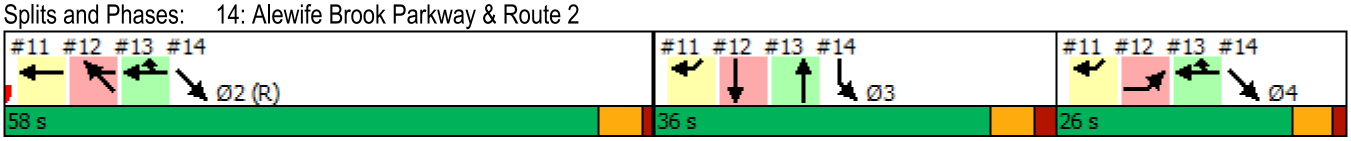
Maximum v/c Ratio: 1.09

Intersection Signal Delay: 9.0 Intersection LOS: A

Intersection Capacity Utilization 59.1% ICU Level of Service B

Analysis Period (min) 15

Splits and Phases: 14: Alewife Brook Parkway & Route 2



Lane Group	SBL	SET
Lane Group Flow (vph)	595	1136
v/c Ratio	0.62	0.52
Control Delay	2.8	11.7
Queue Delay	1.0	0.0
Total Delay	3.7	11.7
Queue Length 50th (ft)	5	220
Queue Length 95th (ft)	0	272
Internal Link Dist (ft)	75	217
Turn Bay Length (ft)		
Base Capacity (vph)	960	2188
Starvation Cap Reductn	156	0
Spillback Cap Reductn	0	0
Storage Cap Reductn	0	0
Reduced v/c Ratio	0.74	0.52

Intersection Summary

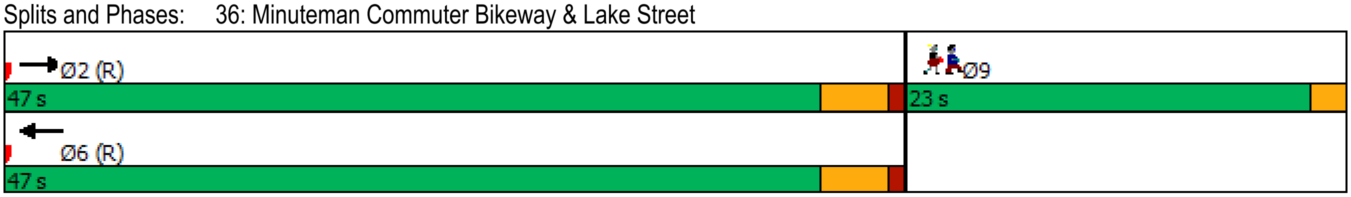
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	618	0	0	1163	0	0	0	0	0	0	0
Future Volume (vph)	0	618	0	0	1163	0	0	0	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	15	15	15	16	16	16	12	12	12	12	12	12
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												
Flt Protected												
Satd. Flow (prot)	0	2049	0	0	2153	0	0	0	0	0	0	0
Flt Permitted												
Satd. Flow (perm)	0	2049	0	0	2153	0	0	0	0	0	0	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)												
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		135			215			175			206	
Travel Time (s)		3.1			4.9			4.0			4.7	
Peak Hour Factor	0.84	0.84	0.84	0.97	0.97	0.97	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	2%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Adj. Flow (vph)	0	736	0	0	1199	0	0	0	0	0	0	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	736	0	0	1199	0	0	0	0	0	0	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)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	0.88	0.88	0.88	0.85	0.85	0.85	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		2			2							
Detector Template		Thru			Thru							
Leading Detector (ft)		100			100							
Trailing Detector (ft)		0			0							
Detector 1 Position(ft)		0			0							
Detector 1 Size(ft)		6			6							
Detector 1 Type		Cl+Ex			Cl+Ex							
Detector 1 Channel												
Detector 1 Extend (s)		0.0			0.0							
Detector 1 Queue (s)		0.0			0.0							
Detector 1 Delay (s)		0.0			0.0							
Detector 2 Position(ft)		94			94							
Detector 2 Size(ft)		6			6							
Detector 2 Type		Cl+Ex			Cl+Ex							
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0							
Turn Type		NA			NA							
Protected Phases		2			6							
Permitted Phases												
Detector Phase		2			6							

Lane Group	Ø9
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Ideal Flow (vphpl)	
Lane Width (ft)	
Lane Util. Factor	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (mph)	
Link Distance (ft)	
Travel Time (s)	
Peak Hour Factor	
Heavy Vehicles (%)	
Adj. Flow (vph)	
Shared Lane Traffic (%)	
Lane Group Flow (vph)	
Enter Blocked Intersection	
Lane Alignment	
Median Width(ft)	
Link Offset(ft)	
Crosswalk Width(ft)	
Two way Left Turn Lane	
Headway Factor	
Turning Speed (mph)	
Number of Detectors	
Detector Template	
Leading Detector (ft)	
Trailing Detector (ft)	
Detector 1 Position(ft)	
Detector 1 Size(ft)	
Detector 1 Type	
Detector 1 Channel	
Detector 1 Extend (s)	
Detector 1 Queue (s)	
Detector 1 Delay (s)	
Detector 2 Position(ft)	
Detector 2 Size(ft)	
Detector 2 Type	
Detector 2 Channel	
Detector 2 Extend (s)	
Turn Type	
Protected Phases	9
Permitted Phases	
Detector Phase	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Switch Phase												
Minimum Initial (s)		4.0			4.0							
Minimum Split (s)		20.5			20.5							
Total Split (s)		47.0			47.0							
Total Split (%)		67.1%			67.1%							
Maximum Green (s)		42.5			42.5							
Yellow Time (s)		3.5			3.5							
All-Red Time (s)		1.0			1.0							
Lost Time Adjust (s)		0.0			0.0							
Total Lost Time (s)		4.5			4.5							
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)		3.0			3.0							
Recall Mode		C-Max			C-Max							
Walk Time (s)												
Flash Dont Walk (s)												
Pedestrian Calls (#/hr)												
Act Effct Green (s)		47.5			47.5							
Actuated g/C Ratio		0.68			0.68							
v/c Ratio		0.53			0.82							
Control Delay		7.4			17.3							
Queue Delay		53.1			50.4							
Total Delay		60.4			67.6							
LOS		E			E							
Approach Delay		60.4			67.6							
Approach LOS		E			E							

Intersection Summary	
Area Type: Other	
Cycle Length: 70	
Actuated Cycle Length: 70	
Offset: 16 (23%), Referenced to phase 2:EBT and 6:WBT, Start of Green	
Natural Cycle: 75	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.82	
Intersection Signal Delay: 64.9	Intersection LOS: E
Intersection Capacity Utilization 65.0%	ICU Level of Service C
Analysis Period (min) 15	

Splits and Phases: 36: Minuteman Commuter Bikeway & Lake Street



Lane Group	Ø9
Switch Phase	
Minimum Initial (s)	4.0
Minimum Split (s)	23.0
Total Split (s)	23.0
Total Split (%)	33%
Maximum Green (s)	21.0
Yellow Time (s)	2.0
All-Red Time (s)	0.0
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	
Lead-Lag Optimize?	
Vehicle Extension (s)	3.0
Recall Mode	None
Walk Time (s)	5.0
Flash Dont Walk (s)	11.0
Pedestrian Calls (#/hr)	304
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	

Intersection Summary

Lane Group	EBT	WBT
Lane Group Flow (vph)	736	1199
v/c Ratio	0.53	0.82
Control Delay	7.4	17.3
Queue Delay	53.1	50.4
Total Delay	60.4	67.6
Queue Length 50th (ft)	132	569
Queue Length 95th (ft)	180	m580
Internal Link Dist (ft)	55	135
Turn Bay Length (ft)		
Base Capacity (vph)	1390	1460
Starvation Cap Reductn	0	729
Spillback Cap Reductn	804	0
Storage Cap Reductn	0	0
Reduced v/c Ratio	1.26	1.64

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	31	541	46	6	1004	0	38	4	5	3	7	121
Future Volume (vph)	31	541	46	6	1004	0	38	4	5	3	7	121
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	14	14	14	13	13	13	12	12	12	12	12	12
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		0.990						0.985			0.875	
Flt Protected		0.998						0.961			0.999	
Satd. Flow (prot)	0	1978	0	0	1944	0	0	1799	0	0	1661	0
Flt Permitted		0.918			0.997			0.487			0.993	
Satd. Flow (perm)	0	1819	0	0	1938	0	0	911	0	0	1651	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		6						7			155	
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		215			1126			206			208	
Travel Time (s)		4.9			25.6			4.7			4.7	
Peak Hour Factor	0.91	0.91	0.91	0.87	0.87	0.87	0.75	0.75	0.75	0.78	0.78	0.78
Heavy Vehicles (%)	0%	1%	5%	0%	1%	0%	0%	0%	0%	0%	0%	0%
Adj. Flow (vph)	34	595	51	7	1154	0	51	5	7	4	9	155
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	680	0	0	1161	0	0	63	0	0	168	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)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	0.92	0.92	0.92	0.96	0.96	0.96	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	Perm	NA		Perm	NA		pm+pt	NA		Perm	NA	
Protected Phases		2			6		3	8			4	
Permitted Phases	2			6			8			4		
Detector Phase	2	2		6	6		3	8		4	4	

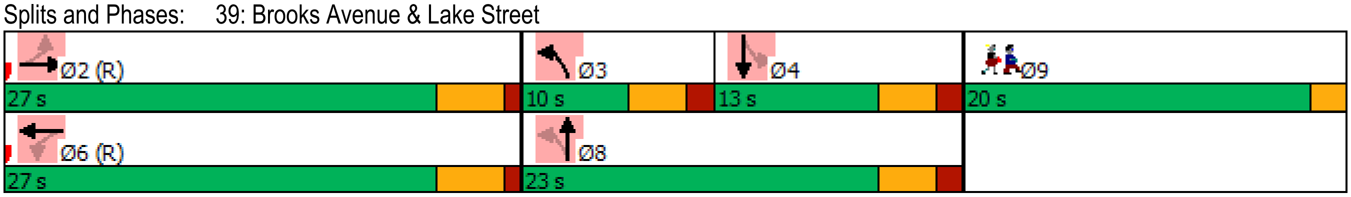
Lane Group	Ø9
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Ideal Flow (vphpl)	
Lane Width (ft)	
Lane Util. Factor	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (mph)	
Link Distance (ft)	
Travel Time (s)	
Peak Hour Factor	
Heavy Vehicles (%)	
Adj. Flow (vph)	
Shared Lane Traffic (%)	
Lane Group Flow (vph)	
Enter Blocked Intersection	
Lane Alignment	
Median Width(ft)	
Link Offset(ft)	
Crosswalk Width(ft)	
Two way Left Turn Lane	
Headway Factor	
Turning Speed (mph)	
Number of Detectors	
Detector Template	
Leading Detector (ft)	
Trailing Detector (ft)	
Detector 1 Position(ft)	
Detector 1 Size(ft)	
Detector 1 Type	
Detector 1 Channel	
Detector 1 Extend (s)	
Detector 1 Queue (s)	
Detector 1 Delay (s)	
Detector 2 Position(ft)	
Detector 2 Size(ft)	
Detector 2 Type	
Detector 2 Channel	
Detector 2 Extend (s)	
Turn Type	
Protected Phases	9
Permitted Phases	
Detector Phase	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Switch Phase												
Minimum Initial (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Minimum Split (s)	20.5	20.5		20.5	20.5		9.0	21.0		13.0	13.0	
Total Split (s)	27.0	27.0		27.0	27.0		10.0	23.0		13.0	13.0	
Total Split (%)	38.6%	38.6%		38.6%	38.6%		14.3%	32.9%		18.6%	18.6%	
Maximum Green (s)	22.5	22.5		22.5	22.5		5.5	18.5		8.5	8.5	
Yellow Time (s)	3.5	3.5		3.5	3.5		3.0	3.0		3.0	3.0	
All-Red Time (s)	1.0	1.0		1.0	1.0		1.5	1.5		1.5	1.5	
Lost Time Adjust (s)		0.0			0.0			0.0			0.0	
Total Lost Time (s)		4.5			4.5			4.5			4.5	
Lead/Lag							Lead			Lag	Lag	
Lead-Lag Optimize?							Yes			Yes	Yes	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	C-Max	C-Max		C-Max	C-Max		None	Min		Min	Min	
Walk Time (s)												
Flash Dont Walk (s)												
Pedestrian Calls (#/hr)												
Act Effct Green (s)		40.9			40.9			9.3			9.3	
Actuated g/C Ratio		0.58			0.58			0.13			0.13	
v/c Ratio		0.64			1.03			0.50			0.48	
Control Delay		23.3			56.0			38.1			10.7	
Queue Delay		29.6			31.1			0.0			0.4	
Total Delay		52.9			87.1			38.1			11.2	
LOS		D			F			D			B	
Approach Delay		52.9			87.1			38.1			11.2	
Approach LOS		D			F			D			B	

Intersection Summary

Area Type: Other
Cycle Length: 70
Actuated Cycle Length: 70
Offset: 0 (0%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green, Master Intersection
Natural Cycle: 110
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 1.03
Intersection Signal Delay: 68.2 Intersection LOS: E
Intersection Capacity Utilization 77.4% ICU Level of Service D
Analysis Period (min) 15

Splits and Phases: 39: Brooks Avenue & Lake Street



Lane Group	Ø9
Switch Phase	
Minimum Initial (s)	4.0
Minimum Split (s)	18.0
Total Split (s)	20.0
Total Split (%)	29%
Maximum Green (s)	18.0
Yellow Time (s)	2.0
All-Red Time (s)	0.0
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	
Lead-Lag Optimize?	
Vehicle Extension (s)	3.0
Recall Mode	None
Walk Time (s)	5.0
Flash Dont Walk (s)	11.0
Pedestrian Calls (#/hr)	52
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	
Intersection Summary	

Lane Group	EBT	WBT	NBT	SBT
Lane Group Flow (vph)	680	1161	63	168
v/c Ratio	0.64	1.03	0.50	0.48
Control Delay	23.3	56.0	38.1	10.7
Queue Delay	29.6	31.1	0.0	0.4
Total Delay	52.9	87.1	38.1	11.2
Queue Length 50th (ft)	246	~635	23	5
Queue Length 95th (ft)	#442	#877	44	35
Internal Link Dist (ft)	135	1046	126	128
Turn Bay Length (ft)				
Base Capacity (vph)	1065	1132	245	372
Starvation Cap Reductn	411	0	0	0
Spillback Cap Reductn	0	478	1	37
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	1.04	1.78	0.26	0.50

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

2027 No-Build Weekday Evening Peak Hour

Intersection	
Int Delay, s/veh	0.4

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	831	3	1	602	9	4
Future Vol, veh/h	831	3	1	602	9	4
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	83	83	94	94	75	75
Heavy Vehicles, %	0	0	0	0	29	0
Mvmt Flow	1001	4	1	640	12	5

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	1005	0	1645	1003
Stage 1	-	-	-	-	1003	-
Stage 2	-	-	-	-	642	-
Critical Hdwy	-	-	4.1	-	6.69	6.2
Critical Hdwy Stg 1	-	-	-	-	5.69	-
Critical Hdwy Stg 2	-	-	-	-	5.69	-
Follow-up Hdwy	-	-	2.2	-	3.761	3.3
Pot Cap-1 Maneuver	-	-	697	-	94	297
Stage 1	-	-	-	-	316	-
Stage 2	-	-	-	-	476	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	697	-	94	297
Mov Cap-2 Maneuver	-	-	-	-	94	-
Stage 1	-	-	-	-	316	-
Stage 2	-	-	-	-	475	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0	40.3
HCM LOS			E

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	119	-	-	697	-
HCM Lane V/C Ratio	0.146	-	-	0.002	-
HCM Control Delay (s)	40.3	-	-	10.2	0
HCM Lane LOS	E	-	-	B	A
HCM 95th %tile Q(veh)	0.5	-	-	0	-

Intersection	
Int Delay, s/veh	0.7

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	829	6	9	588	15	5
Future Vol, veh/h	829	6	9	588	15	5
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	87	87	89	89	75	75
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	953	7	10	661	20	7

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	960	0	1638	957
Stage 1	-	-	-	-	957	-
Stage 2	-	-	-	-	681	-
Critical Hdwy	-	-	4.1	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	-	-	2.2	-	3.5	3.3
Pot Cap-1 Maneuver	-	-	725	-	112	315
Stage 1	-	-	-	-	376	-
Stage 2	-	-	-	-	506	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	725	-	110	315
Mov Cap-2 Maneuver	-	-	-	-	110	-
Stage 1	-	-	-	-	376	-
Stage 2	-	-	-	-	495	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.2	39.4
HCM LOS			E

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	131	-	-	725	-
HCM Lane V/C Ratio	0.204	-	-	0.014	-
HCM Control Delay (s)	39.4	-	-	10	0
HCM Lane LOS	E	-	-	B	A
HCM 95th %tile Q(veh)	0.7	-	-	0	-

Intersection						
Int Delay, s/veh	0.3					

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	833	1	1	591	6	4
Future Vol, veh/h	833	1	1	591	6	4
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	87	87	89	89	75	75
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	957	1	1	664	8	5

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	958	0	1624	958
Stage 1	-	-	-	-	958	-
Stage 2	-	-	-	-	666	-
Critical Hdwy	-	-	4.1	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	-	-	2.2	-	3.5	3.3
Pot Cap-1 Maneuver	-	-	726	-	114	315
Stage 1	-	-	-	-	376	-
Stage 2	-	-	-	-	515	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	726	-	114	315
Mov Cap-2 Maneuver	-	-	-	-	114	-
Stage 1	-	-	-	-	376	-
Stage 2	-	-	-	-	514	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0	30.8
HCM LOS			D

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	153	-	-	726	-
HCM Lane V/C Ratio	0.087	-	-	0.002	-
HCM Control Delay (s)	30.8	-	-	10	0
HCM Lane LOS	D	-	-	A	A
HCM 95th %tile Q(veh)	0.3	-	-	0	-

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	4	814	19	11	578	8	13	1	6	3	0	1
Future Vol, veh/h	4	814	19	11	578	8	13	1	6	3	0	1
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	86	86	86	86	86	86	75	75	75	75	75	75
Heavy Vehicles, %	0	0	0	0	0	0	0	0	0	0	0	0
Mvmt Flow	5	947	22	13	672	9	17	1	8	4	0	1

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	681	0	0	969	0	0	1671	1675	958	1676	1682	677
Stage 1	-	-	-	-	-	-	968	968	-	703	703	-
Stage 2	-	-	-	-	-	-	703	707	-	973	979	-
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	921	-	-	719	-	-	77	96	315	76	95	456
Stage 1	-	-	-	-	-	-	308	335	-	431	443	-
Stage 2	-	-	-	-	-	-	431	441	-	306	331	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	921	-	-	719	-	-	74	92	315	71	91	456
Mov Cap-2 Maneuver	-	-	-	-	-	-	74	92	-	71	91	-
Stage 1	-	-	-	-	-	-	304	331	-	426	430	-
Stage 2	-	-	-	-	-	-	417	428	-	293	327	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0.2	55.6	47.5
HCM LOS			F	E

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	97	921	-	-	719	-	-	90
HCM Lane V/C Ratio	0.275	0.005	-	-	0.018	-	-	0.059
HCM Control Delay (s)	55.6	8.9	0	-	10.1	0	-	47.5
HCM Lane LOS	F	A	A	-	B	A	-	E
HCM 95th %tile Q(veh)	1	0	-	-	0.1	-	-	0.2

Intersection	
Int Delay, s/veh	8.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	19	800	4	60	577	16	9	0	43	9	0	11
Future Vol, veh/h	19	800	4	60	577	16	9	0	43	9	0	11
Conflicting Peds, #/hr	0	0	0	304	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	83	83	83	88	88	88	81	81	81	80	80	80
Heavy Vehicles, %	0	0	0	0	0	0	0	0	0	0	0	0
Mvmt Flow	23	964	5	68	656	18	11	0	53	11	0	14

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	674	0	0	1273	0	0	2125	2127	1271	1840	2120	665
Stage 1	-	-	-	-	-	-	1317	1317	-	801	801	-
Stage 2	-	-	-	-	-	-	808	810	-	1039	1319	-
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	927	-	-	552	-	-	37	50	207	59	51	464
Stage 1	-	-	-	-	-	-	196	229	-	381	400	-
Stage 2	-	-	-	-	-	-	378	396	-	281	229	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	927	-	-	412	-	-	20	26	155	30	26	464
Mov Cap-2 Maneuver	-	-	-	-	-	-	20	26	-	30	26	-
Stage 1	-	-	-	-	-	-	138	162	-	360	294	-
Stage 2	-	-	-	-	-	-	270	291	-	175	162	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.2	1.4	179.4	97.8
HCM LOS			F	F

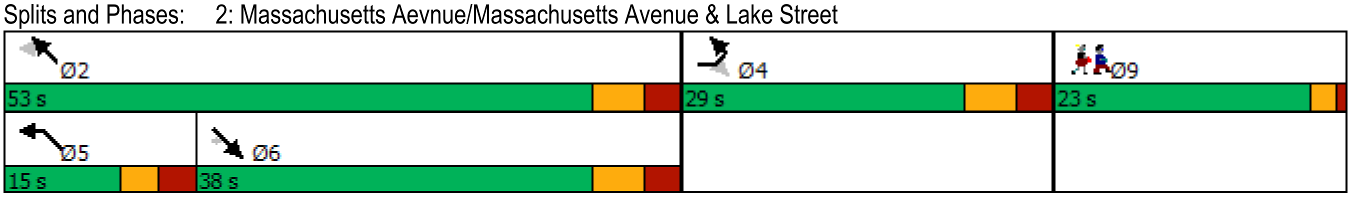
Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	71	927	-	-	412	-	-	62
HCM Lane V/C Ratio	0.904	0.025	-	-	0.165	-	-	0.403
HCM Control Delay (s)	179.4	9	0	-	15.5	0	-	97.8
HCM Lane LOS	F	A	A	-	C	A	-	F
HCM 95th %tile Q(veh)	4.5	0.1	-	-	0.6	-	-	1.5

Lane Group	EBL	EBR	SET	SER	NWL	NWT	Ø9
Lane Configurations							
Traffic Volume (vph)	430	277	658	189	348	739	
Future Volume (vph)	430	277	658	189	348	739	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	
Lane Width (ft)	16	16	11	10	11	12	
Storage Length (ft)	0	100		55	150		
Storage Lanes	1	1		1	1		
Taper Length (ft)	25				25		
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	1.00	
Frt		0.850		0.850			
Flt Protected	0.950				0.950		
Satd. Flow (prot)	2046	1830	3421	1507	1745	1863	
Flt Permitted	0.950				0.220		
Satd. Flow (perm)	2046	1830	3421	1507	404	1863	
Right Turn on Red		Yes		Yes			
Satd. Flow (RTOR)		140		85			
Link Speed (mph)	30		30			30	
Link Distance (ft)	1126		640			645	
Travel Time (s)	25.6		14.5			14.7	
Peak Hour Factor	0.88	0.88	0.92	0.92	0.92	0.92	
Heavy Vehicles (%)	0%	0%	2%	0%	0%	2%	
Adj. Flow (vph)	489	315	715	205	378	803	
Shared Lane Traffic (%)							
Lane Group Flow (vph)	489	315	715	205	378	803	
Enter Blocked Intersection	No	No	No	No	No	No	
Lane Alignment	Left	Right	Left	Right	Left	Left	
Median Width(ft)	16		11			11	
Link Offset(ft)	0		0			0	
Crosswalk Width(ft)	16		16			16	
Two way Left Turn Lane							
Headway Factor	0.85	0.85	1.04	1.09	1.04	1.00	
Turning Speed (mph)	15	9		9	15		
Number of Detectors	1	1	2	1	1	2	
Detector Template	Left	Right	Thru	Right	Left	Thru	
Leading Detector (ft)	20	20	100	20	20	100	
Trailing Detector (ft)	0	0	0	0	0	0	
Detector 1 Position(ft)	0	0	0	0	0	0	
Detector 1 Size(ft)	20	20	6	20	20	6	
Detector 1 Type	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	
Detector 1 Queue (s)	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	
Detector 2 Position(ft)			94			94	
Detector 2 Size(ft)			6			6	
Detector 2 Type			Cl+Ex			Cl+Ex	
Detector 2 Channel							
Detector 2 Extend (s)			0.0			0.0	
Turn Type	Prot	Perm	NA	Perm	pm+pt	NA	

Lane Group	EBL	EBR	SET	SER	NWL	NWT	Ø9
Protected Phases	4		6		5	2	9
Permitted Phases		4		6	2		
Detector Phase	4	4	6	6	5	2	
Switch Phase							
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	23.0	23.0	23.0	23.0	10.0	23.0	19.0
Total Split (s)	29.0	29.0	38.0	38.0	15.0	53.0	23.0
Total Split (%)	27.6%	27.6%	36.2%	36.2%	14.3%	50.5%	22%
Maximum Green (s)	22.0	22.0	31.0	31.0	9.0	46.0	20.0
Yellow Time (s)	4.0	4.0	4.0	4.0	3.0	4.0	2.0
All-Red Time (s)	3.0	3.0	3.0	3.0	3.0	3.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	7.0	7.0	7.0	7.0	6.0	7.0	
Lead/Lag			Lag	Lag	Lead		
Lead-Lag Optimize?			Yes	Yes	Yes		
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None	Max	Max	None	Max	None
Walk Time (s)							5.0
Flash Dont Walk (s)							11.0
Pedestrian Calls (#/hr)							35
Act Effct Green (s)	22.2	22.2	31.3	31.3	47.5	46.5	
Actuated g/C Ratio	0.24	0.24	0.34	0.34	0.51	0.50	
v/c Ratio	1.01	0.58	0.62	0.37	1.13	0.87	
Control Delay	80.9	23.3	30.4	17.2	110.9	34.8	
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	
Total Delay	80.9	23.3	30.4	17.2	110.9	34.8	
LOS	F	C	C	B	F	C	
Approach Delay	58.3		27.5			59.2	
Approach LOS	E		C			E	

Intersection Summary	
Area Type: Other	
Cycle Length: 105	
Actuated Cycle Length: 93.4	
Natural Cycle: 100	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 1.13	
Intersection Signal Delay: 48.9	Intersection LOS: D
Intersection Capacity Utilization 78.0%	ICU Level of Service D
Analysis Period (min) 15	

Splits and Phases: 2: Massachusetts Aevnue/Massachusetts Avenue & Lake Street



Lane Group	EBL	EBR	SET	SER	NWL	NWT
Lane Group Flow (vph)	489	315	715	205	378	803
v/c Ratio	1.01	0.58	0.62	0.37	1.13	0.87
Control Delay	80.9	23.3	30.4	17.2	110.9	34.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	80.9	23.3	30.4	17.2	110.9	34.8
Queue Length 50th (ft)	~359	100	211	58	~217	480
Queue Length 95th (ft)	#537	185	277	122	#422	#740
Internal Link Dist (ft)	1046		560			565
Turn Bay Length (ft)		100		55	150	
Base Capacity (vph)	486	542	1147	561	335	927
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	1.01	0.58	0.62	0.37	1.13	0.87

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

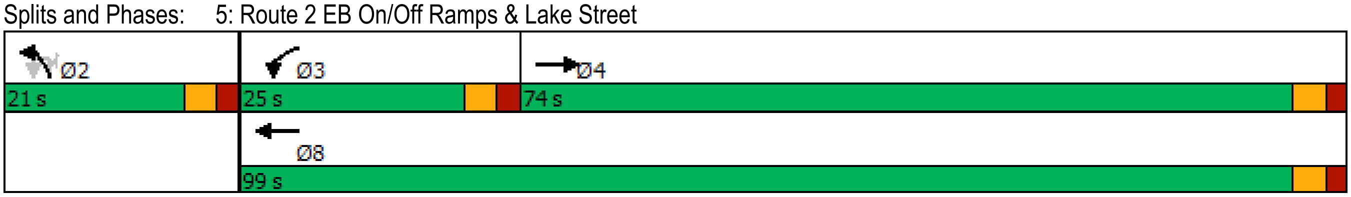
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Lane Group	EBT	EBR	WBL	WBT	NBU	NBL	NBR
Lane Configurations							
Traffic Volume (vph)	545	181	171	302	14	531	632
Future Volume (vph)	545	181	171	302	14	531	632
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	16	16	10	11	12	16	14
Storage Length (ft)		150	110			0	0
Storage Lanes		1	1			1	1
Taper Length (ft)			25			25	
Lane Util. Factor	1.00	1.00	1.00	0.95	1.00	1.00	1.00
Frt		0.850					0.850
Flt Protected			0.950			0.950	
Satd. Flow (prot)	2153	1664	1652	3490	0	2046	1723
Flt Permitted			0.950			0.950	
Satd. Flow (perm)	2153	1664	1652	3490	0	2046	1723
Right Turn on Red		Yes					Yes
Satd. Flow (RTOR)		70					441
Link Speed (mph)	30			30		30	
Link Distance (ft)	373			505		387	
Travel Time (s)	8.5			11.5		8.8	
Peak Hour Factor	0.94	0.94	0.87	0.87	0.96	0.96	0.96
Heavy Vehicles (%)	0%	10%	2%	0%	0%	0%	0%
Adj. Flow (vph)	580	193	197	347	15	553	658
Shared Lane Traffic (%)							
Lane Group Flow (vph)	580	193	197	347	0	568	658
Enter Blocked Intersection	No	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	R NA	Left	Right
Median Width(ft)	12			12		16	
Link Offset(ft)	0			0		0	
Crosswalk Width(ft)	16			16		16	
Two way Left Turn Lane							
Headway Factor	0.85	0.85	1.09	1.04	1.00	0.85	0.92
Turning Speed (mph)		9	15		9	15	9
Number of Detectors	2	1	1	2	1	1	1
Detector Template	Thru	Right	Left	Thru	Left	Left	Right
Leading Detector (ft)	100	20	20	100	20	20	20
Trailing Detector (ft)	0	0	0	0	0	0	0
Detector 1 Position(ft)	0	0	0	0	0	0	0
Detector 1 Size(ft)	6	20	20	6	20	20	20
Detector 1 Type	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
Detector 1 Queue (s)	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
Detector 2 Position(ft)	94			94			
Detector 2 Size(ft)	6			6			
Detector 2 Type	Cl+Ex			Cl+Ex			
Detector 2 Channel							
Detector 2 Extend (s)	0.0			0.0			
Turn Type	NA	Free	Prot	NA	Perm	Prot	Perm

