

Project Narrative

**Cape View Way
Bourne, Massachusetts**

May 2021

Revised December 21, 2021



Prepared for:
Preservation of Affordable Housing, Inc.
2 Oliver Street, Suite 500
Boston, MA 02109

Prepared by:
Horsley Witten Group, Inc
90 Route 6A
Sandwich, MA 02563



Horsley Witten Group
Sustainable Environmental Solutions
horsleywitten.com

Cape View Way Bourne, MA Project Narrative

May 2021
Revised December 2021
Revised December 21, 2021

Table of Contents

1.0	INTRODUCTION & GENERAL DESCRIPTION OF DESIGN REVISIONS	1
1.1	Existing Conditions	5
1.2	Soils	5
1.3	FEMA Designation.....	5
1.4	State-listed Rare Species Habitat	5
1.5	Wetland Resource Areas	6
2.0	PROPOSED PROJECT NARRATIVE (revised December 2021)	6
2.1	Use of Building and Architecture.....	6
2.2	Traffic Flow, parking, loading, and circulation	8
2.3	Landscape, external lighting, snow removal, and screening	8
2.4	Proposed and Existing Public and Private Utilities	13
2.5	Description of natural area protection and enhancement	15
2.6	School impact	15

TABLES

Table 1:	Building Information
Table 2:	Income and Rent Limits
Table 3:	Recommended Plant List
Table 4:	Proposed Wastewater Design Flow

FIGURES

Figure 1 – USGS Locus Map
Figure 2 – Soils Map
Figure 3 – FEMA Flood Zones
Figure 4 – Environmental Constraints

APPENDIX

A - Review Letters and Response

B - Lighting Specifications

Cape View Way Bourne, MA Project Narrative

May 2021
Revised December 2021
Revised December 21, 2021

1.0 INTRODUCTION & GENERAL DESCRIPTION OF DESIGN REVISIONS

The Applicant (POAH) is submitting a revised development plan package for the property located on Cape View Way for a 42-unit (reduced from 51) affordable housing residential development (the “Development”). The Property is currently owned by the Bourne Housing Authority.

The revised submission reflects changes made to the proposed building and overall site design, based upon a thorough and extensive design review process. Since the original filing in March of 2021, two rounds of revisions (September 2021 and December 2021) have been submitted to the town of Bourne Zoning Board of Appeals (ZBA) to address comments from various town departments, the Town’s peer reviewer, Professional Consulting Services Corporation, PC (PCS), and the ZBA members. The peer review comments, and response letters can be found in Appendix A.

The revised site engineering plans submitted address the comments received from the Town’s peer review consultant, PCS on August 11, 2021, and as addressed in Horsley Witten Group Inc.’s (HW) response letter dated September 14, 2021 (Appendix A). The updated plans also address the final peer review comments received in the PCS letter dated September 27, 2021. Below is a brief summary of the specific revisions:

SUBDIVISION

- The applicant’s attorney discussed the Modification of the Subdivision Plan with the Board by at the last hearing. The Board Chairman indicated that he was satisfied with the draft Findings and Conditions as to the Board approving and endorsing the Modified Subdivision Plan.
- Sheet C-3 “Proposed Subdivision Plan: has been removed from the plan set and a stand alone “Modification of the Definitive Subdivision Plan” has been submitted which includes the following:
 - The title “Definitive Subdivision Plan”
 - A signature block for the ZBA (serving as Planning Board) to endorse the plan and the Town Clerk block.
 - Show bounds (permanent monuments) to define the layout (PC, PT, and corner roundings).

- The new lot (all land outside the right-of-way) should be labeled as “Lot 1” with the area and area of upland stated.
- Shows the Zoning District.
- The current lots be labeled as “Former Lot 86,” “Former Lot 88,” etc.
- The edge of right-of-way beyond the roadway terminus should be shown with dashed lines and the right-of-way labeled as “To Be Abandoned.” Graphically, Lot 1 should be depicted so it is clear it includes the segment of the former right-of-way that is to be abandoned.
- Properties at 45 Meetinghouse Lane (original subdivision Lots 1 and 2) and 51 Meetinghouse Lane (original subdivision Lots 3, 4, and 5) should be graphically depicted so it is clear that they are included in the subdivision modification.
- Note that 51 Meetinghouse Lane (original subdivision Lots 3, 4, and 5) must be shown in their entirety.
- Graphically show the perimeter of the subdivision more prominently and adjust line weights for non-subdivision lots so it is clear what land is included in the subdivision.
- Prior to building permit, the final modified Definitive Subdivision Plan should be recorded in the Registry of Deeds.

STORMWATER

Collection System

- All comments have been addressed.
- It was agreed that Flexstorm® Pure Permanent Inlet Protection inserts would be acceptable and have been added to all catch basins to provide additional 25% TSS removal. The manufacturer information has been added to the appendices of the Stormwater Analysis and Drainage Report.

WASTEWATER

Additional Septic Comments Based On The Revised Conventional Design

- All comments have been addressed (comments 63 thru 79)
- As requested, additional soil testing also will be performed during the construction phase prior to leaching field installation.
- The submitted plans are currently noted as “Permitting Set Only Not for Construction.” Final construction drawings for the entire project, including the wastewater system, will be submitted to the Bourne Health Department for administrative approval prior to the submission of a building and the start of construction.
 - The Bourne Health Agent (Terri Guarino) has also confirmed that all other comments from previous plan submission to the Board of Health appear to have been addressed. (See Appendix A)

COMMENTS FROM THE TIA PEER REVIEW

- A grass strip between the parking lot and sidewalk at the upper parking lot is provided to account for vehicle overhang to maintain the accessible route.