Lane Group	EBT	EBR	WBL	WBT	NBU	NBL	NBR
Protected Phases	4		3	8		2	
Permitted Phases		Free			2		2
Detector Phase	4		3	8	2	2	2
Switch Phase							
Minimum Initial (s)	4.0		4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0		9.0	21.0	21.0	21.0	21.0
Total Split (s)	74.0		25.0	99.0	21.0	21.0	21.0
Total Split (%)	61.7%		20.8%	82.5%	17.5%	17.5%	17.5%
Maximum Green (s)	69.0		20.0	94.0	16.0	16.0	16.0
Yellow Time (s)	3.0		3.0	3.0	3.0	3.0	3.0
All-Red Time (s)	2.0		2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0		0.0	0.0		0.0	0.0
Total Lost Time (s)	5.0		5.0	5.0		5.0	5.0
Lead/Lag	Lag		Lead				
Lead-Lag Optimize?	Yes		Yes				
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0	3.0
Recall Mode	None		None	None	Max	Max	Max
Walk Time (s)	5.0			5.0	5.0	5.0	5.0
Flash Dont Walk (s)	11.0			11.0	11.0	11.0	11.0
Pedestrian Calls (#/hr)	0			0	0	0	0
Act Effct Green (s)	25.7	71.5	14.1	44.9		16.4	16.4
Actuated g/C Ratio	0.36	1.00	0.20	0.63		0.23	0.23
v/c Ratio	0.75	0.12	0.61	0.16		1.21	0.90
Control Delay	26.9	0.1	36.1	5.3		144.0	27.9
Queue Delay	0.0	0.0	0.0	0.0		0.0	0.0
Total Delay	26.9	0.1	36.1	5.3		144.0	27.9
LOS	C	A	D	A		F	C
Approach Delay	20.3			16.4		81.7	
Approach LOS	C			B		F	

Intersection Summary	
Area Type: Other	
Cycle Length: 120	
Actuated Cycle Length: 71.5	
Natural Cycle: 70	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 1.21	
Intersection Signal Delay: 49.1	Intersection LOS: D
Intersection Capacity Utilization 80.9%	ICU Level of Service D
Analysis Period (min) 15	

Splits and Phases: 5: Route 2 EB On/Off Ramps & Lake Street



Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Group Flow (vph)	580	193	197	347	568	658
v/c Ratio	0.75	0.12	0.61	0.16	1.21	0.90
Control Delay	26.9	0.1	36.1	5.3	144.0	27.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	26.9	0.1	36.1	5.3	144.0	27.9
Queue Length 50th (ft)	215	0	79	28	~315	90
Queue Length 95th (ft)	361	0	156	40	#634	#361
Internal Link Dist (ft)	293			425	307	
Turn Bay Length (ft)		150	110			
Base Capacity (vph)	2001	1664	472	3490	468	734
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	0.29	0.12	0.42	0.10	1.21	0.90

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

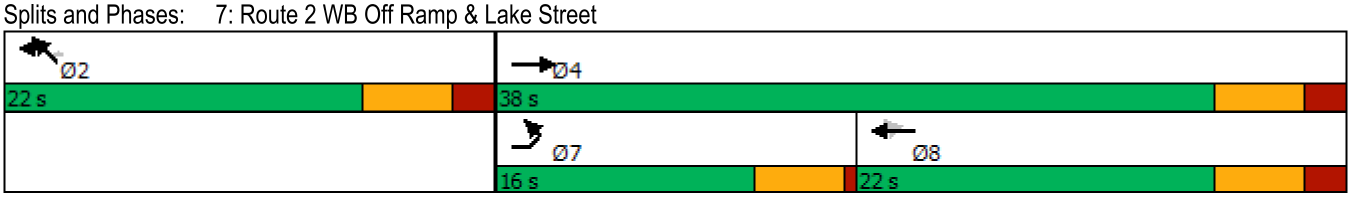
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Traffic Volume (vph)	368	809	0	0	265	346	0	0	0	208	22	25
Future Volume (vph)	368	809	0	0	265	346	0	0	0	208	22	25
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	11	10	12	12	12	11	12	16
Storage Length (ft)	250		0	0		75	0		0	100		0
Storage Lanes	1		0	0		1	0		0	1		1
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	0.95	0.95	1.00
Frt						0.850						0.850
Flt Protected	0.950									0.950	0.961	
Satd. Flow (prot)	1805	1881	0	0	1801	1463	0	0	0	1641	1705	1830
Flt Permitted	0.950									0.950	0.961	
Satd. Flow (perm)	1805	1881	0	0	1801	1463	0	0	0	1641	1705	1830
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)						380						136
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		505			380			459			529	
Travel Time (s)		11.5			8.6			10.4			12.0	
Peak Hour Factor	0.88	0.88	0.88	0.91	0.91	0.91	0.92	0.92	0.92	0.95	0.95	0.95
Heavy Vehicles (%)	0%	1%	0%	0%	2%	3%	0%	0%	0%	1%	5%	0%
Adj. Flow (vph)	418	919	0	0	291	380	0	0	0	219	23	26
Shared Lane Traffic (%)										45%		
Lane Group Flow (vph)	418	919	0	0	291	380	0	0	0	120	122	26
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			11			11	
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	1.04	1.09	1.00	1.00	1.00	1.04	1.00	0.85
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2			2	1				1	2	1
Detector Template	Left	Thru			Thru	Right				Left	Thru	Right
Leading Detector (ft)	20	100			100	20				20	100	20
Trailing Detector (ft)	0	0			0	0				0	0	0
Detector 1 Position(ft)	0	0			0	0				0	0	0
Detector 1 Size(ft)	20	6			6	20				20	6	20
Detector 1 Type	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
Detector 1 Queue (s)	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
Detector 2 Position(ft)		94			94						94	
Detector 2 Size(ft)		6			6						6	
Detector 2 Type		Cl+Ex			Cl+Ex						Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0						0.0	
Turn Type	Prot	NA			NA	Perm				Split	NA	Perm

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Protected Phases	7	4			8					2	2	
Permitted Phases						8						2
Detector Phase	7	4			8	8				2	2	2
Switch Phase												
Minimum Initial (s)	4.0	4.0			4.0	4.0				4.0	4.0	4.0
Minimum Split (s)	8.5	22.0			22.0	22.0				22.0	22.0	22.0
Total Split (s)	16.0	38.0			22.0	22.0				22.0	22.0	22.0
Total Split (%)	26.7%	63.3%			36.7%	36.7%				36.7%	36.7%	36.7%
Maximum Green (s)	11.5	32.0			16.0	16.0				16.0	16.0	16.0
Yellow Time (s)	4.0	4.0			4.0	4.0				4.0	4.0	4.0
All-Red Time (s)	0.5	2.0			2.0	2.0				2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0			0.0	0.0				0.0	0.0	0.0
Total Lost Time (s)	4.5	6.0			6.0	6.0				6.0	6.0	6.0
Lead/Lag	Lead				Lag	Lag						
Lead-Lag Optimize?	Yes				Yes	Yes						
Vehicle Extension (s)	3.0	3.0			3.0	3.0				3.0	3.0	3.0
Recall Mode	None	None			None	None				Max	Max	Max
Walk Time (s)		5.0			5.0	5.0				5.0	5.0	5.0
Flash Dont Walk (s)		11.0			11.0	11.0				11.0	11.0	11.0
Pedestrian Calls (#/hr)		0			0	0				0	0	0
Act Effct Green (s)	11.5	30.6			14.6	14.6				16.0	16.0	16.0
Actuated g/C Ratio	0.20	0.52			0.25	0.25				0.27	0.27	0.27
v/c Ratio	1.18	0.94			0.65	0.59				0.27	0.26	0.04
Control Delay	134.8	32.4			27.2	6.6				19.4	19.3	0.1
Queue Delay	0.0	0.0			0.0	0.0				0.0	0.0	0.0
Total Delay	134.8	32.4			27.2	6.6				19.4	19.3	0.1
LOS	F	C			C	A				B	B	A
Approach Delay		64.4			15.5						17.5	
Approach LOS		E			B						B	

Intersection Summary	
Area Type: Other	
Cycle Length: 60	
Actuated Cycle Length: 58.7	
Natural Cycle: 65	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 1.18	
Intersection Signal Delay: 44.5	Intersection LOS: D
Intersection Capacity Utilization 61.9%	ICU Level of Service B
Analysis Period (min) 15	

Splits and Phases: 7: Route 2 WB Off Ramp & Lake Street



Lane Group	EBL	EBT	WBT	WBR	NWL	NWT	NWR
Lane Group Flow (vph)	418	919	291	380	120	122	26
v/c Ratio	1.18	0.94	0.65	0.59	0.27	0.26	0.04
Control Delay	134.8	32.4	27.2	6.6	19.4	19.3	0.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	134.8	32.4	27.2	6.6	19.4	19.3	0.1
Queue Length 50th (ft)	~191	275	92	0	35	36	0
Queue Length 95th (ft)	#331	#503	162	56	75	76	0
Internal Link Dist (ft)		425	300			449	
Turn Bay Length (ft)	250			75	100		
Base Capacity (vph)	353	1027	492	675	448	465	598
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	1.18	0.89	0.59	0.56	0.27	0.26	0.04

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

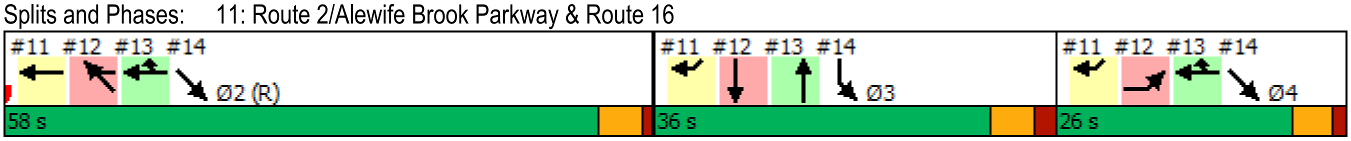
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Lane Group	EBL	EBT	WBT	WBR	SWL	SWR	Ø3	Ø4
Lane Configurations								
Traffic Volume (vph)	0	0	2209	0	0	1131		
Future Volume (vph)	0	0	2209	0	0	1131		
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900		
Lane Width (ft)	13	13	13	13	13	13		
Lane Util. Factor	1.00	1.00	0.91	1.00	1.00	0.88		
Frt						0.850		
Flt Protected								
Satd. Flow (prot)	0	0	4776	0	0	2617		
Flt Permitted								
Satd. Flow (perm)	0	0	4776	0	0	2617		
Right Turn on Red				Yes		Yes		
Satd. Flow (RTOR)						1		
Link Speed (mph)		30	30		30			
Link Distance (ft)		201	192		296			
Travel Time (s)		4.6	4.4		6.7			
Peak Hour Factor	0.92	0.92	0.97	0.97	0.98	0.98		
Heavy Vehicles (%)	2%	2%	1%	0%	0%	1%		
Adj. Flow (vph)	0	0	2277	0	0	1154		
Shared Lane Traffic (%)								
Lane Group Flow (vph)	0	0	2277	0	0	1154		
Enter Blocked Intersection	No	No	No	No	No	No		
Lane Alignment	Left	Left	Left	Right	Left	Right		
Median Width(ft)		0	0		0			
Link Offset(ft)		0	0		0			
Crosswalk Width(ft)		16	16		16			
Two way Left Turn Lane								
Headway Factor	1.10	1.10	1.10	1.10	1.10	1.10		
Turning Speed (mph)	15			9	15	30		
Number of Detectors			2			1		
Detector Template			Thru			Right		
Leading Detector (ft)			100			20		
Trailing Detector (ft)			0			0		
Detector 1 Position(ft)			0			0		
Detector 1 Size(ft)			6			20		
Detector 1 Type			Cl+Ex			Cl+Ex		
Detector 1 Channel								
Detector 1 Extend (s)			0.0			0.0		
Detector 1 Queue (s)			0.0			0.0		
Detector 1 Delay (s)			0.0			0.0		
Detector 2 Position(ft)			94					
Detector 2 Size(ft)			6					
Detector 2 Type			Cl+Ex					
Detector 2 Channel								
Detector 2 Extend (s)			0.0					
Turn Type			NA			custom		
Protected Phases			2			3 4	3	4
Permitted Phases								
Detector Phase			2			3 4		

Lane Group	EBL	EBT	WBT	WBR	SWL	SWR	Ø3	Ø4
Switch Phase								
Minimum Initial (s)			10.0				10.0	10.0
Minimum Split (s)			15.0				19.0	15.0
Total Split (s)			58.0				36.0	26.0
Total Split (%)			48.3%				30%	22%
Maximum Green (s)			53.0				30.0	21.0
Yellow Time (s)			4.0				4.0	3.5
All-Red Time (s)			1.0				2.0	1.5
Lost Time Adjust (s)			0.0					
Total Lost Time (s)			5.0					
Lead/Lag							Lead	Lag
Lead-Lag Optimize?								
Vehicle Extension (s)			3.0				3.0	3.0
Recall Mode			C-Max				Max	Max
Walk Time (s)							5.0	
Flash Dont Walk (s)							8.0	
Pedestrian Calls (#/hr)							0	
Act Effct Green (s)			53.0			56.0		
Actuated g/C Ratio			0.44			0.47		
v/c Ratio			1.08			0.95		
Control Delay			46.7			46.7		
Queue Delay			1.5			0.0		
Total Delay			48.2			46.7		
LOS			D			D		
Approach Delay			48.2		46.7			
Approach LOS			D		D			

Intersection Summary	
Area Type: CBD	
Cycle Length: 120	
Actuated Cycle Length: 120	
Offset: 16 (13%), Referenced to phase 2:WBT, Start of Green	
Natural Cycle: 140	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 1.19	
Intersection Signal Delay: 47.7	Intersection LOS: D
Intersection Capacity Utilization 100.6%	ICU Level of Service G
Analysis Period (min) 15	

Splits and Phases: 11: Route 2/Alewife Brook Parkway & Route 16



Lane Group	WBT	SWR
Lane Group Flow (vph)	2277	1154
v/c Ratio	1.08	0.95
Control Delay	46.7	46.7
Queue Delay	1.5	0.0
Total Delay	48.2	46.7
Queue Length 50th (ft)	~702	472
Queue Length 95th (ft)	m#57	#644
Internal Link Dist (ft)	112	
Turn Bay Length (ft)		
Base Capacity (vph)	2109	1221
Starvation Cap Reductn	7	0
Spillback Cap Reductn	0	0
Storage Cap Reductn	0	0
Reduced v/c Ratio	1.08	0.95

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

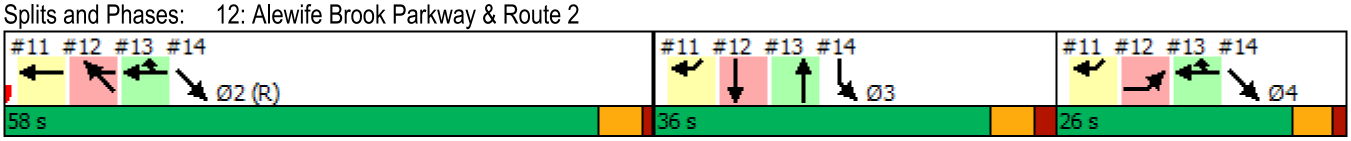
Lane Group	EBL	WBR	SBT	NWT
Lane Configurations				
Traffic Volume (vph)	610	591	250	1618
Future Volume (vph)	610	591	250	1618
Ideal Flow (vphpl)	1900	1900	1900	1900
Lane Width (ft)	13	16	13	13
Lane Util. Factor	0.97	1.00	0.95	0.95
Frt		0.865		
Flt Protected	0.950			
Satd. Flow (prot)	3257	1660	3291	3324
Flt Permitted	0.950			
Satd. Flow (perm)	3257	1660	3291	3324
Right Turn on Red				
Satd. Flow (RTOR)				
Link Speed (mph)			30	30
Link Distance (ft)			202	278
Travel Time (s)			4.6	6.3
Peak Hour Factor	0.90	0.95	0.98	0.97
Heavy Vehicles (%)	0%	1%	2%	1%
Adj. Flow (vph)	678	622	255	1668
Shared Lane Traffic (%)				
Lane Group Flow (vph)	678	622	255	1668
Enter Blocked Intersection	No	No	No	No
Lane Alignment	Left	R NA	Left	L NA
Median Width(ft)			0	0
Link Offset(ft)			0	0
Crosswalk Width(ft)			16	16
Two way Left Turn Lane				
Headway Factor	1.10	0.97	1.10	1.10
Turning Speed (mph)	15	30		
Number of Detectors	1	1	2	2
Detector Template	Left	Right	Thru	Thru
Leading Detector (ft)	20	20	100	100
Trailing Detector (ft)	0	0	0	0
Detector 1 Position(ft)	0	0	0	0
Detector 1 Size(ft)	20	20	6	6
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel				
Detector 1 Extend (s)	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0
Detector 2 Position(ft)			94	94
Detector 2 Size(ft)			6	6
Detector 2 Type			Cl+Ex	Cl+Ex
Detector 2 Channel				
Detector 2 Extend (s)			0.0	0.0
Turn Type	Prot	Prot	NA	NA
Protected Phases	4	2!	3	2!
Permitted Phases				
Detector Phase	4	2	3	2

Lane Group	EBL	WBR	SBT	NWT
Switch Phase				
Minimum Initial (s)	10.0	10.0	10.0	10.0
Minimum Split (s)	15.0	15.0	19.0	15.0
Total Split (s)	26.0	58.0	36.0	58.0
Total Split (%)	21.7%	48.3%	30.0%	48.3%
Maximum Green (s)	21.0	53.0	30.0	53.0
Yellow Time (s)	3.5	4.0	4.0	4.0
All-Red Time (s)	1.5	1.0	2.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	6.0	5.0
Lead/Lag	Lag		Lead	
Lead-Lag Optimize?				
Vehicle Extension (s)	3.0	3.0	3.0	3.0
Recall Mode	Max	C-Max	Max	C-Max
Walk Time (s)			5.0	
Flash Dont Walk (s)			8.0	
Pedestrian Calls (#/hr)			0	
Act Effct Green (s)	21.0	53.0	30.0	53.0
Actuated g/C Ratio	0.18	0.44	0.25	0.44
v/c Ratio	1.19	0.85	0.31	1.14
Control Delay	145.7	29.8	37.8	102.5
Queue Delay	0.0	3.3	0.0	0.3
Total Delay	145.7	33.1	37.8	102.8
LOS	F	C	D	F
Approach Delay			37.8	102.8
Approach LOS			D	F

Intersection Summary

Area Type: CBD
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 16 (13%), Referenced to phase 2:WBT, Start of Green
Natural Cycle: 140
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 1.19
Intersection Signal Delay: 93.2 Intersection LOS: F
Intersection Capacity Utilization 134.7% ICU Level of Service H
Analysis Period (min) 15
! Phase conflict between lane groups.

Splits and Phases: 12: Alewife Brook Parkway & Route 2



Lane Group	EBL	WBR	SBT	NWT
Lane Group Flow (vph)	678	622	255	1668
v/c Ratio	1.19	0.85	0.31	1.14
Control Delay	145.7	29.8	37.8	102.5
Queue Delay	0.0	3.3	0.0	0.3
Total Delay	145.7	33.1	37.8	102.8
Queue Length 50th (ft)	~326	422	84	~792
Queue Length 95th (ft)	#446	#639	123	#931
Internal Link Dist (ft)			122	198
Turn Bay Length (ft)				
Base Capacity (vph)	569	733	822	1468
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	53	0	107
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	1.19	0.91	0.31	1.23

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

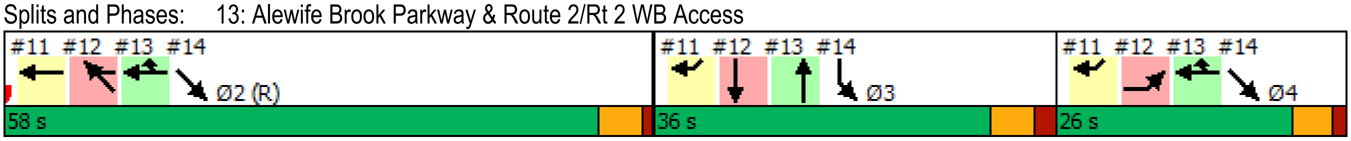
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	0	591	328	0	238	0	0	0	0
Future Volume (vph)	0	0	0	0	591	328	0	238	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		200	0		0	0		0
Storage Lanes	0		0	0		1	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	0.95	1.00	1.00	1.00	1.00
Ped Bike Factor												
Frt						0.850						
Flt Protected												
Satd. Flow (prot)	0	0	0	0	1693	1439	0	3217	0	0	0	0
Flt Permitted												
Satd. Flow (perm)	0	0	0	0	1693	1439	0	3217	0	0	0	0
Right Turn on Red			No			No	No		No			No
Satd. Flow (RTOR)												
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		161			1225			227			185	
Travel Time (s)		3.7			27.8			5.2			4.2	
Confl. Peds. (#/hr)						2						
Peak Hour Factor	0.92	0.92	0.92	0.95	0.95	0.95	0.97	0.97	0.97	0.92	0.92	0.92
Heavy Vehicles (%)	2%	2%	2%	0%	1%	1%	0%	1%	0%	2%	2%	2%
Adj. Flow (vph)	0	0	0	0	622	345	0	245	0	0	0	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	0	0	0	622	345	0	245	0	0	0	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)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors					2	1		2				
Detector Template					Thru	Right		Thru				
Leading Detector (ft)					100	20		100				
Trailing Detector (ft)					0	0		0				
Detector 1 Position(ft)					0	0		0				
Detector 1 Size(ft)					6	20		6				
Detector 1 Type					Cl+Ex	Cl+Ex		Cl+Ex				
Detector 1 Channel												
Detector 1 Extend (s)					0.0	0.0		0.0				
Detector 1 Queue (s)					0.0	0.0		0.0				
Detector 1 Delay (s)					0.0	0.0		0.0				
Detector 2 Position(ft)					94			94				
Detector 2 Size(ft)					6			6				
Detector 2 Type					Cl+Ex			Cl+Ex				
Detector 2 Channel												
Detector 2 Extend (s)					0.0			0.0				

Lane Group	Ø2	Ø4
Lane Configurations		
Traffic Volume (vph)		
Future Volume (vph)		
Ideal Flow (vphpl)		
Storage Length (ft)		
Storage Lanes		
Taper Length (ft)		
Lane Util. Factor		
Ped Bike Factor		
Frt		
Flt Protected		
Satd. Flow (prot)		
Flt Permitted		
Satd. Flow (perm)		
Right Turn on Red		
Satd. Flow (RTOR)		
Link Speed (mph)		
Link Distance (ft)		
Travel Time (s)		
Confl. Peds. (#/hr)		
Peak Hour Factor		
Heavy Vehicles (%)		
Adj. Flow (vph)		
Shared Lane Traffic (%)		
Lane Group Flow (vph)		
Enter Blocked Intersection		
Lane Alignment		
Median Width(ft)		
Link Offset(ft)		
Crosswalk Width(ft)		
Two way Left Turn Lane		
Headway Factor		
Turning Speed (mph)		
Number of Detectors		
Detector Template		
Leading Detector (ft)		
Trailing Detector (ft)		
Detector 1 Position(ft)		
Detector 1 Size(ft)		
Detector 1 Type		
Detector 1 Channel		
Detector 1 Extend (s)		
Detector 1 Queue (s)		
Detector 1 Delay (s)		
Detector 2 Position(ft)		
Detector 2 Size(ft)		
Detector 2 Type		
Detector 2 Channel		
Detector 2 Extend (s)		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Turn Type					NA	Prot		NA				
Protected Phases					2 4	2 4		3				
Permitted Phases												
Detector Phase					2 4	2 4		3				
Switch Phase												
Minimum Initial (s)								10.0				
Minimum Split (s)								19.0				
Total Split (s)								36.0				
Total Split (%)								30.0%				
Maximum Green (s)								30.0				
Yellow Time (s)								4.0				
All-Red Time (s)								2.0				
Lost Time Adjust (s)								0.0				
Total Lost Time (s)								6.0				
Lead/Lag								Lead				
Lead-Lag Optimize?												
Vehicle Extension (s)								3.0				
Recall Mode								Max				
Walk Time (s)								5.0				
Flash Dont Walk (s)								8.0				
Pedestrian Calls (#/hr)								0				
Act Effct Green (s)					79.0	79.0		30.0				
Actuated g/C Ratio					0.66	0.66		0.25				
v/c Ratio					0.56	0.36		0.30				
Control Delay					13.5	10.5		37.8				
Queue Delay					2.1	0.0		0.0				
Total Delay					15.6	10.5		37.8				
LOS					B	B		D				
Approach Delay					13.8			37.8				
Approach LOS					B			D				

Intersection Summary	
Area Type: CBD	
Cycle Length: 120	
Actuated Cycle Length: 120	
Offset: 16 (13%), Referenced to phase 2:WBT, Start of Green	
Natural Cycle: 140	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 1.19	
Intersection Signal Delay: 18.6	Intersection LOS: B
Intersection Capacity Utilization 52.1%	ICU Level of Service A
Analysis Period (min) 15	

Splits and Phases: 13: Alewife Brook Parkway & Route 2/Rt 2 WB Access



Lane Group	Ø2	Ø4
Turn Type		
Protected Phases	2	4
Permitted Phases		
Detector Phase		
Switch Phase		
Minimum Initial (s)	10.0	10.0
Minimum Split (s)	15.0	15.0
Total Split (s)	58.0	26.0
Total Split (%)	48%	22%
Maximum Green (s)	53.0	21.0
Yellow Time (s)	4.0	3.5
All-Red Time (s)	1.0	1.5
Lost Time Adjust (s)		
Total Lost Time (s)		
Lead/Lag		Lag
Lead-Lag Optimize?		
Vehicle Extension (s)	3.0	3.0
Recall Mode	C-Max	Max
Walk Time (s)		
Flash Dont Walk (s)		
Pedestrian Calls (#/hr)		
Act Effct Green (s)		
Actuated g/C Ratio		
v/c Ratio		
Control Delay		
Queue Delay		
Total Delay		
LOS		
Approach Delay		
Approach LOS		

Intersection Summary

Lane Group	WBT	WBR	NBT
Lane Group Flow (vph)	622	345	245
v/c Ratio	0.56	0.36	0.30
Control Delay	13.5	10.5	37.8
Queue Delay	2.1	0.0	0.0
Total Delay	15.6	10.5	37.8
Queue Length 50th (ft)	239	110	81
Queue Length 95th (ft)	337	165	119
Internal Link Dist (ft)	1145		147
Turn Bay Length (ft)		200	
Base Capacity (vph)	1114	947	804
Starvation Cap Reductn	0	0	0
Spillback Cap Reductn	337	0	0
Storage Cap Reductn	0	0	0
Reduced v/c Ratio	0.80	0.36	0.30

Intersection Summary

Lane Group	SBL	SBR	SEL	SET	NWT	NWR	Ø2	Ø4
Lane Configurations								
Traffic Volume (vph)	250	0	0	987	0	0		
Future Volume (vph)	250	0	0	987	0	0		
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900		
Lane Width (ft)	13	13	13	13	13	13		
Lane Util. Factor	0.97	1.00	1.00	0.95	1.00	1.00		
Frt								
Flt Protected	0.950							
Satd. Flow (prot)	3193	0	0	3324	0	0		
Flt Permitted	0.950							
Satd. Flow (perm)	3193	0	0	3324	0	0		
Right Turn on Red	Yes	Yes				Yes		
Satd. Flow (RTOR)	234							
Link Speed (mph)	30			30	30			
Link Distance (ft)	155			297	139			
Travel Time (s)	3.5			6.8	3.2			
Peak Hour Factor	0.98	0.98	0.90	0.90	0.92	0.92		
Heavy Vehicles (%)	2%	0%	0%	1%	2%	2%		
Adj. Flow (vph)	255	0	0	1097	0	0		
Shared Lane Traffic (%)								
Lane Group Flow (vph)	255	0	0	1097	0	0		
Enter Blocked Intersection	No	No	No	No	No	No		
Lane Alignment	Left	Right	Left	Left	Left	Right		
Median Width(ft)	26			0	0			
Link Offset(ft)	0			0	0			
Crosswalk Width(ft)	16			16	16			
Two way Left Turn Lane								
Headway Factor	1.10	1.10	1.10	1.10	1.10	1.10		
Turning Speed (mph)	30	9	15			9		
Number of Detectors	1			2				
Detector Template	Left			Thru				
Leading Detector (ft)	20			100				
Trailing Detector (ft)	0			0				
Detector 1 Position(ft)	0			0				
Detector 1 Size(ft)	20			6				
Detector 1 Type	Cl+Ex			Cl+Ex				
Detector 1 Channel								
Detector 1 Extend (s)	0.0			0.0				
Detector 1 Queue (s)	0.0			0.0				
Detector 1 Delay (s)	0.0			0.0				
Detector 2 Position(ft)				94				
Detector 2 Size(ft)				6				
Detector 2 Type				Cl+Ex				
Detector 2 Channel								
Detector 2 Extend (s)				0.0				
Turn Type	Prot			NA				
Protected Phases	3			2 4			2	4
Permitted Phases								
Detector Phase	3			2 4				

Lane Group	SBL	SBR	SEL	SET	NWT	NWR	Ø2	Ø4
Switch Phase								
Minimum Initial (s)	10.0						10.0	10.0
Minimum Split (s)	19.0						15.0	15.0
Total Split (s)	36.0						58.0	26.0
Total Split (%)	30.0%						48%	22%
Maximum Green (s)	30.0						53.0	21.0
Yellow Time (s)	4.0						4.0	3.5
All-Red Time (s)	2.0						1.0	1.5
Lost Time Adjust (s)	0.0							
Total Lost Time (s)	6.0							
Lead/Lag	Lead							Lag
Lead-Lag Optimize?								
Vehicle Extension (s)	3.0						3.0	3.0
Recall Mode	Max						C-Max	Max
Walk Time (s)	5.0							
Flash Dont Walk (s)	8.0							
Pedestrian Calls (#/hr)	0							
Act Effct Green (s)	30.0			79.0				
Actuated g/C Ratio	0.25			0.66				
v/c Ratio	0.26			0.50				
Control Delay	0.8			11.4				
Queue Delay	0.5			0.0				
Total Delay	1.3			11.4				
LOS	A			B				
Approach Delay	1.3			11.4				
Approach LOS	A			B				

Intersection Summary

Area Type: CBD

Cycle Length: 120

Actuated Cycle Length: 120

Offset: 16 (13%), Referenced to phase 2:WBT, Start of Green

Natural Cycle: 140

Control Type: Actuated-Coordinated

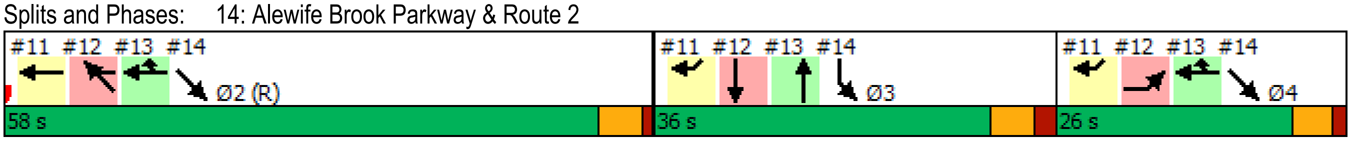
Maximum v/c Ratio: 1.19

Intersection Signal Delay: 9.5 Intersection LOS: A

Intersection Capacity Utilization 47.8% ICU Level of Service A

Analysis Period (min) 15

Splits and Phases: 14: Alewife Brook Parkway & Route 2



Lane Group	SBL	SET
Lane Group Flow (vph)	255	1097
v/c Ratio	0.26	0.50
Control Delay	0.8	11.4
Queue Delay	0.5	0.0
Total Delay	1.3	11.4
Queue Length 50th (ft)	0	209
Queue Length 95th (ft)	1	258
Internal Link Dist (ft)	75	217
Turn Bay Length (ft)		
Base Capacity (vph)	973	2188
Starvation Cap Reductn	391	0
Spillback Cap Reductn	0	0
Storage Cap Reductn	0	0
Reduced v/c Ratio	0.44	0.50

Intersection Summary

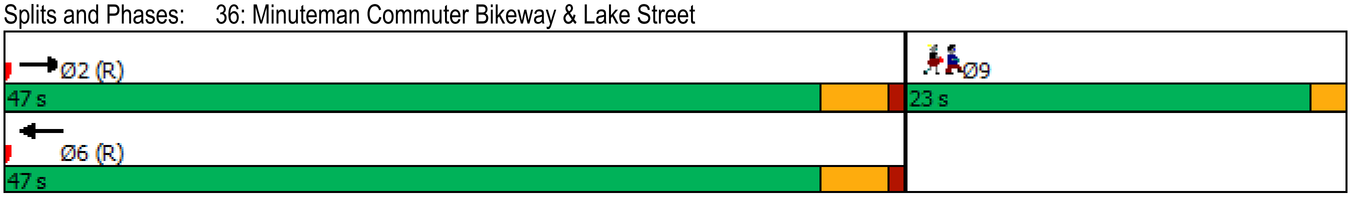
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	852	0	0	653	0	0	0	0	0	0	0
Future Volume (vph)	0	852	0	0	653	0	0	0	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	15	15	15	16	16	16	12	12	12	12	12	12
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												
Flt Protected												
Satd. Flow (prot)	0	2049	0	0	2153	0	0	0	0	0	0	0
Flt Permitted												
Satd. Flow (perm)	0	2049	0	0	2153	0	0	0	0	0	0	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)												
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		135			215			175			206	
Travel Time (s)		3.1			4.9			4.0			4.7	
Peak Hour Factor	0.84	0.84	0.84	0.97	0.97	0.97	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	2%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Adj. Flow (vph)	0	1014	0	0	673	0	0	0	0	0	0	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	1014	0	0	673	0	0	0	0	0	0	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)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	0.88	0.88	0.88	0.85	0.85	0.85	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		2			2							
Detector Template		Thru			Thru							
Leading Detector (ft)		100			100							
Trailing Detector (ft)		0			0							
Detector 1 Position(ft)		0			0							
Detector 1 Size(ft)		6			6							
Detector 1 Type		Cl+Ex			Cl+Ex							
Detector 1 Channel												
Detector 1 Extend (s)		0.0			0.0							
Detector 1 Queue (s)		0.0			0.0							
Detector 1 Delay (s)		0.0			0.0							
Detector 2 Position(ft)		94			94							
Detector 2 Size(ft)		6			6							
Detector 2 Type		Cl+Ex			Cl+Ex							
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0							
Turn Type		NA			NA							
Protected Phases		2			6							
Permitted Phases												
Detector Phase		2			6							

Lane Group	Ø9
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Ideal Flow (vphpl)	
Lane Width (ft)	
Lane Util. Factor	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (mph)	
Link Distance (ft)	
Travel Time (s)	
Peak Hour Factor	
Heavy Vehicles (%)	
Adj. Flow (vph)	
Shared Lane Traffic (%)	
Lane Group Flow (vph)	
Enter Blocked Intersection	
Lane Alignment	
Median Width(ft)	
Link Offset(ft)	
Crosswalk Width(ft)	
Two way Left Turn Lane	
Headway Factor	
Turning Speed (mph)	
Number of Detectors	
Detector Template	
Leading Detector (ft)	
Trailing Detector (ft)	
Detector 1 Position(ft)	
Detector 1 Size(ft)	
Detector 1 Type	
Detector 1 Channel	
Detector 1 Extend (s)	
Detector 1 Queue (s)	
Detector 1 Delay (s)	
Detector 2 Position(ft)	
Detector 2 Size(ft)	
Detector 2 Type	
Detector 2 Channel	
Detector 2 Extend (s)	
Turn Type	
Protected Phases	9
Permitted Phases	
Detector Phase	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Switch Phase												
Minimum Initial (s)		4.0			4.0							
Minimum Split (s)		20.5			20.5							
Total Split (s)		47.0			47.0							
Total Split (%)		67.1%			67.1%							
Maximum Green (s)		42.5			42.5							
Yellow Time (s)		3.5			3.5							
All-Red Time (s)		1.0			1.0							
Lost Time Adjust (s)		0.0			0.0							
Total Lost Time (s)		4.5			4.5							
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)		3.0			3.0							
Recall Mode		C-Max			C-Max							
Walk Time (s)												
Flash Dont Walk (s)												
Pedestrian Calls (#/hr)												
Act Effct Green (s)		47.5			47.5							
Actuated g/C Ratio		0.68			0.68							
v/c Ratio		0.73			0.46							
Control Delay		11.1			6.8							
Queue Delay		51.0			1.7							
Total Delay		62.1			8.5							
LOS		E			A							
Approach Delay		62.1			8.5							
Approach LOS		E			A							

Intersection Summary	
Area Type: Other	
Cycle Length: 70	
Actuated Cycle Length: 70	
Offset: 16 (23%), Referenced to phase 2:EBT and 6:WBT, Start of Green	
Natural Cycle: 60	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.73	
Intersection Signal Delay: 40.7	Intersection LOS: D
Intersection Capacity Utilization 48.6%	ICU Level of Service A
Analysis Period (min) 15	

Splits and Phases: 36: Minuteman Commuter Bikeway & Lake Street



Lane Group	Ø9
Switch Phase	
Minimum Initial (s)	4.0
Minimum Split (s)	18.0
Total Split (s)	23.0
Total Split (%)	33%
Maximum Green (s)	21.0
Yellow Time (s)	2.0
All-Red Time (s)	0.0
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	
Lead-Lag Optimize?	
Vehicle Extension (s)	3.0
Recall Mode	None
Walk Time (s)	5.0
Flash Dont Walk (s)	11.0
Pedestrian Calls (#/hr)	211
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	
Intersection Summary	

	→	←
Lane Group	EBT	WBT
Lane Group Flow (vph)	1014	673
v/c Ratio	0.73	0.46
Control Delay	11.1	6.8
Queue Delay	51.0	1.7
Total Delay	62.1	8.5
Queue Length 50th (ft)	230	226
Queue Length 95th (ft)	312	169
Internal Link Dist (ft)	55	135
Turn Bay Length (ft)		
Base Capacity (vph)	1390	1460
Starvation Cap Reductn	0	585
Spillback Cap Reductn	655	0
Storage Cap Reductn	0	0
Reduced v/c Ratio	1.38	0.77

Intersection Summary

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	82	700	70	6	530	1	15	5	7	0	5	108
Future Volume (vph)	82	700	70	6	530	1	15	5	7	0	5	108
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	14	14	14	13	13	13	12	12	12	12	12	12
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		0.989						0.966			0.871	
Flt Protected		0.995			0.999			0.973				
Satd. Flow (prot)	0	1994	0	0	1961	0	0	1786	0	0	1655	0
Flt Permitted		0.893			0.991			0.635				
Satd. Flow (perm)	0	1790	0	0	1946	0	0	1165	0	0	1655	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		8						9			140	
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		215			1126			206			208	
Travel Time (s)		4.9			25.6			4.7			4.7	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.75	0.75	0.75	0.77	0.77	0.77
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Adj. Flow (vph)	93	795	80	7	602	1	20	7	9	0	6	140
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	968	0	0	610	0	0	36	0	0	146	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)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	0.92	0.92	0.92	0.96	0.96	0.96	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	Perm	NA		Perm	NA		Perm	NA			NA	
Protected Phases		2			6			8			4	
Permitted Phases	2			6			8			4		
Detector Phase	2	2		6	6		8	8		4	4	

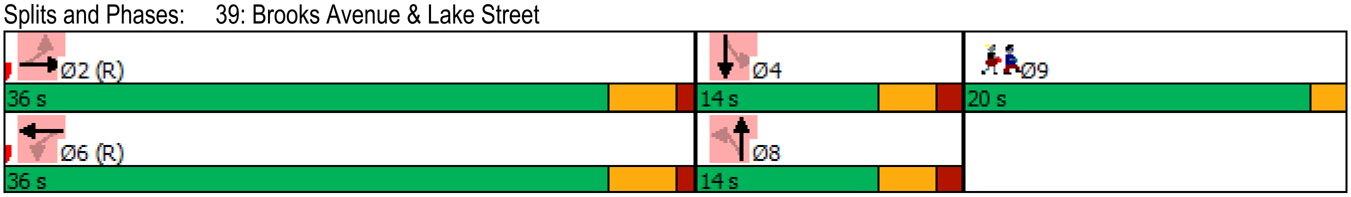
Lane Group	Ø9
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Ideal Flow (vphpl)	
Lane Width (ft)	
Lane Util. Factor	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (mph)	
Link Distance (ft)	
Travel Time (s)	
Peak Hour Factor	
Heavy Vehicles (%)	
Adj. Flow (vph)	
Shared Lane Traffic (%)	
Lane Group Flow (vph)	
Enter Blocked Intersection	
Lane Alignment	
Median Width(ft)	
Link Offset(ft)	
Crosswalk Width(ft)	
Two way Left Turn Lane	
Headway Factor	
Turning Speed (mph)	
Number of Detectors	
Detector Template	
Leading Detector (ft)	
Trailing Detector (ft)	
Detector 1 Position(ft)	
Detector 1 Size(ft)	
Detector 1 Type	
Detector 1 Channel	
Detector 1 Extend (s)	
Detector 1 Queue (s)	
Detector 1 Delay (s)	
Detector 2 Position(ft)	
Detector 2 Size(ft)	
Detector 2 Type	
Detector 2 Channel	
Detector 2 Extend (s)	
Turn Type	
Protected Phases	9
Permitted Phases	
Detector Phase	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Switch Phase												
Minimum Initial (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Minimum Split (s)	20.5	20.5		20.5	20.5		14.0	14.0		14.0	14.0	
Total Split (s)	36.0	36.0		36.0	36.0		14.0	14.0		14.0	14.0	
Total Split (%)	51.4%	51.4%		51.4%	51.4%		20.0%	20.0%		20.0%	20.0%	
Maximum Green (s)	31.5	31.5		31.5	31.5		9.5	9.5		9.5	9.5	
Yellow Time (s)	3.5	3.5		3.5	3.5		3.0	3.0		3.0	3.0	
All-Red Time (s)	1.0	1.0		1.0	1.0		1.5	1.5		1.5	1.5	
Lost Time Adjust (s)		0.0			0.0			0.0			0.0	
Total Lost Time (s)		4.5			4.5			4.5			4.5	
Lead/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	C-Max	C-Max		C-Max	C-Max		Min	Min		Min	Min	
Walk Time (s)												
Flash Dont Walk (s)												
Pedestrian Calls (#/hr)												
Act Effct Green (s)		43.2			43.2			7.0			7.0	
Actuated g/C Ratio		0.62			0.62			0.10			0.10	
v/c Ratio		0.87			0.51			0.29			0.50	
Control Delay		26.5			12.2			29.2			12.8	
Queue Delay		47.9			0.6			0.0			0.2	
Total Delay		74.4			12.7			29.2			13.0	
LOS		E			B			C			B	
Approach Delay		74.4			12.7			29.2			13.0	
Approach LOS		E			B			C			B	

Intersection Summary

Area Type: Other
Cycle Length: 70
Actuated Cycle Length: 70
Offset: 0 (0%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green, Master Intersection
Natural Cycle: 90
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.87
Intersection Signal Delay: 47.0 Intersection LOS: D
Intersection Capacity Utilization 93.3% ICU Level of Service F
Analysis Period (min) 15

Splits and Phases: 39: Brooks Avenue & Lake Street



Lane Group	Ø9
Switch Phase	
Minimum Initial (s)	4.0
Minimum Split (s)	18.0
Total Split (s)	20.0
Total Split (%)	29%
Maximum Green (s)	18.0
Yellow Time (s)	2.0
All-Red Time (s)	0.0
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	
Lead-Lag Optimize?	
Vehicle Extension (s)	3.0
Recall Mode	None
Walk Time (s)	5.0
Flash Dont Walk (s)	11.0
Pedestrian Calls (#/hr)	42
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	

Intersection Summary

Lane Group	EBT	WBT	NBT	SBT
Lane Group Flow (vph)	968	610	36	146
v/c Ratio	0.87	0.51	0.29	0.50
Control Delay	26.5	12.2	29.2	12.8
Queue Delay	47.9	0.6	0.0	0.2
Total Delay	74.4	12.7	29.2	13.0
Queue Length 50th (ft)	~274	171	11	2
Queue Length 95th (ft)	#672	284	29	33
Internal Link Dist (ft)	135	1046	126	128
Turn Bay Length (ft)				
Base Capacity (vph)	1107	1200	165	345
Starvation Cap Reductn	247	0	0	0
Spillback Cap Reductn	0	254	0	18
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	1.13	0.64	0.22	0.45

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

2027 Build Weekday Morning Peak Hour

Intersection						
Int Delay, s/veh	0.3					

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	619	3	1	1202	5	1
Future Vol, veh/h	619	3	1	1202	5	1
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	75	75	87	87	75	75
Heavy Vehicles, %	2	0	0	1	0	0
Mvmt Flow	825	4	1	1382	7	1

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	829	0	2211	827
Stage 1	-	-	-	-	827	-
Stage 2	-	-	-	-	1384	-
Critical Hdwy	-	-	4.1	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	-	-	2.2	-	3.5	3.3
Pot Cap-1 Maneuver	-	-	811	-	49	375
Stage 1	-	-	-	-	433	-
Stage 2	-	-	-	-	235	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	811	-	49	375
Mov Cap-2 Maneuver	-	-	-	-	49	-
Stage 1	-	-	-	-	433	-
Stage 2	-	-	-	-	234	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0	78.2
HCM LOS			F

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	57	-	-	811	-
HCM Lane V/C Ratio	0.14	-	-	0.001	-
HCM Control Delay (s)	78.2	-	-	9.4	0
HCM Lane LOS	F	-	-	A	A
HCM 95th %tile Q(veh)	0.5	-	-	0	-

Intersection	
Int Delay, s/veh	4.8

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	606	14	5	1166	37	6
Future Vol, veh/h	606	14	5	1166	37	6
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	75	75	93	93	75	75
Heavy Vehicles, %	2	0	0	1	0	0
Mvmt Flow	808	19	5	1254	49	8

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	827	0	2082	818
Stage 1	-	-	-	-	818	-
Stage 2	-	-	-	-	1264	-
Critical Hdwy	-	-	4.1	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	-	-	2.2	-	3.5	3.3
Pot Cap-1 Maneuver	-	-	813	-	59	379
Stage 1	-	-	-	-	437	-
Stage 2	-	-	-	-	268	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	813	-	58	379
Mov Cap-2 Maneuver	-	-	-	-	58	-
Stage 1	-	-	-	-	437	-
Stage 2	-	-	-	-	263	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0	179
HCM LOS			F

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	66	-	-	813	-
HCM Lane V/C Ratio	0.869	-	-	0.007	-
HCM Control Delay (s)	179	-	-	9.5	0
HCM Lane LOS	F	-	-	A	A
HCM 95th %tile Q(veh)	4.1	-	-	0	-

Intersection	
Int Delay, s/veh	0.5

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	602	607	3	1164	7	1
Future Vol, veh/h	602	607	3	1164	7	1
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	75	75	93	93	75	75
Heavy Vehicles, %	2	0	0	1	0	0
Mvmt Flow	803	809	3	1252	9	1

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	1612	0	2466	1208
Stage 1	-	-	-	-	1208	-
Stage 2	-	-	-	-	1258	-
Critical Hdwy	-	-	4.1	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	-	-	2.2	-	3.5	3.3
Pot Cap-1 Maneuver	-	-	410	-	34	225
Stage 1	-	-	-	-	286	-
Stage 2	-	-	-	-	270	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	410	-	33	225
Mov Cap-2 Maneuver	-	-	-	-	33	-
Stage 1	-	-	-	-	286	-
Stage 2	-	-	-	-	264	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0	137.8
HCM LOS			F

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	37	-	-	410	-
HCM Lane V/C Ratio	0.288	-	-	0.008	-
HCM Control Delay (s)	137.8	-	-	13.8	0
HCM Lane LOS	F	-	-	B	A
HCM 95th %tile Q(veh)	0.9	-	-	0	-

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	0	590	18	8	1148	5	8	0	14	4	0	11
Future Vol, veh/h	0	590	18	8	1148	5	8	0	14	4	0	11
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	79	79	79	96	96	96	80	80	80	92	92	92
Heavy Vehicles, %	0	1	0	0	0	0	0	0	10	0	0	0
Mvmt Flow	0	747	23	8	1196	5	10	0	18	4	0	12

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	1201	0	0	770	0	0	1980	1976	759	1983	1985	1199
Stage 1	-	-	-	-	-	-	759	759	-	1215	1215	-
Stage 2	-	-	-	-	-	-	1221	1217	-	768	770	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.1	6.5	6.3	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	3.39	3.5	4	3.3
Pot Cap-1 Maneuver	588	-	-	854	-	-	47	63	394	46	62	228
Stage 1	-	-	-	-	-	-	402	418	-	224	256	-
Stage 2	-	-	-	-	-	-	222	256	-	397	413	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	588	-	-	854	-	-	44	61	394	43	60	228
Mov Cap-2 Maneuver	-	-	-	-	-	-	44	61	-	43	60	-
Stage 1	-	-	-	-	-	-	402	418	-	224	249	-
Stage 2	-	-	-	-	-	-	204	249	-	379	413	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0.1	53.5	45
HCM LOS			F	E

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	101	588	-	-	854	-	-	106
HCM Lane V/C Ratio	0.272	-	-	-	0.01	-	-	0.154
HCM Control Delay (s)	53.5	0	-	-	9.3	0	-	45
HCM Lane LOS	F	A	-	-	A	A	-	E
HCM 95th %tile Q(veh)	1	0	-	-	0	-	-	0.5

Intersection	
Int Delay, s/veh	5.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	3	593	12	26	1136	3	9	0	29	3	0	16
Future Vol, veh/h	3	593	12	26	1136	3	9	0	29	3	0	16
Conflicting Peds, #/hr	0	0	0	304	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	84	84	84	97	97	97	75	75	75	75	75	75
Heavy Vehicles, %	0	2	0	0	0	0	0	0	0	0	0	0
Mvmt Flow	4	706	14	27	1171	3	12	0	39	4	0	21

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	1174	0	0	1024	0	0	2262	2253	1017	1968	2259	1173
Stage 1	-	-	-	-	-	-	1025	1025	-	1227	1227	-
Stage 2	-	-	-	-	-	-	1237	1228	-	741	1032	-
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	602	-	-	686	-	-	29	42	291	48	42	236
Stage 1	-	-	-	-	-	-	286	315	-	220	253	-
Stage 2	-	-	-	-	-	-	217	253	-	411	313	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	602	-	-	512	-	-	17	26	217	35	26	236
Mov Cap-2 Maneuver	-	-	-	-	-	-	17	26	-	35	26	-
Stage 1	-	-	-	-	-	-	211	233	-	218	215	-
Stage 2	-	-	-	-	-	-	167	215	-	334	231	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.1	0.3	204.1	41.3
HCM LOS			F	E

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	57	602	-	-	512	-	-	124
HCM Lane V/C Ratio	0.889	0.006	-	-	0.052	-	-	0.204
HCM Control Delay (s)	204.1	11	0	-	12.4	0	-	41.3
HCM Lane LOS	F	B	A	-	B	A	-	E
HCM 95th %tile Q(veh)	4	0	-	-	0.2	-	-	0.7

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	13	7	7	30	19	0
Future Volume (Veh/h)	13	7	7	30	19	0
Sign Control		Stop	Stop		Free	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	14	8	8	33	21	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	79	42	42	0	0	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	79	42	42	0	0	
tC, single (s)	7.1	6.5	6.5	6.2	4.1	
tC, 2 stage (s)						
tF (s)	3.5	4.0	4.0	3.3	2.2	
p0 queue free %	98	99	99	97	99	
cM capacity (veh/h)	872	843	843	1091	1636	

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	22	41	21
Volume Left	14	0	21
Volume Right	0	33	0
cSH	861	1032	1636
Volume to Capacity	0.03	0.04	0.01
Queue Length 95th (ft)	2	3	1
Control Delay (s)	9.3	8.6	7.2
Lane LOS	A	A	A
Approach Delay (s)	9.3	8.6	7.2
Approach LOS	A	A	

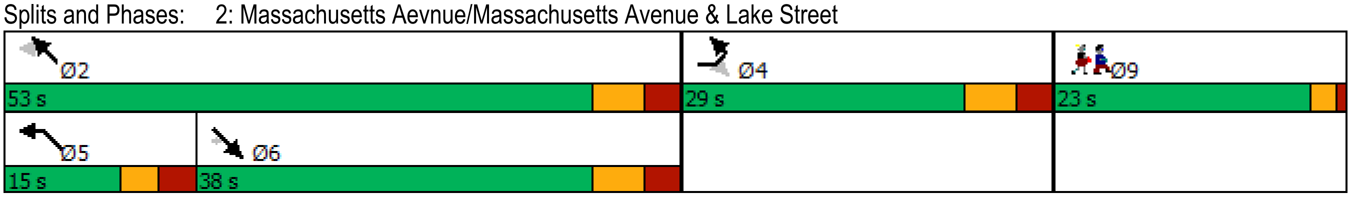
Intersection Summary			
Average Delay	8.5		
Intersection Capacity Utilization	17.8%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBR	SET	SER	NWL	NWT	Ø9
Lane Configurations							
Traffic Volume (vph)	261	295	851	609	403	454	
Future Volume (vph)	261	295	851	609	403	454	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	
Lane Width (ft)	16	16	11	10	11	12	
Storage Length (ft)	0	100		55	150		
Storage Lanes	1	1		1	1		
Taper Length (ft)	25				25		
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	1.00	
Frt		0.850		0.850			
Flt Protected	0.950				0.950		
Satd. Flow (prot)	2025	1812	3421	1492	1728	1863	
Flt Permitted	0.950				0.142		
Satd. Flow (perm)	2025	1812	3421	1492	258	1863	
Right Turn on Red		Yes		Yes			
Satd. Flow (RTOR)		245		212			
Link Speed (mph)	30		30			30	
Link Distance (ft)	1126		640			645	
Travel Time (s)	25.6		14.5			14.7	
Peak Hour Factor	0.91	0.91	0.92	0.92	0.92	0.92	
Heavy Vehicles (%)	1%	1%	2%	1%	1%	2%	
Adj. Flow (vph)	287	324	925	662	438	493	
Shared Lane Traffic (%)							
Lane Group Flow (vph)	287	324	925	662	438	493	
Enter Blocked Intersection	No	No	No	No	No	No	
Lane Alignment	Left	Right	Left	Right	Left	Left	
Median Width(ft)	16		11			11	
Link Offset(ft)	0		0			0	
Crosswalk Width(ft)	16		16			16	
Two way Left Turn Lane							
Headway Factor	0.85	0.85	1.04	1.09	1.04	1.00	
Turning Speed (mph)	15	9		9	15		
Number of Detectors	1	1	2	1	1	2	
Detector Template	Left	Right	Thru	Right	Left	Thru	
Leading Detector (ft)	20	20	100	20	20	100	
Trailing Detector (ft)	0	0	0	0	0	0	
Detector 1 Position(ft)	0	0	0	0	0	0	
Detector 1 Size(ft)	20	20	6	20	20	6	
Detector 1 Type	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	
Detector 1 Queue (s)	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	
Detector 2 Position(ft)			94			94	
Detector 2 Size(ft)			6			6	
Detector 2 Type			Cl+Ex			Cl+Ex	
Detector 2 Channel							
Detector 2 Extend (s)			0.0			0.0	
Turn Type	Prot	Perm	NA	Perm	pm+pt	NA	

Lane Group	EBL	EBR	SET	SER	NWL	NWT	Ø9
Protected Phases	4		6		5	2	9
Permitted Phases		4		6	2		
Detector Phase	4	4	6	6	5	2	
Switch Phase							
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	23.0	23.0	23.0	23.0	10.0	23.0	19.0
Total Split (s)	29.0	29.0	38.0	38.0	15.0	53.0	23.0
Total Split (%)	27.6%	27.6%	36.2%	36.2%	14.3%	50.5%	22%
Maximum Green (s)	22.0	22.0	31.0	31.0	9.0	46.0	20.0
Yellow Time (s)	4.0	4.0	4.0	4.0	3.0	4.0	2.0
All-Red Time (s)	3.0	3.0	3.0	3.0	3.0	3.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	7.0	7.0	7.0	7.0	6.0	7.0	
Lead/Lag			Lag	Lag	Lead		
Lead-Lag Optimize?			Yes	Yes	Yes		
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None	Max	Max	None	Max	None
Walk Time (s)							5.0
Flash Dont Walk (s)							11.0
Pedestrian Calls (#/hr)							35
Act Effct Green (s)	17.2	17.2	31.8	31.8	48.2	47.2	
Actuated g/C Ratio	0.19	0.19	0.36	0.36	0.54	0.53	
v/c Ratio	0.73	0.59	0.76	0.99	1.50	0.50	
Control Delay	46.7	14.3	32.8	55.6	261.8	18.7	
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	
Total Delay	46.7	14.3	32.8	55.6	261.8	18.7	
LOS	D	B	C	E	F	B	
Approach Delay	29.5		42.3			133.1	
Approach LOS	C		D			F	

Intersection Summary	
Area Type: Other	
Cycle Length: 105	
Actuated Cycle Length: 88.9	
Natural Cycle: 120	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 1.50	
Intersection Signal Delay: 66.8	Intersection LOS: E
Intersection Capacity Utilization 77.0%	ICU Level of Service D
Analysis Period (min) 15	

Splits and Phases: 2: Massachusetts Aevnue/Massachusetts Avenue & Lake Street



Lane Group	EBL	EBR	SET	SER	NWL	NWT
Lane Group Flow (vph)	287	324	925	662	438	493
v/c Ratio	0.73	0.59	0.76	0.99	1.50	0.50
Control Delay	46.7	14.3	32.8	55.6	261.8	18.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	46.7	14.3	32.8	55.6	261.8	18.7
Queue Length 50th (ft)	170	42	282	~364	~339	214
Queue Length 95th (ft)	259	125	#409	#606	#554	332
Internal Link Dist (ft)	1046		560			565
Turn Bay Length (ft)		100		55	150	
Base Capacity (vph)	514	642	1224	669	292	989
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	0.56	0.50	0.76	0.99	1.50	0.50