In addition, revisions have been made to the architectural and site design plans to address comments received from both the ZBA members and North Sagamore Water District. Below is a summary of the revisions to the design plans as presented at the ZBA Hearings on 11/17/21 and 12.

BUILDING

- Reduced total unit count from 51 to 42 units.
- Reduced proposed building footprint (1,600 sf) from 20,700 sf to 19,100 sf.
 - Western leg of building shortened by approximately twenty-four feet.
- Reduced the height of the building on both the east and west wings.
 - Height on both ends of building lowered to two-stories by eliminating four units from third floor

SETBACK AND BUFFERS

- Relocated the building to maintain a 15 foot rear setback along north property line.
- Increased the building setback from the 50' wetland buffer to 24 feet.
- Increased the existing buffer in the northeast corner of the lot (abutting Cherry Hill Apartments) by 8 feet.

SITE DESIGN

- The access drive and wall is "pushed" further south, requiring a more substantial retaining wall (to be designed by others) along the southern property line.
 - Concrete block retaining wall with capstone (or equivalent) replaces the boulder wall to accommodate required greater height (8'-6").
 - The wall steps down on both ends to a minimum height of 18"
 - A wall elevation and typical detail has been added.
 - A guardrail has also been added.
- 73 total spaces parking ratio increased to 1.7 spaces per unit.
 - Includes 4 handicapped parking spaces.
 - The compact parking spaces along the access drive (12) have been removed.
- Screening fence vinyl chain link fence locations have been modified based upon the applicants discussions with the abutters. A screening fence detail has been added.
- Additional benches have been added as requested.
- A grill has been added to the patio space.

OUTDOOR SPACES

- Increased the outdoor space at the rear of the building by 10.5 feet.
- Open field play space and pathway have been added north of the lower parking lot, on top of the leachfield.

WASTEWATER

- The design is revised to reflect the reduced wastewater flow from 9,900 gallons per day, down to 8,800 gallons per day.
- Septic tank and pump chamber volume reduced along with leach field footprint reduced by approx. 2,100 sf.
- Additional soil testing, if required, will be performed during the construction phase prior to leaching field installation.

LANDSCAPE AND LIGHTING

- Landscape plan has been revised to address the building relocation.
- Revisions to the proposed vegetated buffer along the southern property line, due to the relocated drive and loop.
 - Adjusted plant layout and added evergreens to help offset lost screening.
 - A section of screening fence has been added.
- Additional ornamental grass/perennial screening buffer has been added to the lower parking lot northern edge at the request of the Cherry Hill Apartments.
- Additional trees (4) added along the western edge of the upper parking lot between the building and parking lot.
- Additional trees (3) added to the southwestern edge of the building between the 50' Wetland Buffer and building.
- Lighting layout has been adjusted and a revised photometric plan has been provided.
- Light selected is dark sky compliant and shielded (see Appendix B).

The following table summarizes and compares the proposed general site revisions to the original submission:

Table 1: Site Design Comparison

	March 5, 2021	December 2021
Lot Size ¹ (sf) +/-	143,882	157,598
Proposed Building Footprint (sf) +/-	20,700	19,040
Paved Roads and Parking (sf) +/-	47,446	46,508
Paved Sidewalks (sf) +/-	3,859	4,553
% Open Space	64%	56%
Open Space ² (sf) +/-	92,084	87,497

¹ The lot size increased from March to December as part of the Right-of-Way is no longer proposed to remain.

² All remaining landscaped or undisturbed area, includes above ground stormwater management areas and community green space.

1.1 Existing Conditions

The Property is located in an R-40 Zoning District and is vacant except for some existing subdivision infrastructure (including two hydrants and some existing pavement and a water line) which will be removed and replaced with new infrastructure. The site is 3.07-acres located on Cape View Way, off of Meetinghouse Lane and is characterized by dense vegetation and invasive species. The existing Cape View Way road has a paved surface that extends approximately 145 feet from Meetinghouse Lane. The road then continues as a dirt road. A wetland is located on the western portion of the Property.

The site is bordered by Cherry Hill Court to the east and Meetinghouse Lane and commercial properties to the south. The site abuts residential properties located on Homestead Road, Homestead Road Extension, and Andrew Road to the west, and the Bourne Fire Department and United States Postal Service to the south. It is also conveniently located within walking distance to public transit and local amenities (Figure 1).

The general topography of the site slopes toward the east. The site's topography includes some fairly significant grade changes. There are two small earthen mounds towards the center of the site. Overall, the site exhibits elevation changes of 58 to 74 feet above mean sea level. The site generally drains from north/northeast to the southwest corner.

1.2 Soils

According to the "Soil Survey of Barnstable County, Massachusetts" (Fletcher, 1993) soils underlying the Site are classified as Carver Loamy Coarse Sand (Figure 2). This soil group is classified as hydrologic soil group A and described as "very deep, gently sloping, excessively drained soil generally is in broad areas on outwash plains but is also in areas of sandy glacial lake deposits."

Nine site soil evaluation test pits were performed in October 2019 to complete a Phase 2 environmental assessment and assess the subsurface conditions to determine its suitability for the construction of wastewater and stormwater management practices.

1.3 FEMA Designation

According to the FEMA Flood Insurance Rate Maps (Community Panel Number 250001C0318J, effective July 16, 2014), the site is located within Flood Zone X, "Areas determined to be outside the 0.2% annual chance floodplain" (Figure 3).