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

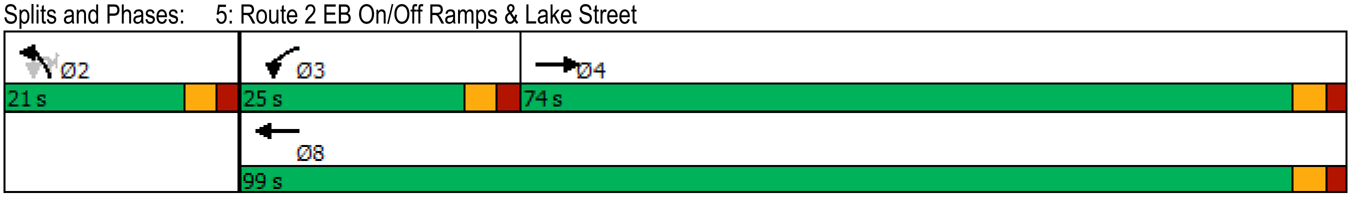
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Lane Group	EBT	EBR	WBL	WBT	NBU	NBL	NBR
Lane Configurations							
Traffic Volume (vph)	312	493	212	421	271	221	523
Future Volume (vph)	312	493	212	421	271	221	523
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	16	16	10	11	12	16	14
Storage Length (ft)		150	110			0	0
Storage Lanes		1	1			1	1
Taper Length (ft)			25			25	
Lane Util. Factor	1.00	1.00	1.00	0.95	1.00	1.00	1.00
Frt		0.850					0.850
Flt Protected			0.950			0.950	
Satd. Flow (prot)	2132	1812	1685	3455	0	2037	1706
Flt Permitted			0.950			0.950	
Satd. Flow (perm)	2132	1812	1685	3455	0	2037	1706
Right Turn on Red		Yes					Yes
Satd. Flow (RTOR)		332					405
Link Speed (mph)	30			30		30	
Link Distance (ft)	239			505		387	
Travel Time (s)	5.4			11.5		8.8	
Peak Hour Factor	0.91	0.91	0.84	0.84	0.91	0.91	0.91
Heavy Vehicles (%)	1%	1%	0%	1%	0%	1%	1%
Adj. Flow (vph)	343	542	252	501	298	243	575
Shared Lane Traffic (%)							
Lane Group Flow (vph)	343	542	252	501	0	541	575
Enter Blocked Intersection	No	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	R NA	Left	Right
Median Width(ft)	12			12		16	
Link Offset(ft)	0			0		0	
Crosswalk Width(ft)	16			16		16	
Two way Left Turn Lane							
Headway Factor	0.85	0.85	1.09	1.04	1.00	0.85	0.92
Turning Speed (mph)		9	15		9	15	9
Number of Detectors	2	1	1	2	1	1	1
Detector Template	Thru	Right	Left	Thru	Left	Left	Right
Leading Detector (ft)	100	20	20	100	20	20	20
Trailing Detector (ft)	0	0	0	0	0	0	0
Detector 1 Position(ft)	0	0	0	0	0	0	0
Detector 1 Size(ft)	6	20	20	6	20	20	20
Detector 1 Type	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
Detector 1 Queue (s)	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
Detector 2 Position(ft)	94			94			
Detector 2 Size(ft)	6			6			
Detector 2 Type	Cl+Ex			Cl+Ex			
Detector 2 Channel							
Detector 2 Extend (s)	0.0			0.0			
Turn Type	NA	Free	Prot	NA	Perm	Prot	Perm

Lane Group	EBT	EBR	WBL	WBT	NBU	NBL	NBR
Protected Phases	4		3	8		2	
Permitted Phases		Free			2		2
Detector Phase	4		3	8	2	2	2
Switch Phase							
Minimum Initial (s)	4.0		4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0		9.0	21.0	21.0	21.0	21.0
Total Split (s)	74.0		25.0	99.0	21.0	21.0	21.0
Total Split (%)	61.7%		20.8%	82.5%	17.5%	17.5%	17.5%
Maximum Green (s)	69.0		20.0	94.0	16.0	16.0	16.0
Yellow Time (s)	3.0		3.0	3.0	3.0	3.0	3.0
All-Red Time (s)	2.0		2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0		0.0	0.0		0.0	0.0
Total Lost Time (s)	5.0		5.0	5.0		5.0	5.0
Lead/Lag	Lag		Lead				
Lead-Lag Optimize?	Yes		Yes				
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0	3.0
Recall Mode	None		None	None	Max	Max	Max
Walk Time (s)	5.0			5.0	5.0	5.0	5.0
Flash Dont Walk (s)	11.0			11.0	11.0	11.0	11.0
Pedestrian Calls (#/hr)	0			0	0	0	0
Act Effct Green (s)	15.8	63.5	16.4	37.3		16.1	16.1
Actuated g/C Ratio	0.25	1.00	0.26	0.59		0.25	0.25
v/c Ratio	0.65	0.30	0.58	0.25		1.04	0.78
Control Delay	27.8	0.4	27.3	6.4		80.3	17.0
Queue Delay	0.0	0.0	0.0	0.0		0.0	0.0
Total Delay	27.8	0.4	27.3	6.4		80.3	17.0
LOS	C	A	C	A		F	B
Approach Delay	11.0			13.4		47.7	
Approach LOS	B			B		D	

Intersection Summary	
Area Type: Other	
Cycle Length: 120	
Actuated Cycle Length: 63.5	
Natural Cycle: 60	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 1.04	
Intersection Signal Delay: 26.5	Intersection LOS: C
Intersection Capacity Utilization 67.9%	ICU Level of Service C
Analysis Period (min) 15	

Splits and Phases: 5: Route 2 EB On/Off Ramps & Lake Street



Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Group Flow (vph)	343	542	252	501	541	575
v/c Ratio	0.65	0.30	0.58	0.25	1.04	0.78
Control Delay	27.8	0.4	27.3	6.4	80.3	17.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	27.8	0.4	27.3	6.4	80.3	17.0
Queue Length 50th (ft)	119	0	84	43	~236	55
Queue Length 95th (ft)	205	0	152	57	#482	#246
Internal Link Dist (ft)	159			425	307	
Turn Bay Length (ft)		150	110			
Base Capacity (vph)	2110	1812	535	3455	518	735
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	0.16	0.30	0.47	0.15	1.04	0.78

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

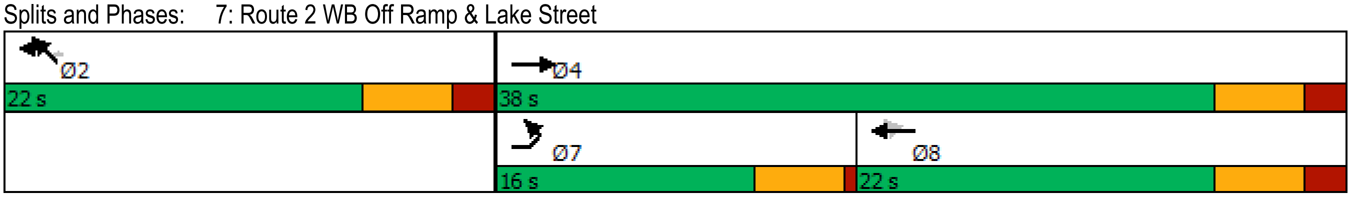
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Traffic Volume (vph)	224	611	0	0	482	725	0	0	0	151	6	11
Future Volume (vph)	224	611	0	0	482	725	0	0	0	151	6	11
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	11	10	12	12	12	11	12	16
Storage Length (ft)	250		0	0		75	0		0	100		0
Storage Lanes	1		0	0		1	0		0	1		1
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	0.95	0.95	1.00
Frt						0.850						0.850
Flt Protected	0.950									0.950	0.956	
Satd. Flow (prot)	1805	1881	0	0	1837	1492	0	0	0	1579	1594	1830
Flt Permitted	0.950									0.950	0.956	
Satd. Flow (perm)	1805	1881	0	0	1837	1492	0	0	0	1579	1594	1830
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)						492						136
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		505			380			459			529	
Travel Time (s)		11.5			8.6			10.4			12.0	
Peak Hour Factor	0.88	0.88	0.88	0.92	0.92	0.92	0.92	0.92	0.92	0.81	0.81	0.81
Heavy Vehicles (%)	0%	1%	0%	0%	0%	1%	0%	0%	0%	5%	50%	0%
Adj. Flow (vph)	255	694	0	0	524	788	0	0	0	186	7	14
Shared Lane Traffic (%)										48%		
Lane Group Flow (vph)	255	694	0	0	524	788	0	0	0	97	96	14
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			11			11	
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	1.04	1.09	1.00	1.00	1.00	1.04	1.00	0.85
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2			2	1				1	2	1
Detector Template	Left	Thru			Thru	Right				Left	Thru	Right
Leading Detector (ft)	20	100			100	20				20	100	20
Trailing Detector (ft)	0	0			0	0				0	0	0
Detector 1 Position(ft)	0	0			0	0				0	0	0
Detector 1 Size(ft)	20	6			6	20				20	6	20
Detector 1 Type	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
Detector 1 Queue (s)	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
Detector 2 Position(ft)		94			94						94	
Detector 2 Size(ft)		6			6						6	
Detector 2 Type		Cl+Ex			Cl+Ex						Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0						0.0	
Turn Type	Prot	NA			NA	Perm				Split	NA	Perm

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Protected Phases	7	4			8					2	2	
Permitted Phases						8						2
Detector Phase	7	4			8	8				2	2	2
Switch Phase												
Minimum Initial (s)	4.0	4.0			4.0	4.0				4.0	4.0	4.0
Minimum Split (s)	8.5	22.0			22.0	22.0				22.0	22.0	22.0
Total Split (s)	16.0	38.0			22.0	22.0				22.0	22.0	22.0
Total Split (%)	26.7%	63.3%			36.7%	36.7%				36.7%	36.7%	36.7%
Maximum Green (s)	11.5	32.0			16.0	16.0				16.0	16.0	16.0
Yellow Time (s)	4.0	4.0			4.0	4.0				4.0	4.0	4.0
All-Red Time (s)	0.5	2.0			2.0	2.0				2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0			0.0	0.0				0.0	0.0	0.0
Total Lost Time (s)	4.5	6.0			6.0	6.0				6.0	6.0	6.0
Lead/Lag	Lead				Lag	Lag						
Lead-Lag Optimize?	Yes				Yes	Yes						
Vehicle Extension (s)	3.0	3.0			3.0	3.0				3.0	3.0	3.0
Recall Mode	None	None			None	None				Max	Max	Max
Walk Time (s)		5.0			5.0	5.0				5.0	5.0	5.0
Flash Dont Walk (s)		11.0			11.0	11.0				11.0	11.0	11.0
Pedestrian Calls (#/hr)		0			0	0				0	0	0
Act Effct Green (s)	11.0	31.5			16.0	16.0				16.0	16.0	16.0
Actuated g/C Ratio	0.18	0.53			0.27	0.27				0.27	0.27	0.27
v/c Ratio	0.77	0.70			1.06	1.04				0.23	0.22	0.02
Control Delay	40.9	15.1			83.8	54.7				19.0	18.9	0.1
Queue Delay	0.0	0.0			0.0	0.0				0.0	0.0	0.0
Total Delay	40.9	15.1			83.8	54.7				19.0	18.9	0.1
LOS	D	B			F	D				B	B	A
Approach Delay		22.0			66.3						17.7	
Approach LOS		C			E						B	

Intersection Summary	
Area Type: Other	
Cycle Length: 60	
Actuated Cycle Length: 59.5	
Natural Cycle: 80	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 1.06	
Intersection Signal Delay: 45.2	Intersection LOS: D
Intersection Capacity Utilization 75.4%	ICU Level of Service D
Analysis Period (min) 15	

Splits and Phases: 7: Route 2 WB Off Ramp & Lake Street



Lane Group	EBL	EBT	WBT	WBR	NWL	NWT	NWR
Lane Group Flow (vph)	255	694	524	788	97	96	14
v/c Ratio	0.77	0.70	1.06	1.04	0.23	0.22	0.02
Control Delay	40.9	15.1	83.8	54.7	19.0	18.9	0.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	40.9	15.1	83.8	54.7	19.0	18.9	0.1
Queue Length 50th (ft)	88	168	~217	~169	28	28	0
Queue Length 95th (ft)	#179	268	#381	#364	56	55	0
Internal Link Dist (ft)		425	300			449	
Turn Bay Length (ft)	250			75	100		
Base Capacity (vph)	348	1012	494	760	425	429	591
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.73	0.69	1.06	1.04	0.23	0.22	0.02

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

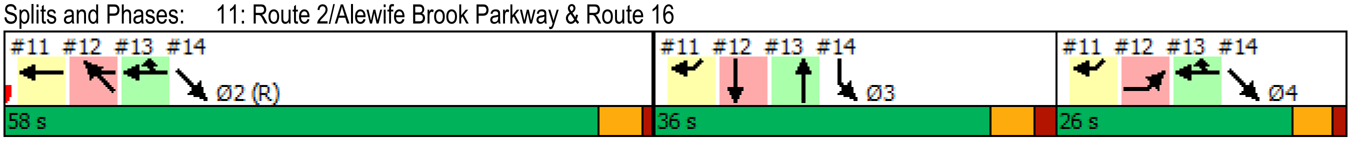
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Lane Group	EBL	EBT	WBT	WBR	SWL	SWR	Ø3	Ø4
Lane Configurations								
Traffic Volume (vph)	0	0	1597	0	0	1062		
Future Volume (vph)	0	0	1597	0	0	1062		
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900		
Lane Width (ft)	13	13	13	13	13	13		
Lane Util. Factor	1.00	1.00	0.91	1.00	1.00	0.88		
Frt						0.850		
Flt Protected								
Satd. Flow (prot)	0	0	4729	0	0	2617		
Flt Permitted								
Satd. Flow (perm)	0	0	4729	0	0	2617		
Right Turn on Red				Yes		Yes		
Satd. Flow (RTOR)						7		
Link Speed (mph)		30	30		30			
Link Distance (ft)		201	192		296			
Travel Time (s)		4.6	4.4		6.7			
Peak Hour Factor	0.92	0.92	0.90	0.92	0.92	0.85		
Heavy Vehicles (%)	2%	2%	2%	2%	2%	1%		
Adj. Flow (vph)	0	0	1774	0	0	1249		
Shared Lane Traffic (%)								
Lane Group Flow (vph)	0	0	1774	0	0	1249		
Enter Blocked Intersection	No	No	No	No	No	No		
Lane Alignment	Left	Left	Left	Right	Left	Right		
Median Width(ft)		0	0		0			
Link Offset(ft)		0	0		0			
Crosswalk Width(ft)		16	16		16			
Two way Left Turn Lane								
Headway Factor	1.10	1.10	1.10	1.10	1.10	1.10		
Turning Speed (mph)	15			9	15	30		
Number of Detectors			2			1		
Detector Template			Thru			Right		
Leading Detector (ft)			100			20		
Trailing Detector (ft)			0			0		
Detector 1 Position(ft)			0			0		
Detector 1 Size(ft)			6			20		
Detector 1 Type			Cl+Ex			Cl+Ex		
Detector 1 Channel								
Detector 1 Extend (s)			0.0			0.0		
Detector 1 Queue (s)			0.0			0.0		
Detector 1 Delay (s)			0.0			0.0		
Detector 2 Position(ft)			94					
Detector 2 Size(ft)			6					
Detector 2 Type			Cl+Ex					
Detector 2 Channel								
Detector 2 Extend (s)			0.0					
Turn Type			NA			custom		
Protected Phases			2			3 4	3	4
Permitted Phases								
Detector Phase			2			3 4		

Lane Group	EBL	EBT	WBT	WBR	SWL	SWR	Ø3	Ø4
Switch Phase								
Minimum Initial (s)			10.0				10.0	10.0
Minimum Split (s)			15.0				19.0	15.0
Total Split (s)			58.0				36.0	26.0
Total Split (%)			48.3%				30%	22%
Maximum Green (s)			53.0				30.0	21.0
Yellow Time (s)			4.0				4.0	3.5
All-Red Time (s)			1.0				2.0	1.5
Lost Time Adjust (s)			0.0					
Total Lost Time (s)			5.0					
Lead/Lag							Lead	Lag
Lead-Lag Optimize?								
Vehicle Extension (s)			3.0				3.0	3.0
Recall Mode			C-Max				Max	Max
Walk Time (s)							5.0	
Flash Dont Walk (s)							8.0	
Pedestrian Calls (#/hr)							0	
Act Effct Green (s)			53.0			56.0		
Actuated g/C Ratio			0.44			0.47		
v/c Ratio			0.85			1.02		
Control Delay			5.6			62.8		
Queue Delay			4.6			0.0		
Total Delay			10.1			62.8		
LOS			B			E		
Approach Delay			10.1		62.8			
Approach LOS			B		E			

Intersection Summary	
Area Type: CBD	
Cycle Length: 120	
Actuated Cycle Length: 120	
Offset: 16 (13%), Referenced to phase 2:WBT, Start of Green	
Natural Cycle: 110	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 1.09	
Intersection Signal Delay: 31.9	Intersection LOS: C
Intersection Capacity Utilization 84.7%	ICU Level of Service E
Analysis Period (min) 15	

Splits and Phases: 11: Route 2/Alewife Brook Parkway & Route 16



Lane Group	WBT	SWR
Lane Group Flow (vph)	1774	1249
v/c Ratio	0.85	1.02
Control Delay	5.6	62.8
Queue Delay	4.6	0.0
Total Delay	10.1	62.8
Queue Length 50th (ft)	43	~581
Queue Length 95th (ft)	m40	#659
Internal Link Dist (ft)	112	
Turn Bay Length (ft)		
Base Capacity (vph)	2088	1225
Starvation Cap Reductn	252	0
Spillback Cap Reductn	0	0
Storage Cap Reductn	0	0
Reduced v/c Ratio	0.97	1.02

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

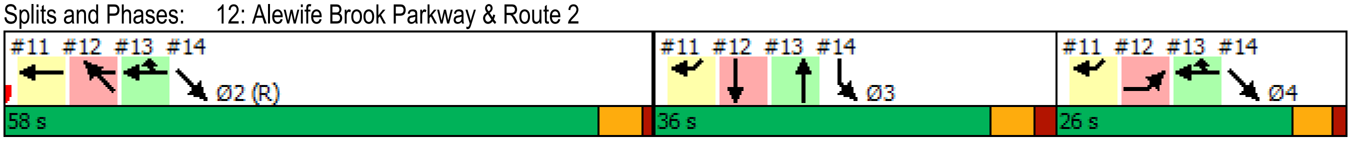
Lane Group	EBL	WBR	SBT	NWT
Lane Configurations				
Traffic Volume (vph)	505	169	506	1428
Future Volume (vph)	505	169	506	1428
Ideal Flow (vphpl)	1900	1900	1900	1900
Lane Width (ft)	13	16	13	13
Lane Util. Factor	0.97	1.00	0.95	0.95
Frt		0.865		
Flt Protected	0.950			
Satd. Flow (prot)	3224	1581	3291	3291
Flt Permitted	0.950			
Satd. Flow (perm)	3224	1581	3291	3291
Right Turn on Red				
Satd. Flow (RTOR)				
Link Speed (mph)			30	30
Link Distance (ft)			202	278
Travel Time (s)			4.6	6.3
Peak Hour Factor	0.97	0.94	0.85	0.90
Heavy Vehicles (%)	1%	6%	2%	2%
Adj. Flow (vph)	521	180	595	1587
Shared Lane Traffic (%)				
Lane Group Flow (vph)	521	180	595	1587
Enter Blocked Intersection	No	No	No	No
Lane Alignment	Left	R NA	Left	L NA
Median Width(ft)			0	0
Link Offset(ft)			0	0
Crosswalk Width(ft)			16	16
Two way Left Turn Lane				
Headway Factor	1.10	0.97	1.10	1.10
Turning Speed (mph)	15	30		
Number of Detectors	1	1	2	2
Detector Template	Left	Right	Thru	Thru
Leading Detector (ft)	20	20	100	100
Trailing Detector (ft)	0	0	0	0
Detector 1 Position(ft)	0	0	0	0
Detector 1 Size(ft)	20	20	6	6
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel				
Detector 1 Extend (s)	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0
Detector 2 Position(ft)			94	94
Detector 2 Size(ft)			6	6
Detector 2 Type			Cl+Ex	Cl+Ex
Detector 2 Channel				
Detector 2 Extend (s)			0.0	0.0
Turn Type	Prot	Prot	NA	NA
Protected Phases	4	2!	3	2!
Permitted Phases				
Detector Phase	4	2	3	2

Lane Group	EBL	WBR	SBT	NWT
Switch Phase				
Minimum Initial (s)	10.0	10.0	10.0	10.0
Minimum Split (s)	15.0	15.0	19.0	15.0
Total Split (s)	26.0	58.0	36.0	58.0
Total Split (%)	21.7%	48.3%	30.0%	48.3%
Maximum Green (s)	21.0	53.0	30.0	53.0
Yellow Time (s)	3.5	4.0	4.0	4.0
All-Red Time (s)	1.5	1.0	2.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	6.0	5.0
Lead/Lag	Lag		Lead	
Lead-Lag Optimize?				
Vehicle Extension (s)	3.0	3.0	3.0	3.0
Recall Mode	Max	C-Max	Max	C-Max
Walk Time (s)			5.0	
Flash Dont Walk (s)			8.0	
Pedestrian Calls (#/hr)			0	
Act Effct Green (s)	21.0	53.0	30.0	53.0
Actuated g/C Ratio	0.18	0.44	0.25	0.44
v/c Ratio	0.92	0.26	0.72	1.09
Control Delay	72.2	14.3	47.1	85.8
Queue Delay	0.0	2.4	0.0	3.3
Total Delay	72.2	16.7	47.1	89.1
LOS	E	B	D	F
Approach Delay			47.1	89.1
Approach LOS			D	F

Intersection Summary	
Area Type: CBD	
Cycle Length: 120	
Actuated Cycle Length: 120	
Offset: 16 (13%), Referenced to phase 2:WBT, Start of Green	
Natural Cycle: 110	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 1.09	
Intersection Signal Delay: 72.8	Intersection LOS: E
Intersection Capacity Utilization 103.7%	ICU Level of Service G
Analysis Period (min) 15	

! Phase conflict between lane groups.

Splits and Phases: 12: Alewife Brook Parkway & Route 2



Lane Group	EBL	WBR	SBT	NWT
Lane Group Flow (vph)	521	180	595	1587
v/c Ratio	0.92	0.26	0.72	1.09
Control Delay	72.2	14.3	47.1	85.8
Queue Delay	0.0	2.4	0.0	3.3
Total Delay	72.2	16.7	47.1	89.1
Queue Length 50th (ft)	206	86	223	~730
Queue Length 95th (ft)	#308	138	269	#868
Internal Link Dist (ft)			122	198
Turn Bay Length (ft)				
Base Capacity (vph)	564	698	822	1453
Starvation Cap Reductn	0	397	0	0
Spillback Cap Reductn	0	6	0	13
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.92	0.60	0.72	1.10

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

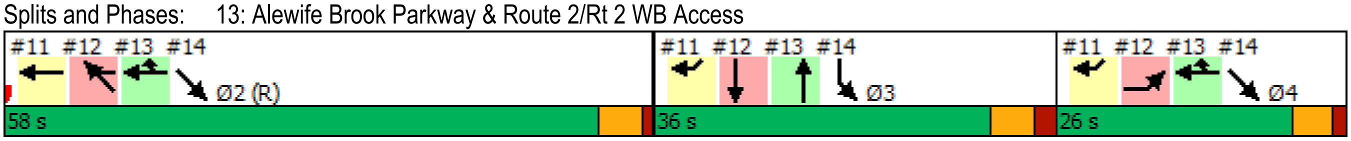
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	0	169	54	0	224	0	0	0	0
Future Volume (vph)	0	0	0	0	169	54	0	224	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		200	0		0	0		0
Storage Lanes	0		0	0		1	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	0.95	1.00	1.00	1.00	1.00
Ped Bike Factor												
Frt						0.850						
Flt Protected												
Satd. Flow (prot)	0	0	0	0	1613	1333	0	3154	0	0	0	0
Flt Permitted												
Satd. Flow (perm)	0	0	0	0	1613	1333	0	3154	0	0	0	0
Right Turn on Red			No			No	No		No			No
Satd. Flow (RTOR)												
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		161			1225			227			185	
Travel Time (s)		3.7			27.8			5.2			4.2	
Confl. Peds. (#/hr)						2						
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.90	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	2%	2%	2%	0%	6%	9%	2%	3%	2%	2%	2%	2%
Adj. Flow (vph)	0	0	0	0	184	59	0	249	0	0	0	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	0	0	0	184	59	0	249	0	0	0	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)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors					2	1		2				
Detector Template					Thru	Right		Thru				
Leading Detector (ft)					100	20		100				
Trailing Detector (ft)					0	0		0				
Detector 1 Position(ft)					0	0		0				
Detector 1 Size(ft)					6	20		6				
Detector 1 Type					Cl+Ex	Cl+Ex		Cl+Ex				
Detector 1 Channel												
Detector 1 Extend (s)					0.0	0.0		0.0				
Detector 1 Queue (s)					0.0	0.0		0.0				
Detector 1 Delay (s)					0.0	0.0		0.0				
Detector 2 Position(ft)					94			94				
Detector 2 Size(ft)					6			6				
Detector 2 Type					Cl+Ex			Cl+Ex				
Detector 2 Channel												
Detector 2 Extend (s)					0.0			0.0				

Lane Group	Ø2	Ø4
Lane Configurations		
Traffic Volume (vph)		
Future Volume (vph)		
Ideal Flow (vphpl)		
Storage Length (ft)		
Storage Lanes		
Taper Length (ft)		
Lane Util. Factor		
Ped Bike Factor		
Frt		
Flt Protected		
Satd. Flow (prot)		
Flt Permitted		
Satd. Flow (perm)		
Right Turn on Red		
Satd. Flow (RTOR)		
Link Speed (mph)		
Link Distance (ft)		
Travel Time (s)		
Confl. Peds. (#/hr)		
Peak Hour Factor		
Heavy Vehicles (%)		
Adj. Flow (vph)		
Shared Lane Traffic (%)		
Lane Group Flow (vph)		
Enter Blocked Intersection		
Lane Alignment		
Median Width(ft)		
Link Offset(ft)		
Crosswalk Width(ft)		
Two way Left Turn Lane		
Headway Factor		
Turning Speed (mph)		
Number of Detectors		
Detector Template		
Leading Detector (ft)		
Trailing Detector (ft)		
Detector 1 Position(ft)		
Detector 1 Size(ft)		
Detector 1 Type		
Detector 1 Channel		
Detector 1 Extend (s)		
Detector 1 Queue (s)		
Detector 1 Delay (s)		
Detector 2 Position(ft)		
Detector 2 Size(ft)		
Detector 2 Type		
Detector 2 Channel		
Detector 2 Extend (s)		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Turn Type					NA	Prot		NA				
Protected Phases					2 4	2 4		3				
Permitted Phases												
Detector Phase					2 4	2 4		3				
Switch Phase												
Minimum Initial (s)								10.0				
Minimum Split (s)								19.0				
Total Split (s)								36.0				
Total Split (%)								30.0%				
Maximum Green (s)								30.0				
Yellow Time (s)								4.0				
All-Red Time (s)								2.0				
Lost Time Adjust (s)								0.0				
Total Lost Time (s)								6.0				
Lead/Lag								Lead				
Lead-Lag Optimize?												
Vehicle Extension (s)								3.0				
Recall Mode								Max				
Walk Time (s)								5.0				
Flash Dont Walk (s)								8.0				
Pedestrian Calls (#/hr)								0				
Act Effct Green (s)					79.0	79.0		30.0				
Actuated g/C Ratio					0.66	0.66		0.25				
v/c Ratio					0.17	0.07		0.32				
Control Delay					8.4	7.6		38.0				
Queue Delay					0.1	0.0		0.0				
Total Delay					8.5	7.6		38.0				
LOS					A	A		D				
Approach Delay					8.3			38.0				
Approach LOS					A			D				

Intersection Summary	
Area Type: CBD	
Cycle Length: 120	
Actuated Cycle Length: 120	
Offset: 16 (13%), Referenced to phase 2:WBT, Start of Green	
Natural Cycle: 110	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 1.09	
Intersection Signal Delay: 23.3	Intersection LOS: C
Intersection Capacity Utilization 27.4%	ICU Level of Service A
Analysis Period (min) 15	

Splits and Phases: 13: Alewife Brook Parkway & Route 2/Rt 2 WB Access



Lane Group	Ø2	Ø4
Turn Type		
Protected Phases	2	4
Permitted Phases		
Detector Phase		
Switch Phase		
Minimum Initial (s)	10.0	10.0
Minimum Split (s)	15.0	15.0
Total Split (s)	58.0	26.0
Total Split (%)	48%	22%
Maximum Green (s)	53.0	21.0
Yellow Time (s)	4.0	3.5
All-Red Time (s)	1.0	1.5
Lost Time Adjust (s)		
Total Lost Time (s)		
Lead/Lag		Lag
Lead-Lag Optimize?		
Vehicle Extension (s)	3.0	3.0
Recall Mode	C-Max	Max
Walk Time (s)		
Flash Dont Walk (s)		
Pedestrian Calls (#/hr)		
Act Effct Green (s)		
Actuated g/C Ratio		
v/c Ratio		
Control Delay		
Queue Delay		
Total Delay		
LOS		
Approach Delay		
Approach LOS		

Intersection Summary

Lane Group	WBT	WBR	NBT
Lane Group Flow (vph)	184	59	249
v/c Ratio	0.17	0.07	0.32
Control Delay	8.4	7.6	38.0
Queue Delay	0.1	0.0	0.0
Total Delay	8.5	7.6	38.0
Queue Length 50th (ft)	50	15	83
Queue Length 95th (ft)	81	31	121
Internal Link Dist (ft)	1145		147
Turn Bay Length (ft)		200	
Base Capacity (vph)	1061	877	788
Starvation Cap Reductn	0	0	0
Spillback Cap Reductn	223	0	0
Storage Cap Reductn	0	0	0
Reduced v/c Ratio	0.22	0.07	0.32

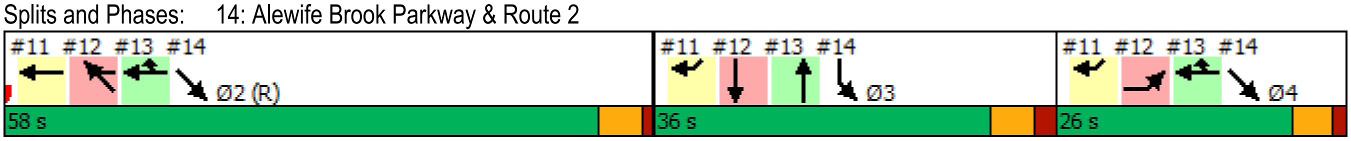
Intersection Summary

Lane Group	SBL	SBR	SEL	SET	NWT	NWR	Ø2	Ø4
Lane Configurations								
Traffic Volume (vph)	506	0	0	1104	0	0		
Future Volume (vph)	506	0	0	1104	0	0		
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900		
Lane Width (ft)	13	13	13	13	13	13		
Lane Util. Factor	0.97	1.00	1.00	0.95	1.00	1.00		
Frt								
Flt Protected	0.950							
Satd. Flow (prot)	3193	0	0	3324	0	0		
Flt Permitted	0.950							
Satd. Flow (perm)	3193	0	0	3324	0	0		
Right Turn on Red	Yes	Yes				Yes		
Satd. Flow (RTOR)	215							
Link Speed (mph)	30			30	30			
Link Distance (ft)	155			297	139			
Travel Time (s)	3.5			6.8	3.2			
Peak Hour Factor	0.85	0.92	0.92	0.97	0.92	0.92		
Heavy Vehicles (%)	2%	2%	2%	1%	2%	2%		
Adj. Flow (vph)	595	0	0	1138	0	0		
Shared Lane Traffic (%)								
Lane Group Flow (vph)	595	0	0	1138	0	0		
Enter Blocked Intersection	No	No	No	No	No	No		
Lane Alignment	Left	Right	Left	Left	Left	Right		
Median Width(ft)	26			0	0			
Link Offset(ft)	0			0	0			
Crosswalk Width(ft)	16			16	16			
Two way Left Turn Lane								
Headway Factor	1.10	1.10	1.10	1.10	1.10	1.10		
Turning Speed (mph)	30	9	15			9		
Number of Detectors	1			2				
Detector Template	Left			Thru				
Leading Detector (ft)	20			100				
Trailing Detector (ft)	0			0				
Detector 1 Position(ft)	0			0				
Detector 1 Size(ft)	20			6				
Detector 1 Type	Cl+Ex			Cl+Ex				
Detector 1 Channel								
Detector 1 Extend (s)	0.0			0.0				
Detector 1 Queue (s)	0.0			0.0				
Detector 1 Delay (s)	0.0			0.0				
Detector 2 Position(ft)				94				
Detector 2 Size(ft)				6				
Detector 2 Type				Cl+Ex				
Detector 2 Channel								
Detector 2 Extend (s)				0.0				
Turn Type	Prot			NA				
Protected Phases	3			2 4			2	4
Permitted Phases								
Detector Phase	3			2 4				

Lane Group	SBL	SBR	SEL	SET	NWT	NWR	Ø2	Ø4
Switch Phase								
Minimum Initial (s)	10.0						10.0	10.0
Minimum Split (s)	19.0						15.0	15.0
Total Split (s)	36.0						58.0	26.0
Total Split (%)	30.0%						48%	22%
Maximum Green (s)	30.0						53.0	21.0
Yellow Time (s)	4.0						4.0	3.5
All-Red Time (s)	2.0						1.0	1.5
Lost Time Adjust (s)	0.0							
Total Lost Time (s)	6.0							
Lead/Lag	Lead							Lag
Lead-Lag Optimize?								
Vehicle Extension (s)	3.0						3.0	3.0
Recall Mode	Max						C-Max	Max
Walk Time (s)	5.0							
Flash Dont Walk (s)	8.0							
Pedestrian Calls (#/hr)	0							
Act Effct Green (s)	30.0			79.0				
Actuated g/C Ratio	0.25			0.66				
v/c Ratio	0.62			0.52				
Control Delay	2.8			11.7				
Queue Delay	1.0			0.0				
Total Delay	3.7			11.7				
LOS	A			B				
Approach Delay	3.7			11.7				
Approach LOS	A			B				

Intersection Summary	
Area Type: CBD	
Cycle Length: 120	
Actuated Cycle Length: 120	
Offset: 16 (13%), Referenced to phase 2:WBT, Start of Green	
Natural Cycle: 110	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 1.09	
Intersection Signal Delay: 9.0	Intersection LOS: A
Intersection Capacity Utilization 59.1%	ICU Level of Service B
Analysis Period (min) 15	

Splits and Phases: 14: Alewife Brook Parkway & Route 2



Lane Group	SBL	SET
Lane Group Flow (vph)	595	1138
v/c Ratio	0.62	0.52
Control Delay	2.8	11.7
Queue Delay	1.0	0.0
Total Delay	3.7	11.7
Queue Length 50th (ft)	5	221
Queue Length 95th (ft)	0	272
Internal Link Dist (ft)	75	217
Turn Bay Length (ft)		
Base Capacity (vph)	959	2188
Starvation Cap Reductn	155	0
Spillback Cap Reductn	0	0
Storage Cap Reductn	0	0
Reduced v/c Ratio	0.74	0.52

Intersection Summary

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	625	0	0	1165	0	0	0	0	0	0	0
Future Volume (vph)	0	625	0	0	1165	0	0	0	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	15	15	15	16	16	16	12	12	12	12	12	12
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												
Flt Protected												
Satd. Flow (prot)	0	2049	0	0	2153	0	0	0	0	0	0	0
Flt Permitted												
Satd. Flow (perm)	0	2049	0	0	2153	0	0	0	0	0	0	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)												
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		135			215			175			206	
Travel Time (s)		3.1			4.9			4.0			4.7	
Peak Hour Factor	0.84	0.84	0.84	0.97	0.97	0.97	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	2%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Adj. Flow (vph)	0	744	0	0	1201	0	0	0	0	0	0	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	744	0	0	1201	0	0	0	0	0	0	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)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	0.88	0.88	0.88	0.85	0.85	0.85	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		2			2							
Detector Template		Thru			Thru							
Leading Detector (ft)		100			100							
Trailing Detector (ft)		0			0							
Detector 1 Position(ft)		0			0							
Detector 1 Size(ft)		6			6							
Detector 1 Type		Cl+Ex			Cl+Ex							
Detector 1 Channel												
Detector 1 Extend (s)		0.0			0.0							
Detector 1 Queue (s)		0.0			0.0							
Detector 1 Delay (s)		0.0			0.0							
Detector 2 Position(ft)		94			94							
Detector 2 Size(ft)		6			6							
Detector 2 Type		Cl+Ex			Cl+Ex							
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0							
Turn Type		NA			NA							
Protected Phases		2			6							
Permitted Phases												
Detector Phase		2			6							

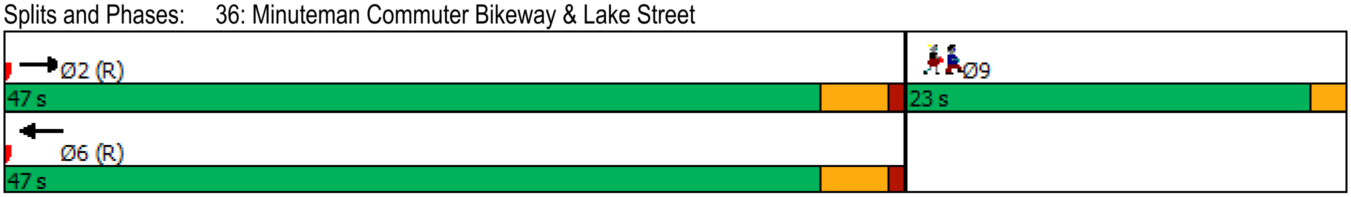
Lane Group	Ø9
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Ideal Flow (vphpl)	
Lane Width (ft)	
Lane Util. Factor	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (mph)	
Link Distance (ft)	
Travel Time (s)	
Peak Hour Factor	
Heavy Vehicles (%)	
Adj. Flow (vph)	
Shared Lane Traffic (%)	
Lane Group Flow (vph)	
Enter Blocked Intersection	
Lane Alignment	
Median Width(ft)	
Link Offset(ft)	
Crosswalk Width(ft)	
Two way Left Turn Lane	
Headway Factor	
Turning Speed (mph)	
Number of Detectors	
Detector Template	
Leading Detector (ft)	
Trailing Detector (ft)	
Detector 1 Position(ft)	
Detector 1 Size(ft)	
Detector 1 Type	
Detector 1 Channel	
Detector 1 Extend (s)	
Detector 1 Queue (s)	
Detector 1 Delay (s)	
Detector 2 Position(ft)	
Detector 2 Size(ft)	
Detector 2 Type	
Detector 2 Channel	
Detector 2 Extend (s)	
Turn Type	
Protected Phases	9
Permitted Phases	
Detector Phase	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Switch Phase												
Minimum Initial (s)		4.0			4.0							
Minimum Split (s)		20.5			20.5							
Total Split (s)		47.0			47.0							
Total Split (%)		67.1%			67.1%							
Maximum Green (s)		42.5			42.5							
Yellow Time (s)		3.5			3.5							
All-Red Time (s)		1.0			1.0							
Lost Time Adjust (s)		0.0			0.0							
Total Lost Time (s)		4.5			4.5							
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)		3.0			3.0							
Recall Mode		C-Max			C-Max							
Walk Time (s)												
Flash Dont Walk (s)												
Pedestrian Calls (#/hr)												
Act Effct Green (s)		47.5			47.5							
Actuated g/C Ratio		0.68			0.68							
v/c Ratio		0.54			0.82							
Control Delay		7.4			17.3							
Queue Delay		53.2			50.3							
Total Delay		60.6			67.7							
LOS		E			E							
Approach Delay		60.6			67.7							
Approach LOS		E			E							

Intersection Summary

Area Type: Other
Cycle Length: 70
Actuated Cycle Length: 70
Offset: 16 (23%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 60
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.82
Intersection Signal Delay: 65.0   Intersection LOS: E
Intersection Capacity Utilization 65.1%   ICU Level of Service C
Analysis Period (min) 15

Splits and Phases: 36: Minuteman Commuter Bikeway & Lake Street



Lane Group	Ø9
Switch Phase	
Minimum Initial (s)	4.0
Minimum Split (s)	18.0
Total Split (s)	23.0
Total Split (%)	33%
Maximum Green (s)	21.0
Yellow Time (s)	2.0
All-Red Time (s)	0.0
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	
Lead-Lag Optimize?	
Vehicle Extension (s)	3.0
Recall Mode	None
Walk Time (s)	5.0
Flash Dont Walk (s)	11.0
Pedestrian Calls (#/hr)	311
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	

Intersection Summary

Lane Group	EBT	WBT
Lane Group Flow (vph)	744	1201
v/c Ratio	0.54	0.82
Control Delay	7.4	17.3
Queue Delay	53.2	50.3
Total Delay	60.6	67.7
Queue Length 50th (ft)	134	570
Queue Length 95th (ft)	182	m580
Internal Link Dist (ft)	55	135
Turn Bay Length (ft)		
Base Capacity (vph)	1390	1460
Starvation Cap Reductn	0	729
Spillback Cap Reductn	812	0
Storage Cap Reductn	0	0
Reduced v/c Ratio	1.29	1.64

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

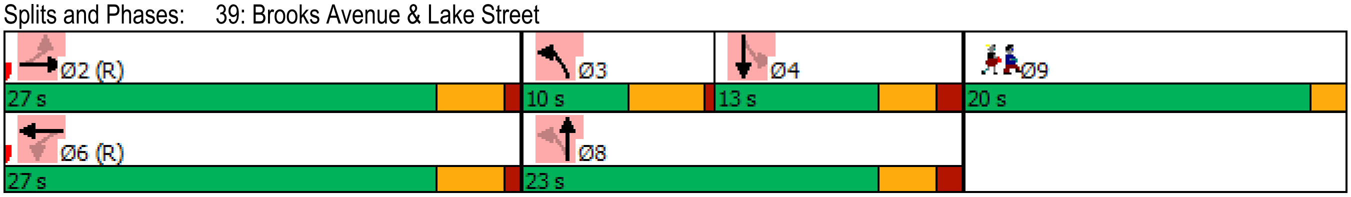
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	31	548	46	6	1006	0	38	4	5	3	7	121
Future Volume (vph)	31	548	46	6	1006	0	38	4	5	3	7	121
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	14	14	14	13	13	13	12	12	12	12	12	12
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		0.990						0.985			0.875	
Flt Protected		0.998						0.961			0.999	
Satd. Flow (prot)	0	1978	0	0	1944	0	0	1799	0	0	1661	0
Flt Permitted		0.919			0.997			0.487			0.993	
Satd. Flow (perm)	0	1821	0	0	1938	0	0	911	0	0	1651	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		6						7			155	
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		215			1126			206			208	
Travel Time (s)		4.9			25.6			4.7			4.7	
Peak Hour Factor	0.91	0.91	0.91	0.87	0.87	0.87	0.75	0.75	0.75	0.78	0.78	0.78
Heavy Vehicles (%)	0%	1%	5%	0%	1%	0%	0%	0%	0%	0%	0%	0%
Adj. Flow (vph)	34	602	51	7	1156	0	51	5	7	4	9	155
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	687	0	0	1163	0	0	63	0	0	168	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)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	0.92	0.92	0.92	0.96	0.96	0.96	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	Perm	NA		Perm	NA		pm+pt	NA		Perm	NA	
Protected Phases		2			6		3	8			4	
Permitted Phases	2			6			8			4		
Detector Phase	2	2		6	6		3	8		4	4	

Lane Group	Ø9
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Ideal Flow (vphpl)	
Lane Width (ft)	
Lane Util. Factor	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (mph)	
Link Distance (ft)	
Travel Time (s)	
Peak Hour Factor	
Heavy Vehicles (%)	
Adj. Flow (vph)	
Shared Lane Traffic (%)	
Lane Group Flow (vph)	
Enter Blocked Intersection	
Lane Alignment	
Median Width(ft)	
Link Offset(ft)	
Crosswalk Width(ft)	
Two way Left Turn Lane	
Headway Factor	
Turning Speed (mph)	
Number of Detectors	
Detector Template	
Leading Detector (ft)	
Trailing Detector (ft)	
Detector 1 Position(ft)	
Detector 1 Size(ft)	
Detector 1 Type	
Detector 1 Channel	
Detector 1 Extend (s)	
Detector 1 Queue (s)	
Detector 1 Delay (s)	
Detector 2 Position(ft)	
Detector 2 Size(ft)	
Detector 2 Type	
Detector 2 Channel	
Detector 2 Extend (s)	
Turn Type	
Protected Phases	9
Permitted Phases	
Detector Phase	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Switch Phase												
Minimum Initial (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Minimum Split (s)	20.5	20.5		20.5	20.5		8.5	14.0		13.0	13.0	
Total Split (s)	27.0	27.0		27.0	27.0		10.0	23.0		13.0	13.0	
Total Split (%)	38.6%	38.6%		38.6%	38.6%		14.3%	32.9%		18.6%	18.6%	
Maximum Green (s)	22.5	22.5		22.5	22.5		5.5	18.5		8.5	8.5	
Yellow Time (s)	3.5	3.5		3.5	3.5		4.0	3.0		3.0	3.0	
All-Red Time (s)	1.0	1.0		1.0	1.0		0.5	1.5		1.5	1.5	
Lost Time Adjust (s)		0.0			0.0			0.0			0.0	
Total Lost Time (s)		4.5			4.5			4.5			4.5	
Lead/Lag							Lead			Lag	Lag	
Lead-Lag Optimize?							Yes			Yes	Yes	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	C-Max	C-Max		C-Max	C-Max		None	Min		Min	Min	
Walk Time (s)												
Flash Dont Walk (s)												
Pedestrian Calls (#/hr)												
Act Effct Green (s)		40.9			40.9			9.3			9.3	
Actuated g/C Ratio		0.58			0.58			0.13			0.13	
v/c Ratio		0.64			1.03			0.50			0.48	
Control Delay		23.5			56.5			38.1			10.7	
Queue Delay		33.2			30.6			0.0			0.4	
Total Delay		56.7			87.1			38.1			11.2	
LOS		E			F			D			B	
Approach Delay		56.7			87.1			38.1			11.2	
Approach LOS		E			F			D			B	

Intersection Summary	
Area Type: Other	
Cycle Length: 70	
Actuated Cycle Length: 70	
Offset: 0 (0%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green, Master Intersection	
Natural Cycle: 110	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 1.03	
Intersection Signal Delay: 69.4	Intersection LOS: E
Intersection Capacity Utilization 77.5%	ICU Level of Service D
Analysis Period (min) 15	

Splits and Phases: 39: Brooks Avenue & Lake Street



Lane Group	Ø9
Switch Phase	
Minimum Initial (s)	4.0
Minimum Split (s)	18.0
Total Split (s)	20.0
Total Split (%)	29%
Maximum Green (s)	18.0
Yellow Time (s)	2.0
All-Red Time (s)	0.0
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	
Lead-Lag Optimize?	
Vehicle Extension (s)	3.0
Recall Mode	None
Walk Time (s)	5.0
Flash Dont Walk (s)	11.0
Pedestrian Calls (#/hr)	52
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	

Intersection Summary

Lane Group	EBT	WBT	NBT	SBT
Lane Group Flow (vph)	687	1163	63	168
v/c Ratio	0.64	1.03	0.50	0.48
Control Delay	23.5	56.5	38.1	10.7
Queue Delay	33.2	30.6	0.0	0.4
Total Delay	56.7	87.1	38.1	11.2
Queue Length 50th (ft)	249	~636	23	5
Queue Length 95th (ft)	#448	#879	44	35
Internal Link Dist (ft)	135	1046	126	128
Turn Bay Length (ft)				
Base Capacity (vph)	1066	1132	245	372
Starvation Cap Reductn	412	0	0	0
Spillback Cap Reductn	0	482	1	38
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	1.05	1.79	0.26	0.50

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

2027 Build Weekday Evening Peak Hour

Intersection	
Int Delay, s/veh	0.4

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	844	3	1	610	9	4
Future Vol, veh/h	844	3	1	610	9	4
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	83	83	94	94	75	75
Heavy Vehicles, %	0	0	0	0	29	0
Mvmt Flow	1017	4	1	649	12	5

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	1021	0	1670	1019
Stage 1	-	-	-	-	1019	-
Stage 2	-	-	-	-	651	-
Critical Hdwy	-	-	4.1	-	6.69	6.2
Critical Hdwy Stg 1	-	-	-	-	5.69	-
Critical Hdwy Stg 2	-	-	-	-	5.69	-
Follow-up Hdwy	-	-	2.2	-	3.761	3.3
Pot Cap-1 Maneuver	-	-	688	-	91	290
Stage 1	-	-	-	-	311	-
Stage 2	-	-	-	-	472	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	688	-	91	290
Mov Cap-2 Maneuver	-	-	-	-	91	-
Stage 1	-	-	-	-	311	-
Stage 2	-	-	-	-	471	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0	41.8
HCM LOS			E

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	115	-	-	688	-
HCM Lane V/C Ratio	0.151	-	-	0.002	-
HCM Control Delay (s)	41.8	-	-	10.2	0
HCM Lane LOS	E	-	-	B	A
HCM 95th %tile Q(veh)	0.5	-	-	0	-

Intersection						
Int Delay, s/veh	1.1					

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	842	6	9	588	23	5
Future Vol, veh/h	842	6	9	588	23	5
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	87	87	89	89	75	75
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	968	7	10	661	31	7

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	975	0	1653	972
Stage 1	-	-	-	-	972	-
Stage 2	-	-	-	-	681	-
Critical Hdwy	-	-	4.1	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	-	-	2.2	-	3.5	3.3
Pot Cap-1 Maneuver	-	-	716	-	109	309
Stage 1	-	-	-	-	370	-
Stage 2	-	-	-	-	506	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	716	-	107	309
Mov Cap-2 Maneuver	-	-	-	-	107	-
Stage 1	-	-	-	-	370	-
Stage 2	-	-	-	-	495	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.2	47.5
HCM LOS			E

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	121	-	-	716	-
HCM Lane V/C Ratio	0.309	-	-	0.014	-
HCM Control Delay (s)	47.5	-	-	10.1	0
HCM Lane LOS	E	-	-	B	A
HCM 95th %tile Q(veh)	1.2	-	-	0	-

Intersection	
Int Delay, s/veh	0.3

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	846	1	1	591	6	4
Future Vol, veh/h	846	1	1	591	6	4
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	87	87	89	89	75	75
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	972	1	1	664	8	5

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	973	0	1639	973
Stage 1	-	-	-	-	973	-
Stage 2	-	-	-	-	666	-
Critical Hdwy	-	-	4.1	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	-	-	2.2	-	3.5	3.3
Pot Cap-1 Maneuver	-	-	717	-	112	309
Stage 1	-	-	-	-	370	-
Stage 2	-	-	-	-	515	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	717	-	112	309
Mov Cap-2 Maneuver	-	-	-	-	112	-
Stage 1	-	-	-	-	370	-
Stage 2	-	-	-	-	514	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0	31.3
HCM LOS			D

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	150	-	-	717	-
HCM Lane V/C Ratio	0.089	-	-	0.002	-
HCM Control Delay (s)	31.3	-	-	10	0
HCM Lane LOS	D	-	-	B	A
HCM 95th %tile Q(veh)	0.3	-	-	0	-

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	4	827	19	11	578	8	13	1	6	3	0	1
Future Vol, veh/h	4	827	19	11	578	8	13	1	6	3	0	1
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	86	86	86	86	86	86	75	75	75	75	75	75
Heavy Vehicles, %	0	0	0	0	0	0	0	0	0	0	0	0
Mvmt Flow	5	962	22	13	672	9	17	1	8	4	0	1

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	681	0	0	984	0	0	1686	1690	973	1691	1697	677
Stage 1	-	-	-	-	-	-	983	983	-	703	703	-
Stage 2	-	-	-	-	-	-	703	707	-	988	994	-
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	921	-	-	710	-	-	75	94	309	75	93	456
Stage 1	-	-	-	-	-	-	302	329	-	431	443	-
Stage 2	-	-	-	-	-	-	431	441	-	300	326	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	921	-	-	710	-	-	72	90	309	70	89	456
Mov Cap-2 Maneuver	-	-	-	-	-	-	72	90	-	70	89	-
Stage 1	-	-	-	-	-	-	298	325	-	426	430	-
Stage 2	-	-	-	-	-	-	417	428	-	288	322	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0.2	57.1	48
HCM LOS			F	E

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	95	921	-	-	710	-	-	89
HCM Lane V/C Ratio	0.281	0.005	-	-	0.018	-	-	0.06
HCM Control Delay (s)	57.1	8.9	0	-	10.2	0	-	48
HCM Lane LOS	F	A	A	-	B	A	-	E
HCM 95th %tile Q(veh)	1	0	-	-	0.1	-	-	0.2

Intersection	
Int Delay, s/veh	10

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	19	800	17	67	577	16	9	0	48	9	0	11
Future Vol, veh/h	19	800	17	67	577	16	9	0	48	9	0	11
Conflicting Peds, #/hr	0	0	0	304	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	83	83	83	88	88	88	81	81	81	80	80	80
Heavy Vehicles, %	0	0	0	0	0	0	0	0	0	0	0	0
Mvmt Flow	23	964	20	76	656	18	11	0	59	11	0	14

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	674	0	0	1288	0	0	2148	2150	1278	1867	2151	665
Stage 1	-	-	-	-	-	-	1324	1324	-	817	817	-
Stage 2	-	-	-	-	-	-	824	826	-	1050	1334	-
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	927	-	-	545	-	-	35	49	205	56	49	464
Stage 1	-	-	-	-	-	-	194	227	-	373	393	-
Stage 2	-	-	-	-	-	-	370	389	-	277	225	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	927	-	-	407	-	-	19	24	153	25	24	464
Mov Cap-2 Maneuver	-	-	-	-	-	-	19	24	-	25	24	-
Stage 1	-	-	-	-	-	-	137	160	-	352	275	-
Stage 2	-	-	-	-	-	-	252	273	-	160	159	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.2	1.6	198.3	126.6
HCM LOS			F	F

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	72	927	-	-	407	-	-	52
HCM Lane V/C Ratio	0.977	0.025	-	-	0.187	-	-	0.481
HCM Control Delay (s)	198.3	9	0	-	15.9	0	-	126.6
HCM Lane LOS	F	A	A	-	C	A	-	F
HCM 95th %tile Q(veh)	5	0.1	-	-	0.7	-	-	1.8

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	8	5	20	20	15	0
Future Volume (Veh/h)	8	5	20	20	15	0
Sign Control		Stop	Stop		Free	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	9	5	22	22	16	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	65	32	32	0	0	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	65	32	32	0	0	
tC, single (s)	7.1	6.5	6.5	6.2	4.1	
tC, 2 stage (s)						
tF (s)	3.5	4.0	4.0	3.3	2.2	
p0 queue free %	99	99	97	98	99	
cM capacity (veh/h)	890	856	856	1091	1636	

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	14	44	16
Volume Left	9	0	16
Volume Right	0	22	0
cSH	878	959	1636
Volume to Capacity	0.02	0.05	0.01
Queue Length 95th (ft)	1	4	1
Control Delay (s)	9.2	8.9	7.2
Lane LOS	A	A	A
Approach Delay (s)	9.2	8.9	7.2
Approach LOS	A	A	

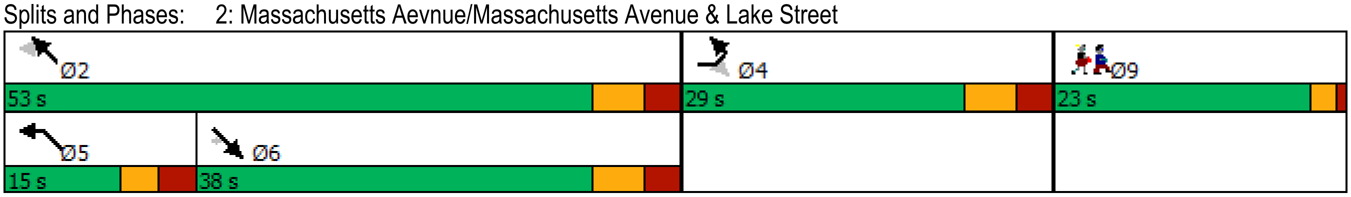
Intersection Summary			
Average Delay	8.6		
Intersection Capacity Utilization	17.4%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBR	SET	SER	NWL	NWT	Ø9
Lane Configurations							
Traffic Volume (vph)	432	280	658	192	352	739	
Future Volume (vph)	432	280	658	192	352	739	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	
Lane Width (ft)	16	16	11	10	11	12	
Storage Length (ft)	0	100		55	150		
Storage Lanes	1	1		1	1		
Taper Length (ft)	25				25		
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	1.00	
Frt		0.850		0.850			
Flt Protected	0.950				0.950		
Satd. Flow (prot)	2046	1830	3421	1507	1745	1863	
Flt Permitted	0.950				0.220		
Satd. Flow (perm)	2046	1830	3421	1507	404	1863	
Right Turn on Red		Yes		Yes			
Satd. Flow (RTOR)		140		87			
Link Speed (mph)	30		30			30	
Link Distance (ft)	1126		640			645	
Travel Time (s)	25.6		14.5			14.7	
Peak Hour Factor	0.88	0.88	0.92	0.92	0.92	0.92	
Heavy Vehicles (%)	0%	0%	2%	0%	0%	2%	
Adj. Flow (vph)	491	318	715	209	383	803	
Shared Lane Traffic (%)							
Lane Group Flow (vph)	491	318	715	209	383	803	
Enter Blocked Intersection	No	No	No	No	No	No	
Lane Alignment	Left	Right	Left	Right	Left	Left	
Median Width(ft)	16		11			11	
Link Offset(ft)	0		0			0	
Crosswalk Width(ft)	16		16			16	
Two way Left Turn Lane							
Headway Factor	0.85	0.85	1.04	1.09	1.04	1.00	
Turning Speed (mph)	15	9		9	15		
Number of Detectors	1	1	2	1	1	2	
Detector Template	Left	Right	Thru	Right	Left	Thru	
Leading Detector (ft)	20	20	100	20	20	100	
Trailing Detector (ft)	0	0	0	0	0	0	
Detector 1 Position(ft)	0	0	0	0	0	0	
Detector 1 Size(ft)	20	20	6	20	20	6	
Detector 1 Type	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	
Detector 1 Queue (s)	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	
Detector 2 Position(ft)			94			94	
Detector 2 Size(ft)			6			6	
Detector 2 Type			Cl+Ex			Cl+Ex	
Detector 2 Channel							
Detector 2 Extend (s)			0.0			0.0	
Turn Type	Prot	Perm	NA	Perm	pm+pt	NA	

Lane Group	EBL	EBR	SET	SER	NWL	NWT	Ø9
Protected Phases	4		6		5	2	9
Permitted Phases		4		6	2		
Detector Phase	4	4	6	6	5	2	
Switch Phase							
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	23.0	23.0	23.0	23.0	10.0	23.0	19.0
Total Split (s)	29.0	29.0	38.0	38.0	15.0	53.0	23.0
Total Split (%)	27.6%	27.6%	36.2%	36.2%	14.3%	50.5%	22%
Maximum Green (s)	22.0	22.0	31.0	31.0	9.0	46.0	20.0
Yellow Time (s)	4.0	4.0	4.0	4.0	3.0	4.0	2.0
All-Red Time (s)	3.0	3.0	3.0	3.0	3.0	3.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	7.0	7.0	7.0	7.0	6.0	7.0	
Lead/Lag			Lag	Lag	Lead		
Lead-Lag Optimize?			Yes	Yes	Yes		
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None	Max	Max	None	Max	None
Walk Time (s)							5.0
Flash Dont Walk (s)							11.0
Pedestrian Calls (#/hr)							35
Act Effct Green (s)	22.2	22.2	31.3	31.3	47.5	46.5	
Actuated g/C Ratio	0.24	0.24	0.34	0.34	0.51	0.50	
v/c Ratio	1.01	0.59	0.62	0.37	1.14	0.87	
Control Delay	81.8	23.6	30.4	17.2	116.1	34.8	
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	
Total Delay	81.8	23.6	30.4	17.2	116.1	34.8	
LOS	F	C	C	B	F	C	
Approach Delay	58.9		27.4			61.1	
Approach LOS	E		C			E	