1.4 State-listed Rare Species Habitat

According to the most recent version of the *Massachusetts Natural Heritage Atlas* (14th Edition, August 1, 2017), the Property is not located within areas of *Estimated Habitat of Rare Wildlife and Certified Vernal Pools* and/or *Priority Habitat of Rare Species* as designated by the Massachusetts Natural Heritage and Endangered Species Program (NHESP, Figure 4).

1.5 Wetland Resource Areas

In May 2019, HW identified and delineated the boundary of wetland resource area in the western portion of the Property, in accordance with methods developed by MassDEP, as set forth in the Massachusetts Wetlands Protection Act regulations.

2.0 PROPOSED PROJECT NARRATIVE (revised December 2021)

The Development includes the new construction of one building, 73 (reduced from 85) parking spaces (reduced from 85), associated sidewalk, and landscaped open spaces for residents of the Development. The proposed site design is compatible with the neighborhood, located near residential uses, incorporates public transportation access, and provides new, affordable, and mixed-income housing.

Specifically, the Applicant proposes to construct the following as a part of the Development:

- 42 dwelling units located in one building
- Approximately 800 linear feet of paved access road
- Two paved parking lots (69 spaces)
 - Standard - 15'-6" X 8'-8"
 - Compact: 15'-6" X 8'-0"
- ADA accessible parking (4 spaces)
- ADA accessible sidewalks
- Interior landscaped areas, buffers, open spaces, benches, outdoor grill and lighting.

2.1 Use of Building and Architecture

As noted above, the Development has been reduced to 42-units of mixed-income housing that will be provided in a two/three-story building with a central common corridor and elevator access to the upper floors. In addition to its 42 units, a small lobby, amenity rooms, and storage units are included. An entrance in the rear of the building allows access to a patio and play space area. The Cape Cod vernacular is embraced in the style and material selections for the building, which includes shingle and lap siding, projecting bays, and gabled roofs elements. Stair towers with transom windows and the hexagonal main entry tower are reminiscent of Cape Cod lighthouse architecture. A curved covered canopy with a trellis and colonnade provides a welcoming entrance, as well as a gathering place for residents.

The individual units have an efficient and simple plan, resulting in 1, 2 and 3 bedroom units of 617 to 1133 SF. Three units of the proposed 42 units will be designed to be handicapped accessible. Many others are designed to meet the needs of families with children and help residents age in place by providing one floor living and generous clearances for future mobility challenges. Careful attention is given to important "transitional" spaces such as entry vestibules and hallways. Bays will be carefully used to give additional room exactly where needed and to help subtly define areas of the floor plan. Each room will

have at least 2 windows ensuring generous lighting and ventilation. Issues such as sight lines, acoustic privacy, efficient circulation, and adequate storage have all been considered. The units will all be designed to be affordable, both in their first cost and in their lifecycle costs. Low maintenance materials will be specified throughout. On the exterior natural white cedar shingles or architectural fiber cement siding/shingles, painted cellular PVC trim and no-maintenance vinyl insulated windows will be utilized.

The unit count, unit mix and square footage of each unit is provided in the table below.

Table 2: Building Information

	Level 1	Level 2	Level 3
Total # of units	12	17	13
Unit mix	1BR - 5 2BR - 3 3BR - 4	1BR - 3 2BR - 13 3BR - 1	1BR - 3 2BR - 10
Unit size	1BR – 617- 645 sf 2BR – 900- 922 sf 3BR - 1133 sf	1BR – 617- 641 sf 2BR – 877- 1133 sf 3BR - 1133 sf	1BR – 617-721 sf 2BR – 877-1133 sf
Building floor area	19,150 sf	19,150 sf	14,288 sf
Type	Rental	Rental	Rental

Housing Affordability

Cape View Way will expand housing options for households at a range of incomes (Table 2). The units will be available to residents earning 30% of the Area Median Income to 80% of the Area Median Income, creating a mixed income community. For Low Income Housing Tax Credit (LIHTC) and Workforce units, income-eligible residents are required to pay the full rent, therefore, residents must be working in order to meet the monthly rent payment. For Section 8 units, residents typically pay between 30-50% of their household income towards the rent payment and a housing payment voucher from a local housing authority covers the difference.

According to the Department of Housing and Community Development, as of December 21, 2020, only 6.9% of Bourne housing is subsidized.

Table 2: Income and Rent Limits

Unit Type	# of units	Area Median Income	# of People per Household	Income Limits (2021)	Rent Limits (2021)
1BR	9	LIHTC- 60%	1-2	\$40,680-\$46,680	\$1,094
1BR	0	Workforce-80%	1-2	\$54,480-\$62,240	\$1,362
2BR	22	LIHTC- 60%	2-4	\$46,680-\$58,320	\$1,312

2BR	6	S8-PBV-30%	2-4	\$23,340-\$29,160	\$656
2BR	0	Workforce-80%	2-4	\$62,240-\$77,760	\$1,750
3BR	2	LIHTC-60%	3-6	\$52,500-\$67,680	\$1,516
3BR	3	S8-PBV-30%	3-6	\$26,250-\$33,840	\$758
3BR	0	Workforce-80%	3-6	\$70,000-\$90,240	\$2,022
Total	42				

2021 Income and Rent Limits for Barnstable County

Source: novoco.com

2.2 Traffic Flow, parking, loading, and circulation

Site circulation is designed to provide safe and efficient access. Access from Meetinghouse Lane and vehicular and pedestrian circulation throughout the site is provided by one access drive. The proposed access drive allows for two-way traffic at 24-feet wide up through the second parking lot and then to one-way traffic at 12-feet wide and designed to accommodate the turning and maneuvering requirements of the largest anticipated responding emergency vehicle per the Bourne Fire Department. Both parking lots have 24-feet wide drive aisles.