Intersection Summary	
Area Type: Other	
Cycle Length: 105	
Actuated Cycle Length: 93.4	
Natural Cycle: 100	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 1.14	
Intersection Signal Delay: 49.8	Intersection LOS: D
Intersection Capacity Utilization 78.3%	ICU Level of Service D
Analysis Period (min) 15	

Splits and Phases: 2: Massachusetts Aevnue/Massachusetts Avenue & Lake Street



Lane Group	EBL	EBR	SET	SER	NWL	NWT
Lane Group Flow (vph)	491	318	715	209	383	803
v/c Ratio	1.01	0.59	0.62	0.37	1.14	0.87
Control Delay	81.8	23.6	30.4	17.2	116.1	34.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	81.8	23.6	30.4	17.2	116.1	34.8
Queue Length 50th (ft)	~362	102	211	59	~224	480
Queue Length 95th (ft)	#541	188	277	124	#433	#740
Internal Link Dist (ft)	1046		560			565
Turn Bay Length (ft)		100		55	150	
Base Capacity (vph)	486	542	1147	562	335	927
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	1.01	0.59	0.62	0.37	1.14	0.87

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

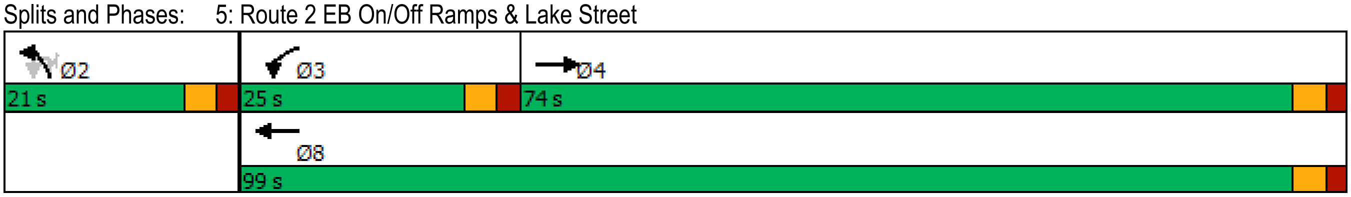
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Lane Group	EBT	EBR	WBL	WBT	NBU	NBL	NBR
Lane Configurations							
Traffic Volume (vph)	547	181	172	303	14	531	641
Future Volume (vph)	547	181	172	303	14	531	641
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	16	16	10	11	12	16	14
Storage Length (ft)		150	110			0	0
Storage Lanes		1	1			1	1
Taper Length (ft)			25			25	
Lane Util. Factor	1.00	1.00	1.00	0.95	1.00	1.00	1.00
Frt		0.850					0.850
Flt Protected			0.950			0.950	
Satd. Flow (prot)	2153	1664	1652	3490	0	2046	1723
Flt Permitted			0.950			0.950	
Satd. Flow (perm)	2153	1664	1652	3490	0	2046	1723
Right Turn on Red		Yes					Yes
Satd. Flow (RTOR)		70					448
Link Speed (mph)	30			30		30	
Link Distance (ft)	239			505		387	
Travel Time (s)	5.4			11.5		8.8	
Peak Hour Factor	0.94	0.94	0.87	0.87	0.96	0.96	0.96
Heavy Vehicles (%)	0%	10%	2%	0%	0%	0%	0%
Adj. Flow (vph)	582	193	198	348	15	553	668
Shared Lane Traffic (%)							
Lane Group Flow (vph)	582	193	198	348	0	568	668
Enter Blocked Intersection	No	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	R NA	Left	Right
Median Width(ft)	12			12		16	
Link Offset(ft)	0			0		0	
Crosswalk Width(ft)	16			16		16	
Two way Left Turn Lane							
Headway Factor	0.85	0.85	1.09	1.04	1.00	0.85	0.92
Turning Speed (mph)		9	15		9	15	9
Number of Detectors	2	1	1	2	1	1	1
Detector Template	Thru	Right	Left	Thru	Left	Left	Right
Leading Detector (ft)	100	20	20	100	20	20	20
Trailing Detector (ft)	0	0	0	0	0	0	0
Detector 1 Position(ft)	0	0	0	0	0	0	0
Detector 1 Size(ft)	6	20	20	6	20	20	20
Detector 1 Type	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
Detector 1 Queue (s)	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
Detector 2 Position(ft)	94			94			
Detector 2 Size(ft)	6			6			
Detector 2 Type	Cl+Ex			Cl+Ex			
Detector 2 Channel							
Detector 2 Extend (s)	0.0			0.0			
Turn Type	NA	Free	Prot	NA	Perm	Prot	Perm

Lane Group	EBT	EBR	WBL	WBT	NBU	NBL	NBR
Protected Phases	4		3	8		2	
Permitted Phases		Free			2		2
Detector Phase	4		3	8	2	2	2
Switch Phase							
Minimum Initial (s)	4.0		4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0		9.0	21.0	21.0	21.0	21.0
Total Split (s)	74.0		25.0	99.0	21.0	21.0	21.0
Total Split (%)	61.7%		20.8%	82.5%	17.5%	17.5%	17.5%
Maximum Green (s)	69.0		20.0	94.0	16.0	16.0	16.0
Yellow Time (s)	3.0		3.0	3.0	3.0	3.0	3.0
All-Red Time (s)	2.0		2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0		0.0	0.0		0.0	0.0
Total Lost Time (s)	5.0		5.0	5.0		5.0	5.0
Lead/Lag	Lag		Lead				
Lead-Lag Optimize?	Yes		Yes				
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0	3.0
Recall Mode	None		None	None	Max	Max	Max
Walk Time (s)	5.0			5.0	5.0	5.0	5.0
Flash Dont Walk (s)	11.0			11.0	11.0	11.0	11.0
Pedestrian Calls (#/hr)	0			0	0	0	0
Act Effct Green (s)	25.8	71.6	14.1	45.0		16.3	16.3
Actuated g/C Ratio	0.36	1.00	0.20	0.63		0.23	0.23
v/c Ratio	0.75	0.12	0.61	0.16		1.22	0.90
Control Delay	27.0	0.1	36.2	5.3		145.5	28.7
Queue Delay	0.0	0.0	0.0	0.0		0.0	0.0
Total Delay	27.0	0.1	36.2	5.3		145.5	28.7
LOS	C	A	D	A		F	C
Approach Delay	20.3			16.5		82.4	
Approach LOS	C			B		F	

Intersection Summary	
Area Type: Other	
Cycle Length: 120	
Actuated Cycle Length: 71.6	
Natural Cycle: 70	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 1.22	
Intersection Signal Delay: 49.5	Intersection LOS: D
Intersection Capacity Utilization 81.0%	ICU Level of Service D
Analysis Period (min) 15	

Splits and Phases: 5: Route 2 EB On/Off Ramps & Lake Street



Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Group Flow (vph)	582	193	198	348	568	668
v/c Ratio	0.75	0.12	0.61	0.16	1.22	0.90
Control Delay	27.0	0.1	36.2	5.3	145.5	28.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	27.0	0.1	36.2	5.3	145.5	28.7
Queue Length 50th (ft)	216	0	80	28	~316	93
Queue Length 95th (ft)	362	0	157	40	#635	#368
Internal Link Dist (ft)	159			425	307	
Turn Bay Length (ft)		150	110			
Base Capacity (vph)	1999	1664	471	3490	467	739
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	0.29	0.12	0.42	0.10	1.22	0.90

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

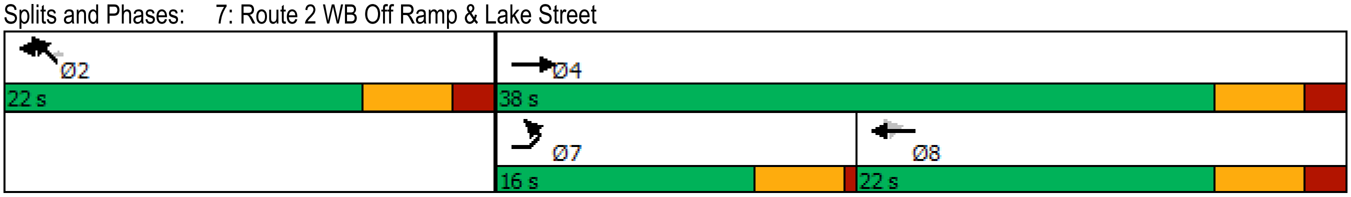
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Traffic Volume (vph)	368	820	0	0	267	352	0	0	0	208	22	27
Future Volume (vph)	368	820	0	0	267	352	0	0	0	208	22	27
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	11	10	12	12	12	11	12	16
Storage Length (ft)	250		0	0		75	0		0	100		0
Storage Lanes	1		0	0		1	0		0	1		1
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	0.95	0.95	1.00
Frt						0.850						0.850
Flt Protected	0.950									0.950	0.961	
Satd. Flow (prot)	1805	1881	0	0	1801	1463	0	0	0	1641	1705	1830
Flt Permitted	0.950									0.950	0.961	
Satd. Flow (perm)	1805	1881	0	0	1801	1463	0	0	0	1641	1705	1830
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)						387						136
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		505			380			459			529	
Travel Time (s)		11.5			8.6			10.4			12.0	
Peak Hour Factor	0.88	0.88	0.88	0.91	0.91	0.91	0.92	0.92	0.92	0.95	0.95	0.95
Heavy Vehicles (%)	0%	1%	0%	0%	2%	3%	0%	0%	0%	1%	5%	0%
Adj. Flow (vph)	418	932	0	0	293	387	0	0	0	219	23	28
Shared Lane Traffic (%)										45%		
Lane Group Flow (vph)	418	932	0	0	293	387	0	0	0	120	122	28
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			11			11	
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	1.04	1.09	1.00	1.00	1.00	1.04	1.00	0.85
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2			2	1				1	2	1
Detector Template	Left	Thru			Thru	Right				Left	Thru	Right
Leading Detector (ft)	20	100			100	20				20	100	20
Trailing Detector (ft)	0	0			0	0				0	0	0
Detector 1 Position(ft)	0	0			0	0				0	0	0
Detector 1 Size(ft)	20	6			6	20				20	6	20
Detector 1 Type	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
Detector 1 Queue (s)	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
Detector 2 Position(ft)		94			94						94	
Detector 2 Size(ft)		6			6						6	
Detector 2 Type		Cl+Ex			Cl+Ex						Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0						0.0	
Turn Type	Prot	NA			NA	Perm				Split	NA	Perm

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Protected Phases	7	4			8					2	2	
Permitted Phases						8						2
Detector Phase	7	4			8	8				2	2	2
Switch Phase												
Minimum Initial (s)	4.0	4.0			4.0	4.0				4.0	4.0	4.0
Minimum Split (s)	8.5	22.0			22.0	22.0				22.0	22.0	22.0
Total Split (s)	16.0	38.0			22.0	22.0				22.0	22.0	22.0
Total Split (%)	26.7%	63.3%			36.7%	36.7%				36.7%	36.7%	36.7%
Maximum Green (s)	11.5	32.0			16.0	16.0				16.0	16.0	16.0
Yellow Time (s)	4.0	4.0			4.0	4.0				4.0	4.0	4.0
All-Red Time (s)	0.5	2.0			2.0	2.0				2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0			0.0	0.0				0.0	0.0	0.0
Total Lost Time (s)	4.5	6.0			6.0	6.0				6.0	6.0	6.0
Lead/Lag	Lead				Lag	Lag						
Lead-Lag Optimize?	Yes				Yes	Yes						
Vehicle Extension (s)	3.0	3.0			3.0	3.0				3.0	3.0	3.0
Recall Mode	None	None			None	None				Max	Max	Max
Walk Time (s)		5.0			5.0	5.0				5.0	5.0	5.0
Flash Dont Walk (s)		11.0			11.0	11.0				11.0	11.0	11.0
Pedestrian Calls (#/hr)		0			0	0				0	0	0
Act Effct Green (s)	11.5	31.0			14.9	14.9				16.0	16.0	16.0
Actuated g/C Ratio	0.19	0.53			0.25	0.25				0.27	0.27	0.27
v/c Ratio	1.19	0.94			0.64	0.59				0.27	0.26	0.05
Control Delay	137.1	33.8			26.9	6.5				19.4	19.3	0.1
Queue Delay	0.0	0.0			0.0	0.0				0.0	0.0	0.0
Total Delay	137.1	33.8			26.9	6.5				19.4	19.3	0.1
LOS	F	C			C	A				B	B	A
Approach Delay		65.8			15.3						17.4	
Approach LOS		E			B						B	

Intersection Summary	
Area Type: Other	
Cycle Length: 60	
Actuated Cycle Length: 59	
Natural Cycle: 65	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 1.19	
Intersection Signal Delay: 45.2	Intersection LOS: D
Intersection Capacity Utilization 62.3%	ICU Level of Service B
Analysis Period (min) 15	

Splits and Phases: 7: Route 2 WB Off Ramp & Lake Street



Lane Group	EBL	EBT	WBT	WBR	NWL	NWT	NWR
Lane Group Flow (vph)	418	932	293	387	120	122	28
v/c Ratio	1.19	0.94	0.64	0.59	0.27	0.26	0.05
Control Delay	137.1	33.8	26.9	6.5	19.4	19.3	0.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	137.1	33.8	26.9	6.5	19.4	19.3	0.1
Queue Length 50th (ft)	~191	283	93	0	35	36	0
Queue Length 95th (ft)	#331	#514	163	57	75	76	0
Internal Link Dist (ft)		425	300			449	
Turn Bay Length (ft)	250			75	100		
Base Capacity (vph)	352	1022	489	678	445	462	595
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	1.19	0.91	0.60	0.57	0.27	0.26	0.05

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Lane Group	EBL	EBT	WBT	WBR	SWL	SWR	Ø3	Ø4
Lane Configurations								
Traffic Volume (vph)	0	0	2211	0	0	1131		
Future Volume (vph)	0	0	2211	0	0	1131		
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900		
Lane Width (ft)	13	13	13	13	13	13		
Lane Util. Factor	1.00	1.00	0.91	1.00	1.00	0.88		
Frt						0.850		
Flt Protected								
Satd. Flow (prot)	0	0	4776	0	0	2617		
Flt Permitted								
Satd. Flow (perm)	0	0	4776	0	0	2617		
Right Turn on Red				Yes		Yes		
Satd. Flow (RTOR)						1		
Link Speed (mph)		30	30		30			
Link Distance (ft)		201	192		296			
Travel Time (s)		4.6	4.4		6.7			
Peak Hour Factor	0.92	0.92	0.97	0.97	0.98	0.98		
Heavy Vehicles (%)	2%	2%	1%	0%	0%	1%		
Adj. Flow (vph)	0	0	2279	0	0	1154		
Shared Lane Traffic (%)								
Lane Group Flow (vph)	0	0	2279	0	0	1154		
Enter Blocked Intersection	No	No	No	No	No	No		
Lane Alignment	Left	Left	Left	Right	Left	Right		
Median Width(ft)		0	0		0			
Link Offset(ft)		0	0		0			
Crosswalk Width(ft)		16	16		16			
Two way Left Turn Lane								
Headway Factor	1.10	1.10	1.10	1.10	1.10	1.10		
Turning Speed (mph)	15			9	15	30		
Number of Detectors			2			1		
Detector Template			Thru			Right		
Leading Detector (ft)			100			20		
Trailing Detector (ft)			0			0		
Detector 1 Position(ft)			0			0		
Detector 1 Size(ft)			6			20		
Detector 1 Type			Cl+Ex			Cl+Ex		
Detector 1 Channel								
Detector 1 Extend (s)			0.0			0.0		
Detector 1 Queue (s)			0.0			0.0		
Detector 1 Delay (s)			0.0			0.0		
Detector 2 Position(ft)			94					
Detector 2 Size(ft)			6					
Detector 2 Type			Cl+Ex					
Detector 2 Channel								
Detector 2 Extend (s)			0.0					
Turn Type			NA			custom		
Protected Phases			2			3 4	3	4
Permitted Phases								
Detector Phase			2			3 4		

Lane Group	EBL	EBT	WBT	WBR	SWL	SWR	Ø3	Ø4
Switch Phase								
Minimum Initial (s)			10.0				10.0	10.0
Minimum Split (s)			15.0				19.0	15.0
Total Split (s)			58.0				36.0	26.0
Total Split (%)			48.3%				30%	22%
Maximum Green (s)			53.0				30.0	21.0
Yellow Time (s)			4.0				4.0	3.5
All-Red Time (s)			1.0				2.0	1.5
Lost Time Adjust (s)			0.0					
Total Lost Time (s)			5.0					
Lead/Lag							Lead	Lag
Lead-Lag Optimize?								
Vehicle Extension (s)			3.0				3.0	3.0
Recall Mode			C-Max				Max	Max
Walk Time (s)							5.0	
Flash Dont Walk (s)							8.0	
Pedestrian Calls (#/hr)							0	
Act Effct Green (s)			53.0			56.0		
Actuated g/C Ratio			0.44			0.47		
v/c Ratio			1.08			0.95		
Control Delay			47.1			46.7		
Queue Delay			1.5			0.0		
Total Delay			48.7			46.7		
LOS			D			D		
Approach Delay			48.7		46.7			
Approach LOS			D		D			

Intersection Summary

Area Type: CBD

Cycle Length: 120

Actuated Cycle Length: 120

Offset: 16 (13%), Referenced to phase 2:WBT, Start of Green

Natural Cycle: 140

Control Type: Actuated-Coordinated

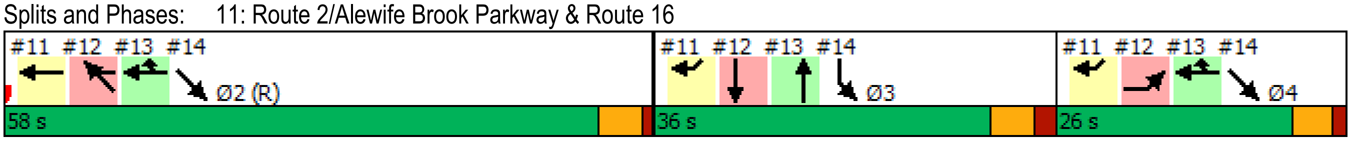
Maximum v/c Ratio: 1.19

Intersection Signal Delay: 48.0 Intersection LOS: D

Intersection Capacity Utilization 100.6% ICU Level of Service G

Analysis Period (min) 15

Splits and Phases: 11: Route 2/Alewife Brook Parkway & Route 16



Lane Group	WBT	SWR
Lane Group Flow (vph)	2279	1154
v/c Ratio	1.08	0.95
Control Delay	47.1	46.7
Queue Delay	1.5	0.0
Total Delay	48.7	46.7
Queue Length 50th (ft)	~704	472
Queue Length 95th (ft)	m#56	#644
Internal Link Dist (ft)	112	
Turn Bay Length (ft)		
Base Capacity (vph)	2109	1221
Starvation Cap Reductn	7	0
Spillback Cap Reductn	0	0
Storage Cap Reductn	0	0
Reduced v/c Ratio	1.08	0.95

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

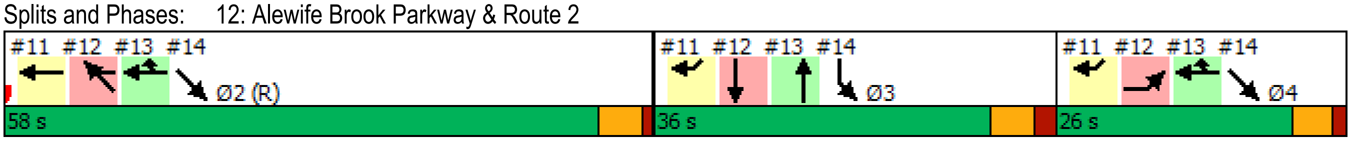
Lane Group	EBL	WBR	SBT	NWT
Lane Configurations				
Traffic Volume (vph)	610	591	250	1620
Future Volume (vph)	610	591	250	1620
Ideal Flow (vphpl)	1900	1900	1900	1900
Lane Width (ft)	13	16	13	13
Lane Util. Factor	0.97	1.00	0.95	0.95
Frt		0.865		
Flt Protected	0.950			
Satd. Flow (prot)	3257	1660	3291	3324
Flt Permitted	0.950			
Satd. Flow (perm)	3257	1660	3291	3324
Right Turn on Red				
Satd. Flow (RTOR)				
Link Speed (mph)			30	30
Link Distance (ft)			202	278
Travel Time (s)			4.6	6.3
Peak Hour Factor	0.90	0.95	0.98	0.97
Heavy Vehicles (%)	0%	1%	2%	1%
Adj. Flow (vph)	678	622	255	1670
Shared Lane Traffic (%)				
Lane Group Flow (vph)	678	622	255	1670
Enter Blocked Intersection	No	No	No	No
Lane Alignment	Left	R NA	Left	L NA
Median Width(ft)			0	0
Link Offset(ft)			0	0
Crosswalk Width(ft)			16	16
Two way Left Turn Lane				
Headway Factor	1.10	0.97	1.10	1.10
Turning Speed (mph)	15	30		
Number of Detectors	1	1	2	2
Detector Template	Left	Right	Thru	Thru
Leading Detector (ft)	20	20	100	100
Trailing Detector (ft)	0	0	0	0
Detector 1 Position(ft)	0	0	0	0
Detector 1 Size(ft)	20	20	6	6
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel				
Detector 1 Extend (s)	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0
Detector 2 Position(ft)			94	94
Detector 2 Size(ft)			6	6
Detector 2 Type			Cl+Ex	Cl+Ex
Detector 2 Channel				
Detector 2 Extend (s)			0.0	0.0
Turn Type	Prot	Prot	NA	NA
Protected Phases	4	2!	3	2!
Permitted Phases				
Detector Phase	4	2	3	2

Lane Group	EBL	WBR	SBT	NWT
Switch Phase				
Minimum Initial (s)	10.0	10.0	10.0	10.0
Minimum Split (s)	15.0	15.0	19.0	15.0
Total Split (s)	26.0	58.0	36.0	58.0
Total Split (%)	21.7%	48.3%	30.0%	48.3%
Maximum Green (s)	21.0	53.0	30.0	53.0
Yellow Time (s)	3.5	4.0	4.0	4.0
All-Red Time (s)	1.5	1.0	2.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	6.0	5.0
Lead/Lag	Lag		Lead	
Lead-Lag Optimize?				
Vehicle Extension (s)	3.0	3.0	3.0	3.0
Recall Mode	Max	C-Max	Max	C-Max
Walk Time (s)			5.0	
Flash Dont Walk (s)			8.0	
Pedestrian Calls (#/hr)			0	
Act Effct Green (s)	21.0	53.0	30.0	53.0
Actuated g/C Ratio	0.18	0.44	0.25	0.44
v/c Ratio	1.19	0.85	0.31	1.14
Control Delay	145.7	29.8	37.8	103.1
Queue Delay	0.0	3.3	0.0	0.3
Total Delay	145.7	33.1	37.8	103.3
LOS	F	C	D	F
Approach Delay			37.8	103.3
Approach LOS			D	F

Intersection Summary	
Area Type: CBD	
Cycle Length: 120	
Actuated Cycle Length: 120	
Offset: 16 (13%), Referenced to phase 2:WBT, Start of Green	
Natural Cycle: 140	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 1.19	
Intersection Signal Delay: 93.5	Intersection LOS: F
Intersection Capacity Utilization 134.8%	ICU Level of Service H
Analysis Period (min) 15	

! Phase conflict between lane groups.

Splits and Phases: 12: Alewife Brook Parkway & Route 2



Lane Group	EBL	WBR	SBT	NWT
Lane Group Flow (vph)	678	622	255	1670
v/c Ratio	1.19	0.85	0.31	1.14
Control Delay	145.7	29.8	37.8	103.1
Queue Delay	0.0	3.3	0.0	0.3
Total Delay	145.7	33.1	37.8	103.3
Queue Length 50th (ft)	~326	422	84	~794
Queue Length 95th (ft)	#446	#639	123	#933
Internal Link Dist (ft)			122	198
Turn Bay Length (ft)				
Base Capacity (vph)	569	733	822	1468
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	53	0	107
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	1.19	0.91	0.31	1.23

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

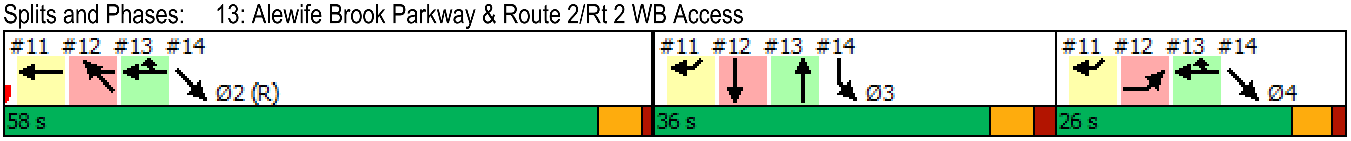
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	0	591	328	0	238	0	0	0	0
Future Volume (vph)	0	0	0	0	591	328	0	238	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		200	0		0	0		0
Storage Lanes	0		0	0		1	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	0.95	1.00	1.00	1.00	1.00
Ped Bike Factor												
Frt						0.850						
Flt Protected												
Satd. Flow (prot)	0	0	0	0	1693	1439	0	3217	0	0	0	0
Flt Permitted												
Satd. Flow (perm)	0	0	0	0	1693	1439	0	3217	0	0	0	0
Right Turn on Red			No			No	No		No			No
Satd. Flow (RTOR)												
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		161			1225			227			185	
Travel Time (s)		3.7			27.8			5.2			4.2	
Confl. Peds. (#/hr)						2						
Peak Hour Factor	0.92	0.92	0.92	0.95	0.95	0.95	0.97	0.97	0.97	0.92	0.92	0.92
Heavy Vehicles (%)	2%	2%	2%	0%	1%	1%	0%	1%	0%	2%	2%	2%
Adj. Flow (vph)	0	0	0	0	622	345	0	245	0	0	0	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	0	0	0	622	345	0	245	0	0	0	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)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors					2	1		2				
Detector Template					Thru	Right		Thru				
Leading Detector (ft)					100	20		100				
Trailing Detector (ft)					0	0		0				
Detector 1 Position(ft)					0	0		0				
Detector 1 Size(ft)					6	20		6				
Detector 1 Type					Cl+Ex	Cl+Ex		Cl+Ex				
Detector 1 Channel												
Detector 1 Extend (s)					0.0	0.0		0.0				
Detector 1 Queue (s)					0.0	0.0		0.0				
Detector 1 Delay (s)					0.0	0.0		0.0				
Detector 2 Position(ft)					94			94				
Detector 2 Size(ft)					6			6				
Detector 2 Type					Cl+Ex			Cl+Ex				
Detector 2 Channel												
Detector 2 Extend (s)					0.0			0.0				

Lane Group	Ø2	Ø4
Lane Configurations		
Traffic Volume (vph)		
Future Volume (vph)		
Ideal Flow (vphpl)		
Storage Length (ft)		
Storage Lanes		
Taper Length (ft)		
Lane Util. Factor		
Ped Bike Factor		
Frt		
Flt Protected		
Satd. Flow (prot)		
Flt Permitted		
Satd. Flow (perm)		
Right Turn on Red		
Satd. Flow (RTOR)		
Link Speed (mph)		
Link Distance (ft)		
Travel Time (s)		
Confl. Peds. (#/hr)		
Peak Hour Factor		
Heavy Vehicles (%)		
Adj. Flow (vph)		
Shared Lane Traffic (%)		
Lane Group Flow (vph)		
Enter Blocked Intersection		
Lane Alignment		
Median Width(ft)		
Link Offset(ft)		
Crosswalk Width(ft)		
Two way Left Turn Lane		
Headway Factor		
Turning Speed (mph)		
Number of Detectors		
Detector Template		
Leading Detector (ft)		
Trailing Detector (ft)		
Detector 1 Position(ft)		
Detector 1 Size(ft)		
Detector 1 Type		
Detector 1 Channel		
Detector 1 Extend (s)		
Detector 1 Queue (s)		
Detector 1 Delay (s)		
Detector 2 Position(ft)		
Detector 2 Size(ft)		
Detector 2 Type		
Detector 2 Channel		
Detector 2 Extend (s)		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Turn Type					NA	Prot		NA				
Protected Phases					2 4	2 4		3				
Permitted Phases												
Detector Phase					2 4	2 4		3				
Switch Phase												
Minimum Initial (s)								10.0				
Minimum Split (s)								19.0				
Total Split (s)								36.0				
Total Split (%)								30.0%				
Maximum Green (s)								30.0				
Yellow Time (s)								4.0				
All-Red Time (s)								2.0				
Lost Time Adjust (s)								0.0				
Total Lost Time (s)								6.0				
Lead/Lag								Lead				
Lead-Lag Optimize?												
Vehicle Extension (s)								3.0				
Recall Mode								Max				
Walk Time (s)								5.0				
Flash Dont Walk (s)								8.0				
Pedestrian Calls (#/hr)								0				
Act Effct Green (s)					79.0	79.0		30.0				
Actuated g/C Ratio					0.66	0.66		0.25				
v/c Ratio					0.56	0.36		0.30				
Control Delay					13.5	10.5		37.8				
Queue Delay					2.1	0.0		0.0				
Total Delay					15.6	10.5		37.8				
LOS					B	B		D				
Approach Delay					13.8			37.8				
Approach LOS					B			D				