A total of 73 spaces are provided in two parking lots (69 spaces)..

Sidewalks are provided along the access drive and connect to the existing sidewalks along Meetinghouse Lane. Americans with Disabilities Act (ADA) compliant sidewalks, entrances, and parking, along with wheelchair ramps, as required, are provided at all buildings, handicapped parking spaces and internal pedestrian driveway crossings.

A traffic study to evaluate the proposed development's impacts to traffic circulation along Meetinghouse Lane was completed and submitted to the ZBA for peer review. All peer review comments have been addressed.

2.3 Landscape, external lighting, snow removal, and screening

A community open space is provided at the rear of the building and includes a playground and open lawn for play and a patio/outdoor seating area with outdoor grill for resident use. A second open space is provided north of the lower parking lot (9,390 sf +/-). This area provides an open mowed lawn area for play. Paths have also been provided to both spaces to allow safe pedestrian access throughout the proposed development. Native trees, shrubs, and ornamental plants are used to define spaces. To protect view sheds around the site, back of house items (e.g., trash enclosures and parking) are screened where possible.

The landscape design objective is to enhance the built environment through the creation of a sustainable landscape that blends into the site's natural surroundings. The overall design philosophy will emphasize the use of native plantings and strive to integrate the proposed development's needs into the site's woodland environment. The intent will be to create a passive landscape that will complement the proposed building architecture and natural beauty, while providing open space for the community's residents and children. It is also important to note that the site is in close proximity to the following public recreational spaces.

- Sagamore Recreation Area and Cape Cod Canal Bike Path (.6 miles – 11 minute walk)
- .Scusset Beach State Reservation (4 miles – 30 minute walk)

To accomplish the design goals, tree lined walkways will be provided throughout the site linking different use areas and providing a connection between Meetinghouse Road and the building. Perimeter landscaping will be provided throughout the parking lots to break up the paved areas and provide shading. To protect view sheds both in into and out of the site around trash enclosures and parking are screened where possible.

The plant selection will take its cue from the native plants of the surrounding plant community. The site is bordered by a wetland to the south and east, care will be taken to minimize disturbance in this area and new plantings will be similar to those found within the undisturbed wetland buffer. Three different seed mixes were selected to provide mowed turf, naturalized and wetland buffer areas.

The proposed plant design will include species listed in the suggested plant list below.

Table 3: Suggested Plant List

Trees		
Street/Large Deciduous		
<i>Acer rubrum</i>	Red Maple	3-3.5" cal.
<i>Nyssa sylvatica</i>	Tupelo	3-3.5" cal.
<i>Quercus alba</i>	White Oak	3-3.5" cal.
<i>Quercus coccinea</i>	Scarlet Oak	3-3.5" cal.
<i>Quercus rubra</i>	Red Oak	3-3.5" cal.
<i>Ulmus americana</i>	American Elm	3-3.5" cal.
Ornamental		
<i>Amelanchier sp.</i>	Serviceberry	6/7' B&B
<i>Betula papyrifera</i>	Paper Birch	10-12' clump
<i>Betula populifolia</i>	Gray Birch	10-12' clump
Evergreen		
<i>Juniperus virginiana</i>	Eastern Red Cedar	8-10' min.
<i>Pinus strobus</i>	White Pine	8-10' min.
Foundation Plants		

Shrubs

<i>Aronia sp.</i>	Chokeberry	24" min. ht.
<i>Clethra alnifolia</i>	Summersweet Clethra	24" min. ht.
<i>Comptonia peregrina</i>	Sweetfern	24" min. ht.
<i>Cornus sericea</i>	Red Twig Dogwood	24" min. ht.
<i>Ilex glabra</i>	Inkberry	24" min. ht.
<i>Hydrangea quercifolia</i>	Oakleaf Hydrangea	24" min. ht.
<i>Hypericum kalmianum</i>	Kalm St. Johnswort	24" min. ht.
<i>Morella pensylvanica</i>	Bayberry	24" min. ht.
<i>Physocarpus opulifolius</i>	Ninebark	24" min. ht.
<i>Rhus aromatica 'Gro Low'</i>	Fragrant Sumac	24" min. ht.
<i>Vaccinium sp.</i>	Blueberry	24" min. ht.
<i>Viburnum dentatum</i>	Arrowwood	24" min. ht.

Perennials/Grasses/Groundcovers

<i>Geum fragarioides</i>	Appalachian Barren Strawberry	#1
<i>Geranium maculatum</i>	Wild Geranium	#1
<i>Heuchera macrorhiza</i>	Coral Bells	#1
<i>Oenothera fruticosa</i>	Evening Primrose	#1
<i>Osmunda cinnamomea</i>	Cinnamon Fern	#1
<i>Pycnanthemum sp.</i>	Mountain Mint	#1
<i>Schizachyrium scoparium</i>	Little Bluestem	#1
<i>Sporobolus heterolepis</i>	Prairie Dropseed	#1

Buffer Plants**Trees**

<i>Acer rubrum</i>	Red Maple	3-3.5" cal.
<i>Amelanchier sp.</i>	Serviceberry	6/7' B&B
<i>Nyssa sylvatica</i>	Tupelo	3-3.5" cal.
<i>Prunus serotina</i>	Black Cherry	3-3.5" cal.
<i>Quercus alba</i>	White Oak	3-3.5" cal.
<i>Quercus bicolor</i>	Swamp White Oak	3-3.5" cal.

Shrubs

<i>Clethra alnifolia</i>	Summersweet Clethra	24" min. ht.
<i>Viburnum dentatum</i>	Arrowwood Viburnum	24" min. ht.