Intersection Summary	
Area Type: CBD	
Cycle Length: 120	
Actuated Cycle Length: 120	
Offset: 16 (13%), Referenced to phase 2:WBT, Start of Green	
Natural Cycle: 140	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 1.19	
Intersection Signal Delay: 18.6	Intersection LOS: B
Intersection Capacity Utilization 52.1%	ICU Level of Service A
Analysis Period (min) 15	

Splits and Phases: 13: Alewife Brook Parkway & Route 2/Rt 2 WB Access



Lane Group	Ø2	Ø4
Turn Type		
Protected Phases	2	4
Permitted Phases		
Detector Phase		
Switch Phase		
Minimum Initial (s)	10.0	10.0
Minimum Split (s)	15.0	15.0
Total Split (s)	58.0	26.0
Total Split (%)	48%	22%
Maximum Green (s)	53.0	21.0
Yellow Time (s)	4.0	3.5
All-Red Time (s)	1.0	1.5
Lost Time Adjust (s)		
Total Lost Time (s)		
Lead/Lag		Lag
Lead-Lag Optimize?		
Vehicle Extension (s)	3.0	3.0
Recall Mode	C-Max	Max
Walk Time (s)		
Flash Dont Walk (s)		
Pedestrian Calls (#/hr)		
Act Effct Green (s)		
Actuated g/C Ratio		
v/c Ratio		
Control Delay		
Queue Delay		
Total Delay		
LOS		
Approach Delay		
Approach LOS		

Intersection Summary

Lane Group	WBT	WBR	NBT
Lane Group Flow (vph)	622	345	245
v/c Ratio	0.56	0.36	0.30
Control Delay	13.5	10.5	37.8
Queue Delay	2.1	0.0	0.0
Total Delay	15.6	10.5	37.8
Queue Length 50th (ft)	239	110	81
Queue Length 95th (ft)	337	165	119
Internal Link Dist (ft)	1145		147
Turn Bay Length (ft)		200	
Base Capacity (vph)	1114	947	804
Starvation Cap Reductn	0	0	0
Spillback Cap Reductn	337	0	0
Storage Cap Reductn	0	0	0
Reduced v/c Ratio	0.80	0.36	0.30

Intersection Summary

Lane Group	SBL	SBR	SEL	SET	NWT	NWR	Ø2	Ø4
Lane Configurations								
Traffic Volume (vph)	250	0	0	988	0	0		
Future Volume (vph)	250	0	0	988	0	0		
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900		
Lane Width (ft)	13	13	13	13	13	13		
Lane Util. Factor	0.97	1.00	1.00	0.95	1.00	1.00		
Frt								
Flt Protected	0.950							
Satd. Flow (prot)	3193	0	0	3324	0	0		
Flt Permitted	0.950							
Satd. Flow (perm)	3193	0	0	3324	0	0		
Right Turn on Red	Yes	Yes				Yes		
Satd. Flow (RTOR)	234							
Link Speed (mph)	30			30	30			
Link Distance (ft)	155			297	139			
Travel Time (s)	3.5			6.8	3.2			
Peak Hour Factor	0.98	0.98	0.90	0.90	0.92	0.92		
Heavy Vehicles (%)	2%	0%	0%	1%	2%	2%		
Adj. Flow (vph)	255	0	0	1098	0	0		
Shared Lane Traffic (%)								
Lane Group Flow (vph)	255	0	0	1098	0	0		
Enter Blocked Intersection	No	No	No	No	No	No		
Lane Alignment	Left	Right	Left	Left	Left	Right		
Median Width(ft)	26			0	0			
Link Offset(ft)	0			0	0			
Crosswalk Width(ft)	16			16	16			
Two way Left Turn Lane								
Headway Factor	1.10	1.10	1.10	1.10	1.10	1.10		
Turning Speed (mph)	30	9	15			9		
Number of Detectors	1			2				
Detector Template	Left			Thru				
Leading Detector (ft)	20			100				
Trailing Detector (ft)	0			0				
Detector 1 Position(ft)	0			0				
Detector 1 Size(ft)	20			6				
Detector 1 Type	Cl+Ex			Cl+Ex				
Detector 1 Channel								
Detector 1 Extend (s)	0.0			0.0				
Detector 1 Queue (s)	0.0			0.0				
Detector 1 Delay (s)	0.0			0.0				
Detector 2 Position(ft)				94				
Detector 2 Size(ft)				6				
Detector 2 Type				Cl+Ex				
Detector 2 Channel								
Detector 2 Extend (s)				0.0				
Turn Type	Prot			NA				
Protected Phases	3			2 4			2	4
Permitted Phases								
Detector Phase	3			2 4				

Lane Group	SBL	SBR	SEL	SET	NWT	NWR	Ø2	Ø4
Switch Phase								
Minimum Initial (s)	10.0						10.0	10.0
Minimum Split (s)	19.0						15.0	15.0
Total Split (s)	36.0						58.0	26.0
Total Split (%)	30.0%						48%	22%
Maximum Green (s)	30.0						53.0	21.0
Yellow Time (s)	4.0						4.0	3.5
All-Red Time (s)	2.0						1.0	1.5
Lost Time Adjust (s)	0.0							
Total Lost Time (s)	6.0							
Lead/Lag	Lead							Lag
Lead-Lag Optimize?								
Vehicle Extension (s)	3.0						3.0	3.0
Recall Mode	Max						C-Max	Max
Walk Time (s)	5.0							
Flash Dont Walk (s)	8.0							
Pedestrian Calls (#/hr)	0							
Act Effct Green (s)	30.0			79.0				
Actuated g/C Ratio	0.25			0.66				
v/c Ratio	0.26			0.50				
Control Delay	0.8			11.4				
Queue Delay	0.5			0.0				
Total Delay	1.3			11.4				
LOS	A			B				
Approach Delay	1.3			11.4				
Approach LOS	A			B				

Intersection Summary

Area Type: CBD

Cycle Length: 120

Actuated Cycle Length: 120

Offset: 16 (13%), Referenced to phase 2:WBT, Start of Green

Natural Cycle: 140

Control Type: Actuated-Coordinated

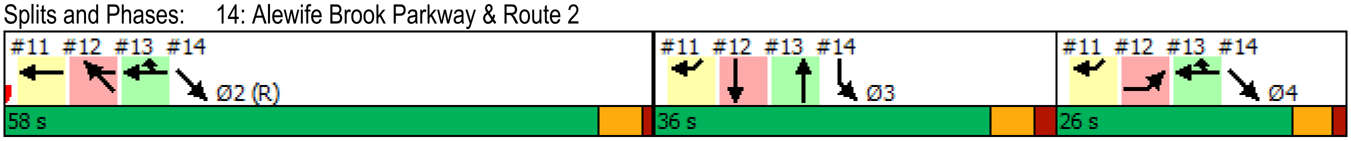
Maximum v/c Ratio: 1.19

Intersection Signal Delay: 9.5 Intersection LOS: A

Intersection Capacity Utilization 47.8% ICU Level of Service A

Analysis Period (min) 15

Splits and Phases: 14: Alewife Brook Parkway & Route 2



Lane Group	SBL	SET
Lane Group Flow (vph)	255	1098
v/c Ratio	0.26	0.50
Control Delay	0.8	11.4
Queue Delay	0.5	0.0
Total Delay	1.3	11.4
Queue Length 50th (ft)	0	210
Queue Length 95th (ft)	1	258
Internal Link Dist (ft)	75	217
Turn Bay Length (ft)		
Base Capacity (vph)	973	2188
Starvation Cap Reductn	391	0
Spillback Cap Reductn	0	0
Storage Cap Reductn	0	0
Reduced v/c Ratio	0.44	0.50

Intersection Summary

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	857	0	0	660	0	0	0	0	0	0	0
Future Volume (vph)	0	857	0	0	660	0	0	0	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	15	15	15	16	16	16	12	12	12	12	12	12
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												
Flt Protected												
Satd. Flow (prot)	0	2049	0	0	2153	0	0	0	0	0	0	0
Flt Permitted												
Satd. Flow (perm)	0	2049	0	0	2153	0	0	0	0	0	0	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)												
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		135			215			175			206	
Travel Time (s)		3.1			4.9			4.0			4.7	
Peak Hour Factor	0.84	0.84	0.84	0.97	0.97	0.97	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	2%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Adj. Flow (vph)	0	1020	0	0	680	0	0	0	0	0	0	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	1020	0	0	680	0	0	0	0	0	0	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)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	0.88	0.88	0.88	0.85	0.85	0.85	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		2			2							
Detector Template		Thru			Thru							
Leading Detector (ft)		100			100							
Trailing Detector (ft)		0			0							
Detector 1 Position(ft)		0			0							
Detector 1 Size(ft)		6			6							
Detector 1 Type		Cl+Ex			Cl+Ex							
Detector 1 Channel												
Detector 1 Extend (s)		0.0			0.0							
Detector 1 Queue (s)		0.0			0.0							
Detector 1 Delay (s)		0.0			0.0							
Detector 2 Position(ft)		94			94							
Detector 2 Size(ft)		6			6							
Detector 2 Type		Cl+Ex			Cl+Ex							
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0							
Turn Type		NA			NA							
Protected Phases		2			6							
Permitted Phases												
Detector Phase		2			6							

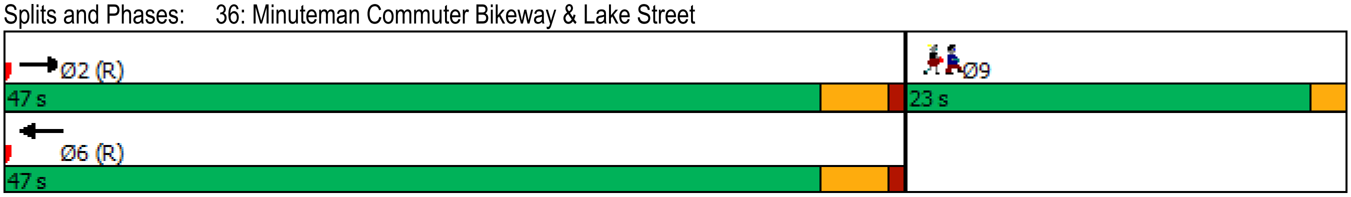
Lane Group	Ø9
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Ideal Flow (vphpl)	
Lane Width (ft)	
Lane Util. Factor	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (mph)	
Link Distance (ft)	
Travel Time (s)	
Peak Hour Factor	
Heavy Vehicles (%)	
Adj. Flow (vph)	
Shared Lane Traffic (%)	
Lane Group Flow (vph)	
Enter Blocked Intersection	
Lane Alignment	
Median Width(ft)	
Link Offset(ft)	
Crosswalk Width(ft)	
Two way Left Turn Lane	
Headway Factor	
Turning Speed (mph)	
Number of Detectors	
Detector Template	
Leading Detector (ft)	
Trailing Detector (ft)	
Detector 1 Position(ft)	
Detector 1 Size(ft)	
Detector 1 Type	
Detector 1 Channel	
Detector 1 Extend (s)	
Detector 1 Queue (s)	
Detector 1 Delay (s)	
Detector 2 Position(ft)	
Detector 2 Size(ft)	
Detector 2 Type	
Detector 2 Channel	
Detector 2 Extend (s)	
Turn Type	
Protected Phases	9
Permitted Phases	
Detector Phase	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Switch Phase												
Minimum Initial (s)		4.0			4.0							
Minimum Split (s)		20.5			20.5							
Total Split (s)		47.0			47.0							
Total Split (%)		67.1%			67.1%							
Maximum Green (s)		42.5			42.5							
Yellow Time (s)		3.5			3.5							
All-Red Time (s)		1.0			1.0							
Lost Time Adjust (s)		0.0			0.0							
Total Lost Time (s)		4.5			4.5							
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)		3.0			3.0							
Recall Mode		C-Max			C-Max							
Walk Time (s)												
Flash Dont Walk (s)												
Pedestrian Calls (#/hr)												
Act Effct Green (s)		47.5			47.5							
Actuated g/C Ratio		0.68			0.68							
v/c Ratio		0.73			0.47							
Control Delay		11.3			6.9							
Queue Delay		50.6			1.8							
Total Delay		61.8			8.6							
LOS		E			A							
Approach Delay		61.8			8.6							
Approach LOS		E			A							

Intersection Summary

Area Type: Other
Cycle Length: 70
Actuated Cycle Length: 70
Offset: 16 (23%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 60
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.73
Intersection Signal Delay: 40.6 Intersection LOS: D
Intersection Capacity Utilization 48.9% ICU Level of Service A
Analysis Period (min) 15

Splits and Phases: 36: Minuteman Commuter Bikeway & Lake Street



Lane Group	Ø9
Switch Phase	
Minimum Initial (s)	4.0
Minimum Split (s)	18.0
Total Split (s)	23.0
Total Split (%)	33%
Maximum Green (s)	21.0
Yellow Time (s)	2.0
All-Red Time (s)	0.0
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	
Lead-Lag Optimize?	
Vehicle Extension (s)	3.0
Recall Mode	None
Walk Time (s)	5.0
Flash Dont Walk (s)	11.0
Pedestrian Calls (#/hr)	220
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	

Intersection Summary

Lane Group	EBT	WBT
Lane Group Flow (vph)	1020	680
v/c Ratio	0.73	0.47
Control Delay	11.3	6.9
Queue Delay	50.6	1.8
Total Delay	61.8	8.6
Queue Length 50th (ft)	233	230
Queue Length 95th (ft)	316	168
Internal Link Dist (ft)	55	135
Turn Bay Length (ft)		
Base Capacity (vph)	1390	1460
Starvation Cap Reductn	0	585
Spillback Cap Reductn	609	0
Storage Cap Reductn	0	0
Reduced v/c Ratio	1.31	0.78

Intersection Summary

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	82	705	70	6	537	1	15	5	7	0	5	108
Future Volume (vph)	82	705	70	6	537	1	15	5	7	0	5	108
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	14	14	14	13	13	13	12	12	12	12	12	12
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		0.989						0.966			0.871	
Flt Protected		0.995			0.999			0.973				
Satd. Flow (prot)	0	1994	0	0	1961	0	0	1786	0	0	1655	0
Flt Permitted		0.893			0.991			0.635				
Satd. Flow (perm)	0	1790	0	0	1946	0	0	1165	0	0	1655	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		8						9			140	
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		215			1126			206			208	
Travel Time (s)		4.9			25.6			4.7			4.7	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.75	0.75	0.75	0.77	0.77	0.77
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Adj. Flow (vph)	93	801	80	7	610	1	20	7	9	0	6	140
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	974	0	0	618	0	0	36	0	0	146	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)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	0.92	0.92	0.92	0.96	0.96	0.96	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	Perm	NA		Perm	NA		Perm	NA			NA	
Protected Phases		2			6			8			4	
Permitted Phases	2			6			8			4		
Detector Phase	2	2		6	6		8	8		4	4	

Lane Group	Ø9
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Ideal Flow (vphpl)	
Lane Width (ft)	
Lane Util. Factor	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (mph)	
Link Distance (ft)	
Travel Time (s)	
Peak Hour Factor	
Heavy Vehicles (%)	
Adj. Flow (vph)	
Shared Lane Traffic (%)	
Lane Group Flow (vph)	
Enter Blocked Intersection	
Lane Alignment	
Median Width(ft)	
Link Offset(ft)	
Crosswalk Width(ft)	
Two way Left Turn Lane	
Headway Factor	
Turning Speed (mph)	
Number of Detectors	
Detector Template	
Leading Detector (ft)	
Trailing Detector (ft)	
Detector 1 Position(ft)	
Detector 1 Size(ft)	
Detector 1 Type	
Detector 1 Channel	
Detector 1 Extend (s)	
Detector 1 Queue (s)	
Detector 1 Delay (s)	
Detector 2 Position(ft)	
Detector 2 Size(ft)	
Detector 2 Type	
Detector 2 Channel	
Detector 2 Extend (s)	
Turn Type	
Protected Phases	9
Permitted Phases	
Detector Phase	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Switch Phase												
Minimum Initial (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Minimum Split (s)	20.5	20.5		20.5	20.5		14.0	14.0		14.0	14.0	
Total Split (s)	36.0	36.0		36.0	36.0		14.0	14.0		14.0	14.0	
Total Split (%)	51.4%	51.4%		51.4%	51.4%		20.0%	20.0%		20.0%	20.0%	
Maximum Green (s)	31.5	31.5		31.5	31.5		9.5	9.5		9.5	9.5	
Yellow Time (s)	3.5	3.5		3.5	3.5		3.0	3.0		3.0	3.0	
All-Red Time (s)	1.0	1.0		1.0	1.0		1.5	1.5		1.5	1.5	
Lost Time Adjust (s)		0.0			0.0			0.0			0.0	
Total Lost Time (s)		4.5			4.5			4.5			4.5	
Lead/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	C-Max	C-Max		C-Max	C-Max		Min	Min		Min	Min	
Walk Time (s)												
Flash Dont Walk (s)												
Pedestrian Calls (#/hr)												
Act Effct Green (s)		43.2			43.2			7.0			7.0	
Actuated g/C Ratio		0.62			0.62			0.10			0.10	
v/c Ratio		0.88			0.52			0.29			0.50	
Control Delay		26.9			12.3			29.2			12.8	
Queue Delay		47.7			0.6			0.0			0.2	
Total Delay		74.6			12.9			29.2			13.0	
LOS		E			B			C			B	
Approach Delay		74.6			12.9			29.2			13.0	
Approach LOS		E			B			C			B	

Intersection Summary

Area Type: Other

Cycle Length: 70

Actuated Cycle Length: 70

Offset: 0 (0%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green, Master Intersection

Natural Cycle: 90

Control Type: Actuated-Coordinated

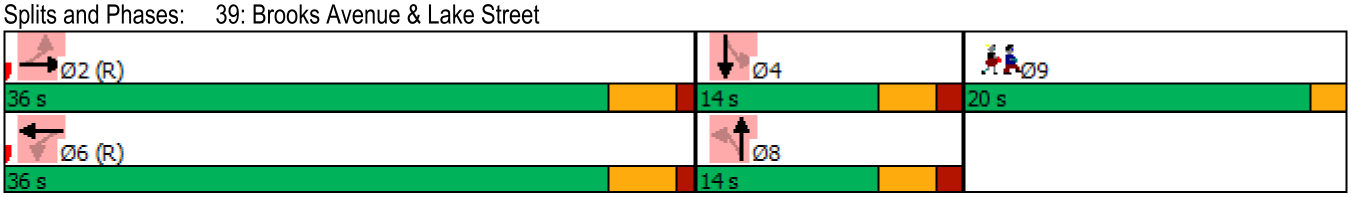
Maximum v/c Ratio: 0.88

Intersection Signal Delay: 47.1 — Intersection LOS: D

Intersection Capacity Utilization 94.0% — ICU Level of Service F

Analysis Period (min) 15

Splits and Phases: 39: Brooks Avenue & Lake Street



Lane Group	Ø9
Switch Phase	
Minimum Initial (s)	4.0
Minimum Split (s)	18.0
Total Split (s)	20.0
Total Split (%)	29%
Maximum Green (s)	18.0
Yellow Time (s)	2.0
All-Red Time (s)	0.0
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	
Lead-Lag Optimize?	
Vehicle Extension (s)	3.0
Recall Mode	None
Walk Time (s)	5.0
Flash Dont Walk (s)	11.0
Pedestrian Calls (#/hr)	42
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	

Intersection Summary

Lane Group	EBT	WBT	NBT	SBT
Lane Group Flow (vph)	974	618	36	146
v/c Ratio	0.88	0.52	0.29	0.50
Control Delay	26.9	12.3	29.2	12.8
Queue Delay	47.7	0.6	0.0	0.2
Total Delay	74.6	12.9	29.2	13.0
Queue Length 50th (ft)	~281	174	11	2
Queue Length 95th (ft)	#678	289	29	33
Internal Link Dist (ft)	135	1046	126	128
Turn Bay Length (ft)				
Base Capacity (vph)	1107	1200	165	345
Starvation Cap Reductn	247	0	0	0
Spillback Cap Reductn	0	254	0	18
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	1.13	0.65	0.22	0.45

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Vanasse & Associates inc
Transportation Engineers & Planners

35 New England Business Center Drive
Suite 140
Andover, MA 01810

Ref: 8451

January 15, 2021

Ms. Jennifer Raitt
Director of Planning and Community Development
Town of Arlington
730 Massachusetts Avenue Annex
Arlington, MA 02476

Re: Responses to Peer Review Comments
Thorndike Place Traffic Impact Assessment
Proposed 176-Unit Residential Development
Arlington, Massachusetts

Dear Ms. Raitt:

Vanasse & Associates, Inc. (VAI) is pleased to submit responses to the December 1, 2020 letter from BETA GROUP, Inc. (BETA) the Town of Arlington's Peer Review consultant. For ease of review, we have listed the comments followed by our responses. Please note there are several comments related to site design that will be responded to under separate cover by the Project's civil engineer, BSC Group.

BETA Peer Review Letter – December 1, 2020

SITE ACCESS, CIRCULATION, AND PARKING

Comment Nos. 1-9: ***"T1. Include dimensioning of parking stalls and drive aisles for the parking garage.***

T2. Identify snow storage areas and verify that snow storage will not reduce parking capacity.

T3. Clarify whether visitor parking spaces will be designated, and the suggested number of visitor spaces and resident spaces.

T4. Long term, presumed tenant, bicycle parking is designated within the garage. Recommend designating exterior bike racks for visitor/short term use near a location of public building access, such as within the proposed parking courtyard area.

T5. Include swept path analysis on Site Plans to ensure Municipal Fire vehicles can adequately maneuver the Site.

T6. The Site Plan should define pedestrian connections to the Minuteman Commuter Bikeway. If an on-site connection is not provided, clarify the shortest route to/from the bikeway.

T7. An existing pedestrian bridge over Route 2 is located on the southern frontage of the Site. If the bridge is structurally sound, recommend providing an on-site pedestrian pathway between the bridge, the Project, and the Commuter Bikeway/Thorndike Field. This would allow direct connection between residential uses and commercial/office/medical space south of Route 2.

T8. Verify locations of accessible entrances. Accessible spaces in the surface lot may be closer to an accessible entrance if they are relocated to the courtyard parking area.

T9. Verify intended circulation of the courtyard parking area."

Response: Comment Nos. 1 through 9 are responded to by BSC Group in a separate response letter.

STUDY AREA

Comment No. 10: ***"Figure 2 and all subsequent volume diagrams show the Alewife Station Access Road as one-way southbound, though lane uses are shown traveling northbound. Revise orientation of the one-way arrow."***

Response: Figures 2 through 11 have been revised to show the correct one-way northbound orientation of Alewife Station Access Road. These revisions are depicted on Figures 2R through 11R, which can be found in the Appendix of this letter.

Comment No. 11: ***"Diagrams suggest there is no connection between Dorothy Road and Margaret Street. Revise accordingly."***

Response: Figures 2 through 11 have been revised to show that Dorothy Road connects to Margaret Street. These revisions are depicted on Figures 2R through 11R, which can be found in the Appendix of this letter.

TRAFFIC VOLUMES

Comment No. 12: ***"Backup traffic volume information is not presented in the appendix for highlighted intersections. Backup data should justify the peak hour factor and heavy vehicle percentages utilized in the traffic analysis." (highlighted intersections: 1) Lake Street at Littlejohn Street, 2) Lake Street at Brooks Avenue, 3) Massachusetts Avenue at Lake Street)***

Response: The backup traffic-volume information for Lake Street at Brooks Avenue is provided in the Appendix of this letter. The backup traffic-volume information for the intersections of Lake Street with Littlejohn Street and Massachusetts Avenue with Lake Street was obtained from the initial traffic study prepared for Thorndike Place, and raw traffic count data was not available. The peak-hour factor (PHF) at the intersection of Lake Street with Littlejohn Street were assumed to be the same as Lake Street at Homestead Road. No trucks were assumed to access Littlejohn Street and the truck percentages for Lake Street were carried over from Lake Street at Homestead Road. For the intersection of Massachusetts Avenue at Lake Street, the Massachusetts Avenue PHFs were unknown and assumed to be 0.92 (consistent with MassDOT guidance for urban conditions) while the PHF on Massachusetts Avenue was carried over from the intersection of Lake Street with Brooks Avenue. The truck percentages for the Massachusetts Avenue through movements were assumed to be 2 percent. The Massachusetts Avenue turning movement truck percentages were carried back from Lake Street at Brooks Avenue and split proportionally based on the turning volumes. Similarly, the Lake Street turning movement truck percentages were carried over from Lake Street at Brooks Avenue and split proportionally based on the turning volumes.

Comment No. 13: ***"Transportation trends throughout the months of COVID-19 have shown increased recreational pedestrian and bicycle activity with decreased commuting vehicular activity. Given the proximity to Alewife Station, it is presumed that significant Bikeway activity is related to commuter trips. With more employees working from home, clarify the validity of the pedestrian and bike volumes utilized for this study."***

Response: The bicycle and pedestrian volumes on the Minuteman Commuter Bikeway were collected pre-COVID-19 and therefore are valid. Pedestrian and bicycle volumes at the intersection of Lake Street with Margaret Street have been adjusted using data from the Massachusetts Department of Transportation (MassDOT) Mobility Dashboard. This data indicated that pedestrian volumes in September 2020 (when the intersection was counted) decreased by 31.53 percent over the September 2019 volumes. Therefore, the pedestrian volumes at this intersection used in the analysis were increased by 31.53 percent. Pedestrian volumes for the intersection of Massachusetts Avenue at Lake Street were obtained from a 2010 Functional Design Report conducted for Massachusetts Avenue by Fay, Spofford & Thorndike, LLC. To adjust these volumes to 2020 baseline conditions, data from the Minuteman Commuter Bikeway was used. Counts on the bikeway at the dog park from 2019 indicate a 54 percent increase in pedestrian activity over 2010 counts during the weekday morning peak period and 37 percent increase during the weekday evening peak period. Calculations are provided in the Appendix of this letter.

PEDESTRIAN AND BICYCLE FACILITIES

Comment No. 14: ***"Recommend the Applicant summarize the condition of nearby pedestrian and bicycle facilities and specify if improvements are required to safely accommodate added non-motorized traffic to/from the Site."***

Response: Pedestrian and bicycle facilities were reviewed along Dorothy Road, Littlejohn Street, Burch Street, and Margaret Street. In general, sidewalks are in fair to good condition. Wheelchair ramps are present at intersections along each roadway. Dorothy Road, Burch Street, and Littlejohn Street have tactile warning panels present on wheelchair ramps. Some of the panels are filled with dirt and some have been worn down. Margaret Street has no tactile warning panels present on wheelchair ramps at intersections. There are no painted crosswalks present at any of the intersections on these streets besides at Lake Street.

THORNDIKE PARK

Comment No. 15: ***"The intersection of Lake Street and Margaret Street was counted in September 2020, during the current COVID-19 pandemic. As this intersection is likely most heavily influenced by Thorndike Field activity, identify whether additional adjustments to the September 2020 data are appropriate to account for typical Field activity, which may not have been present due to the pandemic."***

Response: Traffic volumes on Margaret Street have now been adjusted to account for a decrease in activity at Thorndike Field due to COVID-19. These corrections are only made during the weekday evening peak hour as the field is not open until 9:00 AM, which is after the morning peak hour. Based on discussions with Joe Connelly, the Director of the Department of Recreation for Arlington, approximately five teams are on the field during the afternoon peak hour. He indicated an average of 15 people per team. That is a total of 75 people using the field during this time period. Many people, in particular children, carpool to events such as soccer games and practice. Therefore, it was assumed that there are at least 2 people per vehicle. Using 2 people per vehicle, it is expected that about 38 vehicles access the field during this time period. It was assumed that 50 percent (19) of these vehicles will use Margaret Street to access the field. The weekday evening 2020 Baseline traffic volumes on Margert Street were increased by 19 trips entering and 19 trips exiting. These trips were distributed using existing travel patterns.

PUBLIC TRANSPORTATION

Comment No. 16: ***"Note there is a discrepancy in Table 2 of the TIA stating Alewife Station is southwest of the Site."***

Response: Agreed. See Table 2R below with revision that Alewife Station is southeast of the site.

Table 2R
PUBLIC TRANSPORTATION SERVICES

			Weekday		Saturday		Sunday	
Service	Stop Closest to Site	Distance from Site	Hours of Operation	Headway (minutes)	Hours of Operation	Headway (minutes)	Hours of Operation	Headway (minutes)
Bus Route 67: Turkey Hill – Alewife Station	West Service Road at Lake Street	0.3 mi. NW	5:53 AM – 8:32 PM	25-50	**No Weekend Service**			
Bus Route 77: Arlington Heights – Harvard Station	Mass Ave at Lake Street	0.7 mi. NE	4:48 AM – 1:25 AM	9-20	4:48 AM – 1:26 AM	10-17	6:00 AM – 1:25 AM	10-20
Bus Route 79: Arlington Heights – Alewife Station	Mass Ave at Lake Street	0.7 mi. NE	6:35 AM – 7:24 PM	5-50	**No Weekend Service**			
Bus Route 350: North Burlington – Alewife Station	Mass Ave at Lake Street	0.7 mi. NE	5:53 AM – 11:08 PM	15-56	6:25 AM – 11:10 PM	40-60	7:05 AM – 7:35 PM	55-90
Rapid Transit: Red Line	Alewife Station	0.8 mi. SE	5:16 AM – 12:30 AM	5-9	5:16 AM – 12:30 AM	12-16	6:00 AM – 12:30 AM	12-16

MOTOR VEHICLE CRASH DATA

Comment No. 17: ***"The Massachusetts Avenue Corridor through which Lake Street intersects is within a 2008-2017 MassDOT HSIP Bicycle Cluster. It is noted that the Minuteman Commuter Bikeway and the Alewife Greenway Bike Path serve as an appropriate alternative to points South on Massachusetts Avenue."***

Response: Noted. It is anticipated that most residents will use the Minuteman Commuter Bikeway to access points south on Massachusetts Avenue. This type of commuter information will be provided in the welcome packet to residents and available at a central location on site.