Perennials/Grasses/Groundcovers

<i>Carex sp.</i>	Sedge sp.	#1
<i>Osmunda cinnamomea</i>	Cinnamon Fern	#1

Parking Lot Islands**Shrubs**

<i>Comptonia peregrina</i>	Sweetfern	24" min. ht.
<i>Hypericum sp.</i>	St. Johnswort	24" min. ht.
<i>Rhus aromatica 'Gro Low'</i>	Fragrant Sumac	24" min. ht.

Perennials/Grasses/Groundcovers

<i>Coreopsis</i> sp.	Coreopsis	#1
<i>Baptisia tinctoria</i>	Yellow Wild Indigo	#1
<i>Eupatorium hyssopifolium</i>	Hyssop Leaved Boneset	#1
<i>Geum fragarioides</i>	Appalachian Barren Strawberry	#1
<i>Oenothera fruticosa</i>	Sundrops	#1
<i>Sporobolus heterolepis</i>	Prairie Dropseed	#1

Stormwater Management Areas**Trees**

<i>Betula</i> sp.	Birch	10-12' clump
<i>Nyssa sylvatica</i>	Tupelo	3-3.5" cal.

Shrubs

<i>Clethra alnifolia</i>	Summersweet Clethra	24" min. ht.
<i>Cornus sericea</i>	Red Twig Dogwood	24" min. ht.

Perennials/Grasses/Groundcovers

<i>Asclepias</i> sp.	Milkweed sp.	#1
<i>Carex</i> sp.	Sedge sp.	#1
<i>Eragrostis spectabilis</i>	Purple Lovegrass	#1
<i>Eupatorium hyssopifolium</i>	Hyssop Leaved Boneset	#1
<i>Juncus</i> sp.	Rushes	#1
<i>Panicum virgatum</i>	Switchgrass	#1
<i>Penstemon digitalis</i>	Beardtongue	#1
<i>Pycnanthemum</i> sp.	Mountain Mint	#1
<i>Schizachyrium scoparium</i>	Little Bluestem	#1
<i>Solidago</i> sp.	Goldenrod	#1



Photo 1. Ornamental birch tree shown at 10-12' height, the size at the time of installation. To be 16-20' high after 3 years.



Photo 3. Evergreen juniper 15' high, 3 years after installation (8-10' high at installation).



Photo 2. Deciduous elm tree at 3" caliper size (around 12') the size at installation. To be 15-20' high after 3 years.



Photo 4. Deciduous oak tree at 3" caliper size (around 12' high), the size at installation. To be 15-20' high after 3 years.

Lighting

The lighting selected for the site is an ornamental pendant style fixture that hangs downward facing toward the ground, ensuring light does not trespass or add excess light pollution. The fixtures hang between 12 and 15 off the ground and provides comfortable lighting for the roadway and adjacent sidewalk. The fixture is shielded to eliminate uplight potential. The fixtures selected for this site have 0 Lumens for Uplight-Low and Uplight-High classifications. The fixture is a King Luminaire gloss black classic style, which adds to the pedestrian scale and neighborhood feel of the development. A photometric plan has been provided as part of the application submission. See Attachment 4 for additional lighting information.



Proposed Lighting

Winter Months

The overall layout of the landscape and site design gave consideration for the site during winter months. To accommodate snow storage, and ensure excess snow is not directed to stormwater facilities, locations for storage have been created throughout the development. This gives anyone removing snow several options, and plenty of room for large storm events.

2.4 Proposed and Existing Public and Private Utilities

There are no utilities at the Property. There is access to public water service along Meetinghouse Lane via an 8-inch water main, serviced by the North Sagamore Water District. A looped water main is proposed for the site. The design plans, details and calculations have been submitted to the North Sagamore Water District. Per the letter from the North Sagamore Water District (NSWD) dated April 14, 2021, the District has 18,940 gallons of water per day (gpd) available capacity for new construction. The proposed projected water usage is estimated at 8,610 gpd. It is our understanding, following the Board of Water Commissioner's completion of the application review process, the NSWD will notify the Zoning Board of Appeals of the availability of water for this project.

Meetinghouse Lane provides access to electric and gas. A more detailed description of the stormwater and sewer design is provided in Section 2.4.1 and 2.4.2 below.

2.4.1 Stormwater

The proposed project will incorporate a series of stormwater infiltration, and green stormwater infrastructure (GSI) practices into the overall site and landscape design. The design includes natural practices such as bioretention areas, tree trenches swales, and underground recharge chambers to manage the onsite runoff. The stormwater management system is designed to accomplish the following major objectives:

- To capture and treat, at a minimum, the “first flush” (first one-inch of stormwater runoff) from the impervious surfaces.
- To provide groundwater recharge to the greatest extent practicable in conformance with the Massachusetts Department of Environmental Protection groundwater recharge criteria.
- To minimize runoff from the post-developed conditions at the study points located along the periphery of the site.

These objectives are met through the use of the following stormwater management measures:

- GSI practices (e.g., bioretention and tree trenches) sized to provide water quality treatment for the driveway, walkways, and parking area runoff. The systems are equipped with overflows to convey runoff from larger storm events into proposed underground recharge chambers.
- Underground recharge chambers and recharge basins sized to retain and infiltrate onsite runoff.

See the revised “*Stormwater Analysis and Drainage Report*” prepared by Horsley Witten Group, Inc. dated December 2021 (Attachment 5) for additional information and the “*Stormwater Management Maintenance Plan*” (Attachment 6) for the operation and maintenance requirements.