Comment No. 18: ***"Crash Rate worksheets utilize a K-Factor of 0.082 for all intersections. Clarify the origin of this K-Factor."***

Response: Spot counts from MassDOT Count Station 4925 and Station 4911 that were conducted on July 2019 were used to calculate the K-Factor of 0.082. Backup calculations for the K-Factor are provided in the Appendix.

Comment No. 19: ***"Crash rate worksheets utilize the PM Peak Hour volumes, despite higher volumes in the AM peak hour at some locations. This provides a higher calculated crash rate which is conservative."***

Response: Noted. Even with conservative values at some locations, the crash rates were observed to be lower than the MassDOT District 4 crash rates for unsignalized and signalized intersections.

PLANNED ROADWAY IMPROVEMENTS

Comment No. 20: ***"Clarify/confirm the future (no-build/build) traffic signal phasing for Lake Street at Brooks Avenue and Lake Street at Minuteman Bikeway. As currently evaluated, the pedestrian phase would activate at both the Bikeway and Brooks Avenue at the same time. It is expected that the Bikeway would call more frequently, potentially causing worse operations at Brooks Avenue."***

Response: The phasing design of the new pedestrian signal on Lake Street was reviewed and revised analysis was conducted. The updated analysis can be found in Table 12R, which is provided in VAI's response to BETA Comment No. 37. In addition, it should be noted that with the new pedestrian signal currently in service, it was incorporated into the 2020 Baseline analysis.

PROJECT-GENERATED TRAFFIC

Comment No. 21: ***"Recommend providing backup Vehicle Occupancy information in the Appendix for review."***

Response: Vehicle occupancy data was obtained from US Census and the American Community Survey for Census Tract 3561, the tract in which the Project site is located. This information is provided in the Appendix of this letter.

Comment No. 22: ***"Recommend providing backup Modal Split data in the Appendix."***

Response: Back up data for the Mode Split used in the report are provided in the Appendix of this letter.

Comment No. 23: ***"Modal split includes a 35% transit split in addition to bicycling and walking. Given the proximity to Alewife Station (0.8 miles), it is assumed that all transit trips will initially be Walk/Bike trips. Provide additional justification for walk/bike trips outside of transit trips."***

Response: The Vox on Two mode split survey indicates 19 percent of commuters bike or walk to work. The US Census data for Census Tract 3561, the tract in which the Project site is located, indicates 6.1 percent of commuters bike and 0 percent walk. However, the Vox on Two survey also indicates 1 percent "other" trips while the census data indicates 7.8 percent "other" trips. The bicycle volumes are similar from both sources. Therefore, the estimated pedestrian volumes may be higher using the Vox on Two survey than that of the Census data; however, 8 percent of the 14 percent walking trips would be converted to other trips using the census data, leaving a 6 percent increase in the auto mode share. A 6 percent increase in auto mode share would increase the anticipated site volumes by 56 daily trips, 4 weekday morning peak-hour trips and 5 weekday evening peak-hour trips. The estimated bicycle volumes would be the same using either set of data and the pedestrian volumes are high using the Vox on Two data. However, the estimated vehicle volumes do not change significantly if the pedestrian mode share is reduced to 0 in the analysis.

Comment No. 24: ***""Other" most likely represents taxi and/or rideshare. It is noted that these trips should be included within the vehicle trip category. Given the small percentage, peak hour estimates are not projected to change."***

Response: Noted. Also, the "Other" category typically includes working from home/telecommuting as well as other personal commuting devices including scooters and motorcycles.

Comment No. 25: ***"Clarify and provide detail for the connection between the Site and the Minuteman Bikeway, including interface with Thorndike Field and its parking area."***

Response: Currently, there is no plan to connect the Site directly to the Minuteman Commuter Bikeway. Residents will likely follow Dorothy Road east to Margaret Street then follow Margaret Street south to the bikeway.

Comment No. 26: ***"Provide graphics showing the expected walking path between the Site and both the Red Line and bus platforms within Alewife Station, including an estimation of walking travel time."***

Response: Figure PR-1 depicting the anticipated pedestrian walking path from the Site to the Red Line and bus platforms within Alewife Station is provided in the Appendix of this letter. As depicted on Figure PR-1, the path follows Dorothy Street northeast from the site to Margaret Street then south to the Minuteman Commuter Bikeway which intersects with Steel Place. Alewife Station is accessed directly from Steel Place.

Comment No. 27: ***"Provide detail regarding the connection between the Site to the existing pedestrian overpass of Route 2, and provide detail regarding the connectivity that the pedestrian overpass affords between the Site and facilities on the south side of Route 2."***

Response: Currently, there is no plan to provide a pedestrian connection from the Site to the pedestrian overpass of Route 2.

Comment No. 28: ***"Consult with MassDOT on any available structural assessment of the existing pedestrian overpass, and provide comment on its suitability for future use."***

Response: See VAI's response to Comment No. 27.

TRIP DISTRIBUTION AND ASSIGNMENT

Comment No. 29: ***"The Journey To Work evaluation includes commuter trips to both Towns/Cities and Counties. Discuss whether the inclusion of counties over-weights percentages for previously included municipalities."***

Response: Any Town or City with 1 percent or more of the overall commuter traffic is assigned individually. The municipalities with less than 1 percent are grouped together and assigned by county. Most municipalities close to the site have percentages over 1 percent and are assigned directly to the municipality. Most municipalities in the county groups are further from the site and require accessing a highway/interstate to be reached. Therefore, the county trips would exit the study area heading towards the same highway/interstate access point before diverting to their specific destinations.

Comment No. 30: ***"Clarify why this Burch Street is preferred for northern vehicles rather than Littlejohn Street, Homestead Road, and Margaret Street which are also accessible for similar movements. Mapping services often suggest using Margaret Street instead of Burch Street."***

Response: As existing turning restrictions exist from 7:00 to 9:00 AM and from 4:00 to 7:00 PM on weekdays from Lake Street onto Wilson Avenue, Littlejohn Street, and Homestead Road, the 2027 Build analysis was revised to send all entering vehicles to Margaret Street. Table 11R summarizes the results. It should be noted that Burch Street does not have a turning restriction.

Table 11R
UNSIGNALIZED INTERSECTION CAPACITY ANALYSIS SUMMARY

Intersection/	2020 Baseline				2027 No-Build				2027 Build			
Critical Movement/Peak Hour	V/C[a]	Delay[b]	LOS[c]	Queue[d]	V/C	Delay	LOS	Queue	V/C	Delay	LOS	Queue
Lake Street at Wilson Avenue:												
Weekday Morning:												
Wilson Avenue NB LT/RT	0.11	>50	F	10	0.13	>50	F	10	0.14	>50	F	13
Weekday Evening:												
Wilson Avenue NB LT/RT	0.13	36	E	10	0.15	40	E	13	0.15	42	E	13
Lake Street at Littlejohn Street:												
Weekday Morning:												
Littlejohn Street NB LT/RT	0.47	>50	F	50	0.56	>50	F	60	0.87	>50	F	103
Weekday Evening:												
Littlejohn Street NB LT/RT	0.18	35	E	15	0.20	39	E	18	0.31	48	E	30
Lake Street at Homestead Road:												
Weekday Morning:												
Homestead Road NB LT/RT	0.13	>50	F	10	0.16	>50	F	13	0.29	>50	F	23
Weekday Evening:												
Homestead Road NB LT/RT	0.08	28	D	8	0.09	31	D	8	0.09	31	D	8
Lake Street at Burch Street and Alfred Road:												
Weekday Morning:												
Burch Street NB LT/TH/RT	0.23	43	E	20	0.27	>50	F	25	0.27	>50	F	25
Alfred Road SB LT/TH/RT	0.13	38	E	10	0.15	44	E	13	0.15	45	E	13
Weekday Evening:												
Burch Street NB LT/TH/RT	0.24	47	E	23	0.28	>50	F	25	0.28	>50	F	25
Alfred Road SB LT/TH/RT	0.05	41	E	5	0.06	48	E	5	0.06	48	E	5
Lake Street at Margaret Street and Lakehill Avenue:												
Weekday Morning:												
Margaret Street NB LT/TH/RT	0.67	>50	F	73	0.80	>50	F	83	0.89	>50	F	100
Lakehill Avenue SB LT/TH/RT	0.16	34	D	15	0.20	40	E	18	0.20	41	E	18
Weekday Evening:												
Margaret Street NB LT/TH/RT	0.78	>50	F	98	0.90	>50	F	113	0.98	>50	F	125
Lakehill Avenue SB LT/TH/RT	0.34	>50	F	33	0.40	>50	F	38	0.48	>50	F	45
Dorothy Road/Littlejohn Street at Site Driveway:												
Weekday Morning:												
Site Driveway NB TH/RT	**Intersection constructed under 2027 Build conditions**								0.03	9	A	2
Weekday Evening:												
Site Driveway NB TH/RT									0.02	9	A	1

[a]Volume to capacity ratio.
[b]Delay in seconds per vehicle.
[c]Level of service.
[d]95th percentile queue length in feet.
NB = northbound; SB = southbound; EB = eastbound; WB = westbound; LT = left-turning movements; TH = through movements; RT = right-turning movements.

Comment No. 31: ***"The TIA routes Route 2 eastbound vehicles to turn left onto Frontage Road towards Acorn Park Drive and Route 2 East. This is conservative as Route 2 Eastbound can also be accessed with a right turn ramp approximately 500 feet to the west on Lake Street."***

Response: The Route 2 eastbound ramp on Lake Street would have people enter Route 2 further west than the Frontage Road ramp. Route 2 has heavy congestion and queueing issues, and it is anticipated that most users would try to enter the queue on Route 2 to as far east as possible.

BUILD CONDITION VOLUMES

Comment No. 32: ***"Existing signed turning restrictions exist from 7-9 AM and from 4-7 PM on weekdays from Lake Street onto Wilson Avenue, Littlejohn Street, Homestead Road, and Burch Street. Assess the impact of this restriction and clarify whether discontinuance of this restriction is proposed."***

Response: See VAI's response to Comment No. 30. A discontinuance to the restrictions is not being proposed.

Comment No. 33: ***"Minor discrepancies were found in the 2027 Build networks (Figure 10 and Figure 11) that did not accurately incorporate the assigned Project volumes (Figure 8 and Figure 9). This discrepancy does not appear within the operations analysis worksheets."***

Response: Figure 10R and Figure 11R show the updated 2027 Build networks with the discrepancies rectified. These figures can be found in the Appendix of this letter.

OPERATIONS ANALYSIS

Comment No. 34: ***"Should vehicle volume from the Project travel along Margaret Street instead of Burch Street, these delays would likely further increase. See Comment T30 and T32."***

Response: See VAI's response to Comments 30 and 32. Margaret Street continues to operate at level-of-service (LOS) F under all conditions. The queue on Margaret Street increased by less than 1 vehicle during the weekday morning peak hour and by approximately 3 vehicles during the weekday evening peak hour.

Comment No. 35: ***"The four signalized intersections within the Route 2 at Route 16 intersection were the only intersections evaluated as an Area Type of "Central Business District" which generally suggests a lower saturation flow rate given multiple driveways, parking activity, and pedestrian activity. Given the interchange configuration, this area type does not necessarily apply. It is expected that this methodology was expected to estimate conditions related to blocked intersections consistent with the existing "DO NOT BLOCK THE BOX" markings. Clarify accordingly."***

Response: The Synchro model used for the Route 2 at Route 16 intersection was provided by the City of Cambridge. To be consistent with other area traffic studies analyzing this location changes to the model outside volumes, PHFs, and truck percentages were not made. However, any effects of the Project on this junction (which is not in Arlington) are minor, due to the large volume of regional traffic this junction processes.

Comment No. 36: ***""Signal 2" analysis worksheets are listed with an error stating a "Phase conflict between lane groups." This is expected as both Alewife Station Access Road (WB) and Alewife Brook Parkway/Route 16 (NB) vehicles receive a green at the same time. The receiving leg to the west provides three dedicated through lanes which accommodates this phasing configuration."***

Response: See VAI's response to BETA Comment No. 36.

Comment No. 37: ***"Minor discrepancies in the labeling of Lane Uses and intersections are apparent throughout Table 12. Recommend updating the table for clarity."***

Response: There were minor discrepancies in the labeling of lane uses and intersections throughout Table 12. These discrepancies have been corrected as shown in Table 12R. The updated synchro analysis worksheets for both the signalized and unsignalized intersections are provided in the Appendix of this letter.

Table 12R
SIGNALIZED INTERSECTION CAPACITY ANALYSIS SUMMARY

Intersection/ Critical Movement/Peak Hour	2020 Baseline V/C[a]	Delay[b]	LOS[c]	Queue[d] 50th/95th	2027 No-Build V/C	Delay	LOS	Queue 50th/95th	2027 Build V/C	Delay	LOS	Queue 50th/95th
ROUTE 2 AT ROUTE 16 (4 SIGNALS)												
Signal 1: Route 2 WB at Route 16 SB:												
Weekday Morning:												
Route 2 WB TH	0.81	8	A	41/40	0.85	10	B	43/40	0.85	10	B	43/40
Route 16 SB RT	0.98	53	D	502/613	1.02	63	F	581/659	1.02	63	F	581/659
Overall	--	**27**	**C**	--	--	**32**	**C**	--	--	**32**	**C**	--
Weekday Evening:												
Route 2 WB TH	1.04	31	F	656/52	1.08	48	F	702/57	1.08	49	F	704/56
Route 16 SB RT	0.91	42	D	442/606	0.95	47	D	472/644	0.95	47	D	472/644
Overall	--	**35**	**C**	--	--	**48**	**D**	--	--	**48**	**D**	--
Signal 2: Route 2 EB at Route 16 NB/SB/Alewife Station Access Road:												
Weekday Morning:												
Route 2 EB LT	0.89	67	E	197/291	0.92	72	E	206/308	0.92	72	E	206/308
Alewife Station Access Road WB TH	0.25	17	B	82/134	0.26	17	B	86/138	0.26	17	B	86/138
Route 16 NB LT	1.04	69	F	665/804	1.09	>80	F	728/868	1.09	>80	F	730/868
Route 16 SB TH	0.70	46	D	213/259	0.72	47	D	223/269	0.72	47	D	223/269
Overall	--	**61**	**E**	--	--	**73**	**E**	--	--	**73**	**E**	--
Weekday Evening:												
Route 2 EB LT	1.14	>80	F	300/418	1.19	>80	F	326/446	1.19	>80	F	326/446
Alewife Station Access Road WB TH	0.82	29	C	399/578	0.85	33	C	422/639	0.85	33	C	422/639
Route 16 NB LT	1.10	89	F	741/880	1.14	>80	F	792/931	1.14	>80	F	794/933
Route 16 SB TH	0.30	38	D	81/119	0.31	38	D	84/123	0.31	38	D	84/123
Overall	--	**>80**	**F**	--	--	**>80**	**F**	--	--	**>80**	**F**	--
Signal 3: Route 16 NB/SB at Alewife Station Access Road:												
Weekday Morning:												
Alewife Station Access Road WB TH	0.17	8	A	48/78	0.17	9	A	50/81	0.17	9	A	50/81
Alewife Station Access Road WB RT	0.06	8	A	15/30	0.07	8	A	15/31	0.07	8	A	15/31
Route 16 NB TH	0.30	38	D	80/117	0.32	38	D	83/121	0.32	38	D	83/121
Overall	--	**23**	**C**	--	--	**23**	**C**	--	--	**23**	**C**	--
Weekday Evening:												
Alewife Station Access Road WB TH	0.54	15	B	227/320	0.56	16	B	239/337	0.56	16	B	239/337
Alewife Station Access Road WB RT	0.35	10	B	106/159	0.36	11	B	110/165	0.36	11	B	110/165
Route 16 NB TH	0.29	38	D	78/115	0.30	38	D	81/119	0.30	38	D	81/119
Overall	--	**18**	**B**	--	--	**19**	**B**	--	--	**19**	**B**	--

See notes at end of table.

Table 12R (Continued)
SIGNALIZED INTERSECTION CAPACITY ANALYSIS SUMMARY

Intersection/ Critical Movement/Peak Hour	2020 Baseline				2027 No-Build				2027 Build			
	V/C[a]	Delay[b]	LOS[c]	Queue[d] 50th/95th	V/C	Delay	LOS	Queue 50th/95th	V/C	Delay	LOS	Queue 50th/95th
Signal 4: Route 2 EB at Route 16 SB:												
Weekday Morning:												
Route 2 EB RT	0.50	11	B	209/258	0.52	12	B	220/272	0.52	12	B	221/272
Route 16 SB TH	0.59	3	A	5/0	0.62	4	A	5/0	0.62	4	A	5/0
Overall	--	**9**	**A**	--	--	**9**	**A**	--	--	**9**	**A**	--
Weekday Evening:												
Route 2 EB RT	0.48	11	B	198/245	0.50	11	B	209/255	0.50	11	B	210/258
Route 16 SB TH	0.25	1	A	0/0	0.26	1	A	0/1	0.26	1	A	0/1
Overall	--	**9**	**A**	--	--	**10**	**A**	--	--	**10**	**A**	--
Lake Street at Route 2 EB On/Off-Ramps:												
Weekday Morning:												
Lake Street EB TH	0.59	25	C	95/176	0.64	28	C	118/204	0.65	28	C	119/205
Lake Street EB RT	0.26	0	A	0/0	0.30	0	A	0/0	0.30	0	A	0/0
Lake Street WB LT	0.56	28	C	62/116	0.58	27	C	83/151	0.58	27	C	84/152
Lake Street WB TH	0.25	7	A	39/53	0.25	7	A	42/57	0.25	6	A	43/57
Route 2 EB Off-Ramp NB LT	0.89	44	D	167/400	1.04	79	F	234/482	1.04	>80	F	236/482
Route 2 EB Off-Ramp NB RT	0.70	12	B	36/191	0.78	17	B	54/243	0.78	17	B	55/246
Overall	--	**18**	**B**	--	--	**26**	**C**	--	--	**27**	**C**	--
Weekday Evening:												
Lake Street EB TH	0.73	26	C	196/337	0.75	27	C	215/361	0.75	27	C	216/362
Lake Street EB RT	0.11	0	A	0/0	0.12	0	A	0/0	0.12	0	A	0/0
Lake Street WB LT	0.59	35	C	71/142	0.61	36	D	79/156	0.61	36	D	80/157
Lake Street WB TH	0.15	5	A	26/38	0.16	5	A	28/40	0.16	5	A	87/40
Route 2 EB Off-Ramp NB LT	1.08	>80	F	253/558	>1.20	>80	F	315/634	>1.20	>80	F	316/635
Route 2 EB Off-Ramp NB RT	0.81	19	B	57/280	0.90	28	C	90/361	0.90	29	C	93/368
Overall	--	**35**	**D**	--	--	**49**	**D**	--	--	**20**	**D**	--

See notes at end of table.

Table 12R (Continued)
SIGNALIZED INTERSECTION CAPACITY ANALYSIS SUMMARY

Intersection/ Critical Movement/Peak Hour	2020 Baseline V/C[a]	Delay[b]	LOS[c]	Queue[d] 50th/95th	2027 No-Build V/C	Delay	LOS	Queue 50th/95th	2027 Build V/C	Delay	LOS	Queue 50th/95th
Lake Street at Route 2 WB On/Off-Ramps:												
Weekday Morning:												
Lake Street EB LT	0.73	38	D	81/164	0.77	41	D	88/179	0.77	41	D	88/179
Lake Street EB TH	0.65	14	B	150/238	0.69	15	B	167/265	0.70	15	B	168/268
Lake Street WB TH	0.96	57	E	168/335	1.05	>80	F	214/378	1.06	>80	F	217/381
Lake Street WB RT	0.96	34	C	80/314	1.03	51	F	135/357	1.04	55	F	169/364
Route 2 WB Off-Ramp NB LT	0.18	18	B	22/47	0.23	19	B	28/56	0.23	19	B	28/56
Route 2 WB Off-Ramp NB LT/TH	0.19	18	B	23/48	0.22	19	B	28/55	0.22	19	B	28/55
Route 2 WB Off-Ramp NB RT	0.02	0	A	0/0	0.02	0	A	0/0	0.02	0	A	0/0
Overall	--	**32**	**C**	--	--	**44**	**D**	--	--	**45**	**D**	--
Weekday Evening:												
Lake Street EB LT	1.04	>80	F	155/289	1.18	>80	F	191/331	1.19	>80	F	191/331
Lake Street EB TH	0.89	27	C	247/463	0.94	32	C	275/503	0.94	34	C	283/514
Lake Street WB TH	0.63	27	C	85/152	0.65	27	C	92/162	0.64	27	C	93/163
Lake Street WB RT	0.58	7	A	0/55	0.59	7	A	0/56	0.59	7	A	0/57
Route 2 WB Off-Ramp NB LT	0.25	19	B	33/72	0.27	19	B	35/75	0.27	19	B	35/75
Route 2 WB Off-Ramp NB LT/TH	0.24	19	B	34/72	0.26	19	B	36/76	0.26	19	B	36/76
Route 2 WB Off-Ramp NB RT	0.04	0	A	0/0	0.04	0	A	0/0	0.05	0	A	0/0
Overall	--	**33**	**C**	--	--	**45**	**D**	--	--	**45**	**D**	--
Lake Street at Minuteman Commuter Bikeway:												
Weekday Morning:												
Lake Street EB TH	0.49	45	D	119/162	0.53	60	E	132/180	0.54	61	E	134/182
Lake Street WB TH	0.77	68	E	535/591	0.82	68	E	569/580	0.82	68	E	570/580
Overall	--	**59**	**E**	--	--	**65**	**E**	--	--	**65**	**E**	--
Weekday Evening:												
Lake Street EB TH	0.69	61	**E**	208/282	0.73	62	E	230/312	0.73	62	**E**	233/316
Lake Street WB TH	0.44	8	**A**	213/289	0.46	9	A	226/307	0.47	9	**A**	31/45
Overall	--	**40**	**D**	--	--	**41**	**D**	--	--	**41**	**D**	--

See notes at end of table.

Table 12R (Continued)
SIGNALIZED INTERSECTION CAPACITY ANALYSIS SUMMARY

Intersection/ Critical Movement/Peak Hour	2020 Baseline V/C[a]	Delay[b]	LOS[c]	Queue[d] 50th/95th	2027 No-Build V/C	Delay	LOS	Queue 50th/95th	2027 Build V/C	Delay	LOS	Queue 50th/95th
Lake Street at Brooks Avenue:												
Weekday Morning:												
Lake Street EB LT/TH/RT	0.57	36	D	224/326	0.64	53	D	246/442	0.64	57	E	249/448
Lake Street WB LT/TH/RT	0.94	>80	F	557/790	1.03	>80	F	635/877	1.03	>80	F	636/879
Brooks Avenue NB LT/TH/RT	0.39	38	D	14/32	0.50	38	D	23/44	0.50	38	D	23/44
Brooks Avenue SB LT/TH/RT	0.52	14	B	5/37	0.48	11	B	5/35	0.48	11	B	5/35
Overall	--	**60**	**E**	--	--	**68**	**E**	--	--	**69**	**E**	--
Weekday Evening:												
Lake Street EB LT/TH/RT	0.83	62	E	251/620	0.87	74	E	274/672	0.88	75	E	281/678
Lake Street WB LT/TH/RT	0.49	12	B	159/269	0.51	13	B	171/284	0.52	13	B	174/289
Brooks Avenue NB LT/TH/RT	0.18	27	C	8/23	0.29	29	C	11/29	0.29	29	C	11/29
Brooks Avenue SB LT/TH/RT	0.50	13	B	2/32	0.50	13	B	2/33	0.50	13	B	2/33
Overall	--	**40**	**D**	--	--	**47**	D	--	--	**47**	**D**	--
Massachusetts Avenue at Lake Street:												
Weekday Morning:												
Lake Street EB LT	0.72	46	D	159/245	0.73	47	D	167/257	0.73	47	D	170/259
Lake Street EB RT	0.57	13	B	32/110	0.59	14	B	40/122	0.59	14	B	42/125
Massachusetts Avenue NB LT	>1.20	>80	F	287/502	>1.20	>80	F	336/550	>1.20	>80	F	339/554
Massachusetts Avenue NB TH	0.48	18	B	200/317	0.50	19	B	213/332	0.50	19	B	214/332
Massachusetts Avenue SB TH	0.72	31	C	265/371	0.76	33	C	281/409	0.76	33	C	282/409
Massachusetts Avenue SB RT	0.94	45	D	302/561	0.99	55	E	362/604	0.99	56	E	364/606
Overall	--	**55**	**D**	--	--	**66**	**E**	--	--	**67**	**E**	--
Weekday Evening:												
Lake Street EB LT	0.95	69	E	324/499	1.01	>80	F	359/537	1.01	>80	F	362/541
Lake Street EB RT	0.55	22	C	89/170	0.58	23	C	100/185	0.59	24	C	102/188
Massachusetts Avenue NB LT	1.06	>80	F	191/388	1.13	>80	F	217/422	1.14	>80	F	224/433
Massachusetts Avenue NB TH	0.84	32	C	453/702	0.87	35	C	480/#740	0.87	35	C	480/740
Massachusetts Avenue SB TH	0.60	30	C	202/265	0.62	30	C	211/277	0.62	30	C	211/277
Massachusetts Avenue SB RT	0.35	17	B	54/117	0.37	17	B	58/122	0.37	17	B	59/124
Overall	--	**43**	**D**	--	--	**49**	**D**	--	--	**50**	**D**	--

[a]Volume to capacity ratio.
[b]Average stopped delay per vehicle (in seconds).
[c]Level-of-service.
[d]Queue length in feet.

Comment No. 38: ***"Several lane uses were reported operating with v/c greater than 1.0 despite delays suggesting Level of Service of acceptable levels. The larger v/c suggests the movement/lane is over capacity and should be reported as LOS F."***

Response: Table 12R above shows the revised level-of-service results of the analysis. All lanes with a volume-to-capacity ratio greater than 1.0 are presented as LOS F.

Comment No. 39: ***"Lake Street through volumes at the Minuteman Bikeway presented in the 2027 No-Build evening analysis were found to be lower than those presented on Figure 6 of the TIA. Update accordingly."***

Response: Table 12R above shows the revised level-of-service results of the analysis. The through volumes at the Minuteman Commuter Bikeway presented in the 2027 No-Build evening analysis have been updated to match the volumes on Figure 6R.

Comment No. 40: ***"Lake Street at Massachusetts Avenue flares out to provide a wide area that could be used as two lanes but was modeled as a single lane. Consider modifying analyses to represent actual field conditions."***

Response: The analysis has been updated such that the Lake Street approach to the intersection with Massachusetts Avenue has one left-tune lane and one right-turn lane. Table 12R above shows the revised level-of-service results of the analysis.

CONSTRUCTION IMPACTS

Comment No. 41: ***"Quantify and analyze the effect of construction on the Dorothy Road neighborhood. It is expected that the earthwork required for the site will result in a significant number of trips for large dump trucks, in addition to other construction vehicles related to the grading and construction of the Site building. Verify turning path of large construction vehicles at affected intersections within the neighborhood and to/from Lake Street."***

Response: Comment No. 41 will be responded to by BSC Group in a separate response letter.

CONCLUSIONS

Comment No. 42: ***"Provide additional commentary on the impact of the Project on the Dorothy Road neighborhood, including summarizing expected increases in daily and peak hourly traffic on Littlejohn Street, Dorothy Road, Burch Street and Margaret Street."***

Response: Table 7R shows the traffic-volume increases on Littlejohn Street and Dorothy Road due to the Project. The analysis was updated to send site traffic onto Margaret Street instead of Burch Street, so we have provided the traffic-volume increases for Margaret Street in Table 7R.

Table 7
PEAK-HOUR TRAFFIC-VOLUME INCREASES[a]

Location/Peak Hour	2027 No-Build	2027 Build	Traffic-Volume Increase Over No-Build
Route 2, west of Lake Street:			
Weekday Morning	1,958	1,970	12
Weekday Evening	1,913	1,928	15
Lake Street, west of Route 2 EB On/Off-Ramps:			
Weekday Morning	1,444	1,447	3
Weekday Evening	1,554	1,557	3
Massachusetts Avenue, north of Lake Street:			
Weekday Morning	2,171	2,175	4
Weekday Evening	1,999	2,004	5
Massachusetts Avenue, south of Lake Street:			
Weekday Morning	1,998	2,003	5
Weekday Evening	2,004	2,011	7
Alewife Brook Parkway, south of Route 2:			
Weekday Morning	3,259	3,262	3
Weekday Evening	3,093	3,096	3
Dorothy Road, east of the Site Drive:			
Weekday Morning	49	63	14
Weekday Evening	35	60	25
Margaret Street, south of Lake Street:			
Weekday Morning	62	76	14
Weekday Evening	116	141	25
Littlejohn Street, south of Lake Street:			
Weekday Morning	49	62	13
Weekday Evening	35	43	8

[a]Two-way traffic total.

As can be seen in Table 7R, traffic-volume increases range from 8 to 25 vehicle trips on Dorothy Road, Littlejohn Street, and Margaret Street. Increases of 8 to 25 vehicles per hour equates to 1 additional vehicle every 2.4 to 7.5 minutes, which is a minor increase in traffic to the area.

It is anticipated that this information addresses the comments. Please feel free to contact us directly if there should be any further clarification needed.

Sincerely,

VANASSE & ASSOCIATES, INC.

Scott W. Thornton, P.E.
Senior Associate

Derek Roach, P.E.
Transportation Engineer

cc: BETA Group, Inc. – Greg E. Lucas, P.E., P.T.O.E, R.S.P