2.4.2 Wastewater

Public sewers are not available; therefore the Development will require an onsite wastewater treatment system. A wastewater design flow assessment was performed, based on Title 5 design flow criteria, 310 CMR 15.203, for proposed uses at the site and is provided below in Table 4. Title 5 flow is typically considered a max day flow. The estimated design flow is approximately 8,800 gallons per day (gpd).

Table 4 – Proposed Wastewater Design Flow

Description	Unit Type	Number of Units	Bedrooms per unit	Total bedrooms	Flow Rate (GPD)	Total Design Flow (GPD)
Proposed Buildings						
	1br	9	1	9	110	990
	2br	28	2	56	110	6,160
	3br	5	3	15	110	1,650
Total number of units:		41				
Total Daily Design Flow (Gallons per day)						8,800

Note: Design flows taken from 310 CMR 15.203 System Sewage Flow Design Criteria (Title V).

The wastewater system is comprised of a 28,000 gallon H-20 two compartment septic tank to accommodate 300% of the design flow, a 13,000 gallon H-20 pump chamber sized for 100% emergency capacity, a valve vault to control flow to the leaching fields, a multizone valve which allows alternate dosing of the leaching fields and two subsurface pressure dosed leaching trench systems (leaching fields).

The design plans, details and calculations will be submitted to the Bourne Health Department and will be reviewed and approved administratively by the Health agent. No BOH hearing is required.

2.5 Description of natural area protection and enhancement

A small portion of the project area is located within both the 50' and 100' wetland buffers. The proposed building and all site amenities are located outside of the 50' buffer, with minor grading occurring in within the 50' buffer. The proposed landscape plan includes the restoration of all disturbance within the 50' buffer, including the removal of invasive species and native buffer plantings.

A sediment and erosion control barrier consisting of a silt sock will be placed at the limit of work as shown in the project plans. Erosion control barriers will remain in place and will be maintained in good condition until all work is complete and all soils have been stabilized.

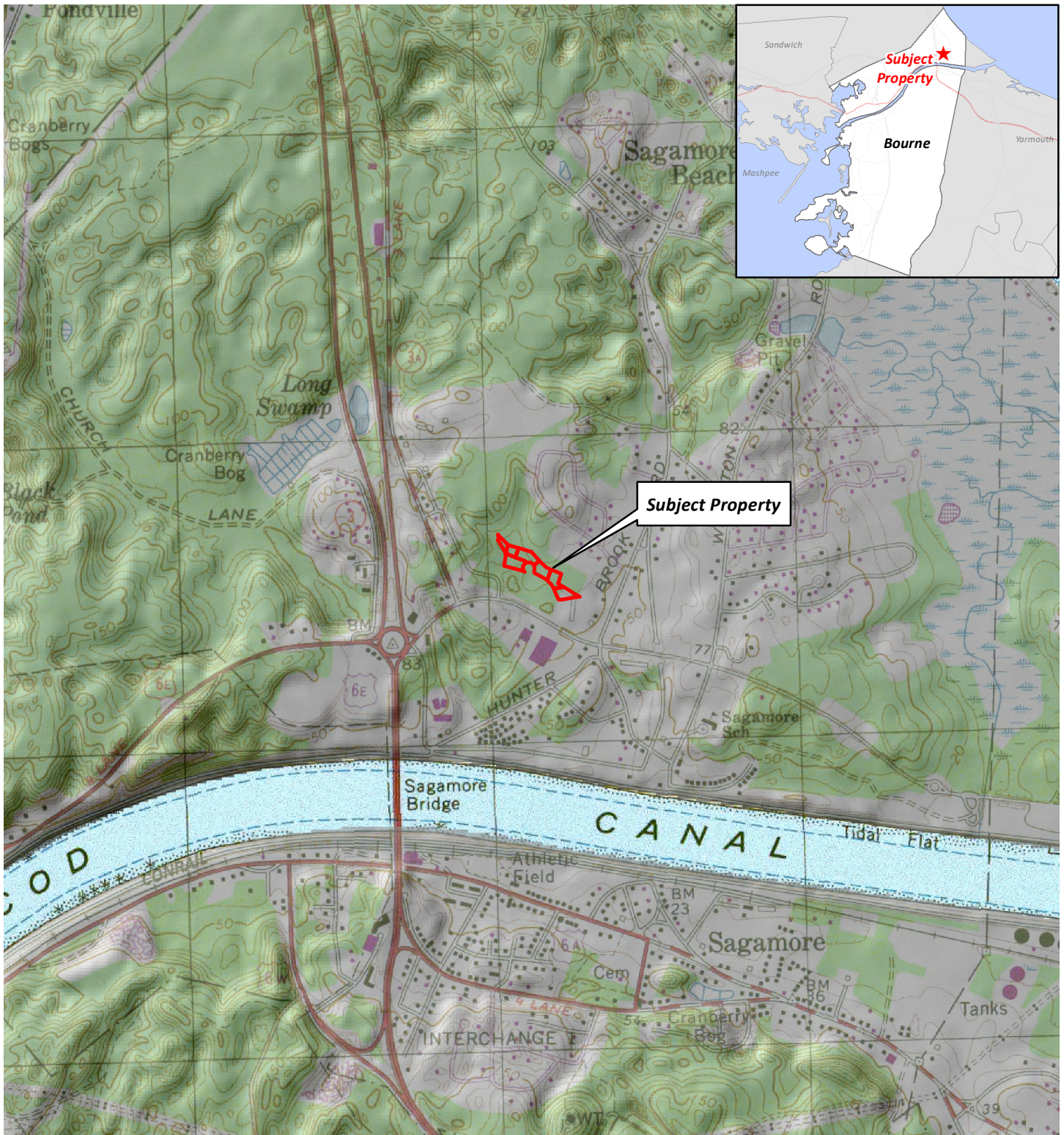
2.6 School impact

Under M.G.L. c. 40B, ss. 20-23, the possible impact of an affordable housing project on school facilities is not a factor that can be considered by the ZBA. See *Silver Tree Limited Partnership v. City of Taunton Board of Appeals*, Housing Appeals Committee Docket No. 86-19, Decision dated October 19, 1988: "...we cannot escape the fact that the provision of municipal services, particularly adequate schoolroom facilities and school infrastructure, remains a municipal obligation. If there are problems, they are problems which the municipality must solve one way or another. *It cannot solve the problem by denying this application which deals with another municipal duty, imposed under a legislative policy which in effect requires Taunton to grant Comprehensive Permits in cases where the proposal meets the qualitative requirements in the statute up to the point where Taunton has met the quantitative minima prescribed in Section 20.*

"This is the position that the Committee has taken in every case where a municipality has argued that an application for a Comprehensive Permit would burden school facilities."

This holding is in fact memorialized in the Chapter 40B Regulations concerning municipal services. See 760 CMR 56.07(2)(b)4. Also see *Dexter Street LLC. V. North Attleborough Board of Appeals*, Housing Appeals Committee Docket No. 00-01, Decision dated July 12, 2000.

FIGURES



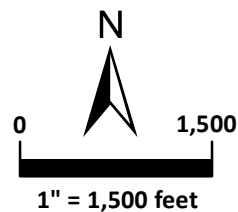
Document Path: H:\Projects\2019\19038 Cape View Way\19038A Survey-Environmental Services Cape View Way\GIS\Maps\USGS_Locus.mxd

Legend



Subject Property

*Hyannis Topographic Quadrangle



Horsley Witten Group
Sustainable Environmental Solutions

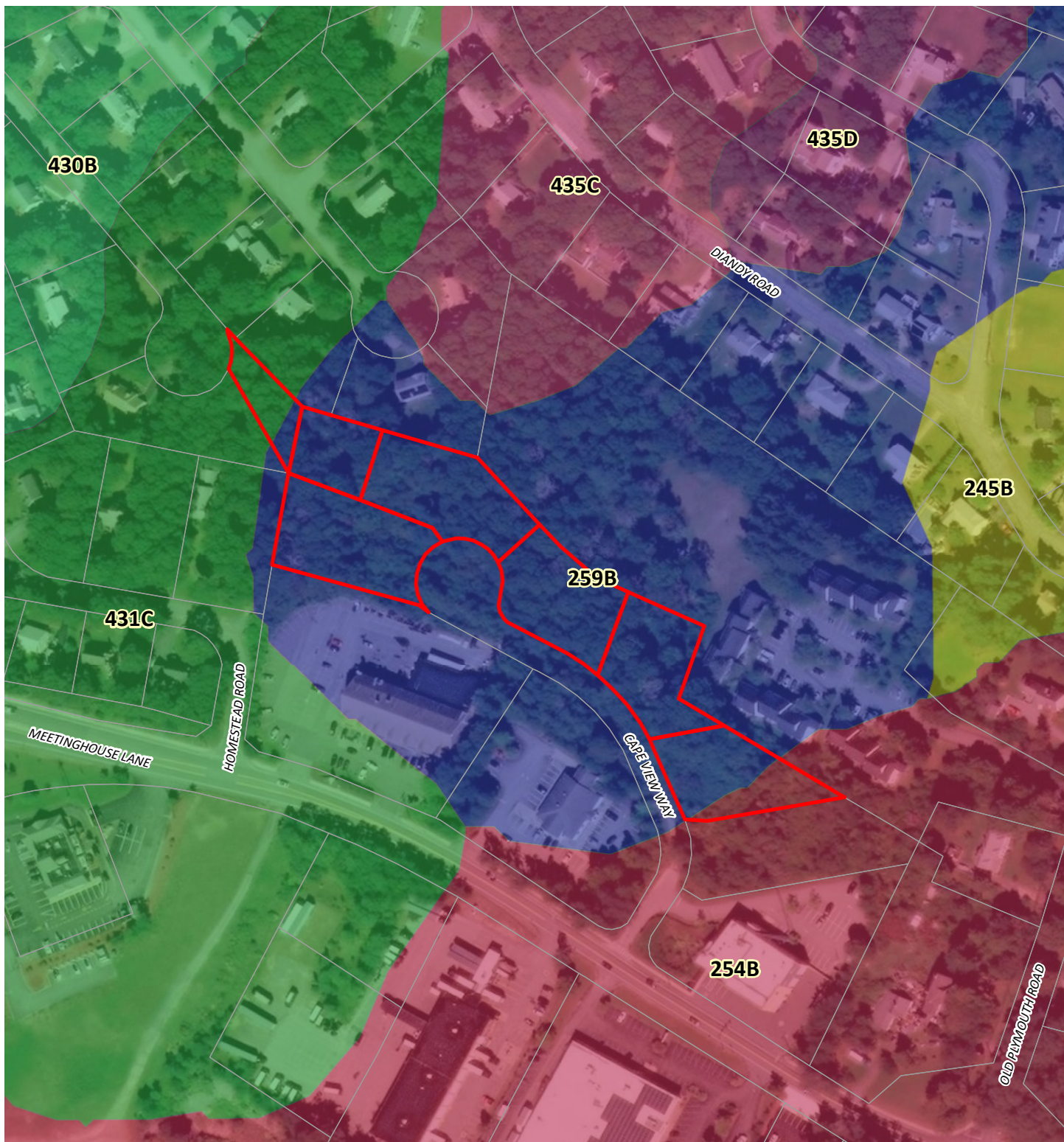
90 Route 6A • Unit 1 • Sandwich, MA 02563
508-833-8600 • horsleywitten.com



USGS Locus
Cape View Way
Bourne, MA

Date: 6/13/2019

Figure 1



Document Path: H:\Projects\2019\19038 Cape View Way\19038A Survey-Environmental Services Cape View Way\GIS\Maps\Soils.mxd

Legend



Subject Property



Parcels

MUSYM, compname, hydgrp



245B, Hinckley, A



259B, Carver, A



430B, Barnstable, B



431C, Barnstable, B

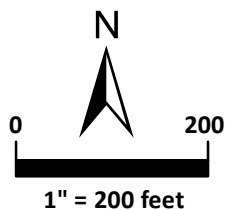


435C, Plymouth, A



435D, Plymouth, A

*Soils - MassGIS 2012



Horsley Witten Group
Sustainable Environmental Solutions

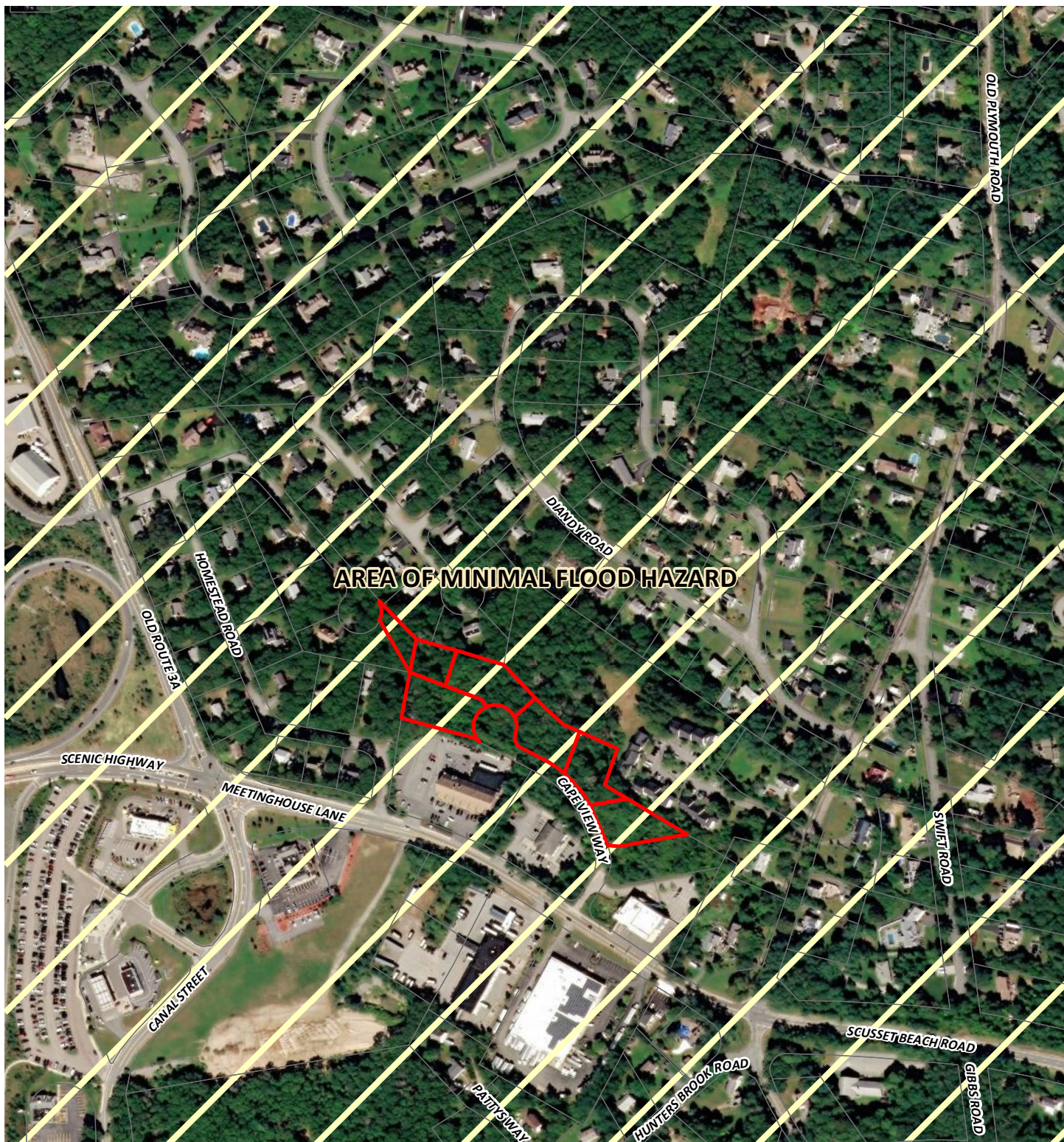
90 Route 6A • Unit 1 • Sandwich, MA 02563
508-833-8600 • horsleywitten.com



NRCS SSURGO-Certified Soils
Cape View Way
Bourne, MA




Date: 6/13/2019

Figure 2

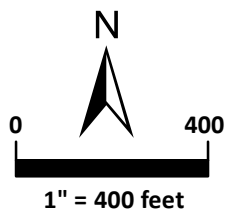


Document Path: H:\Projects\2019\19038 Cape View Way\19038A Survey-Environmental Services Cape View Way\GIS\Maps\FEMA.mxd

Legend

-  Subject Property
-  Parcels
-  Zone X - Area of Minimal Flood Hazard

*FEMA's National Flood Hazard Layer, 2014



Horsley Witten Group
Sustainable Environmental Solutions

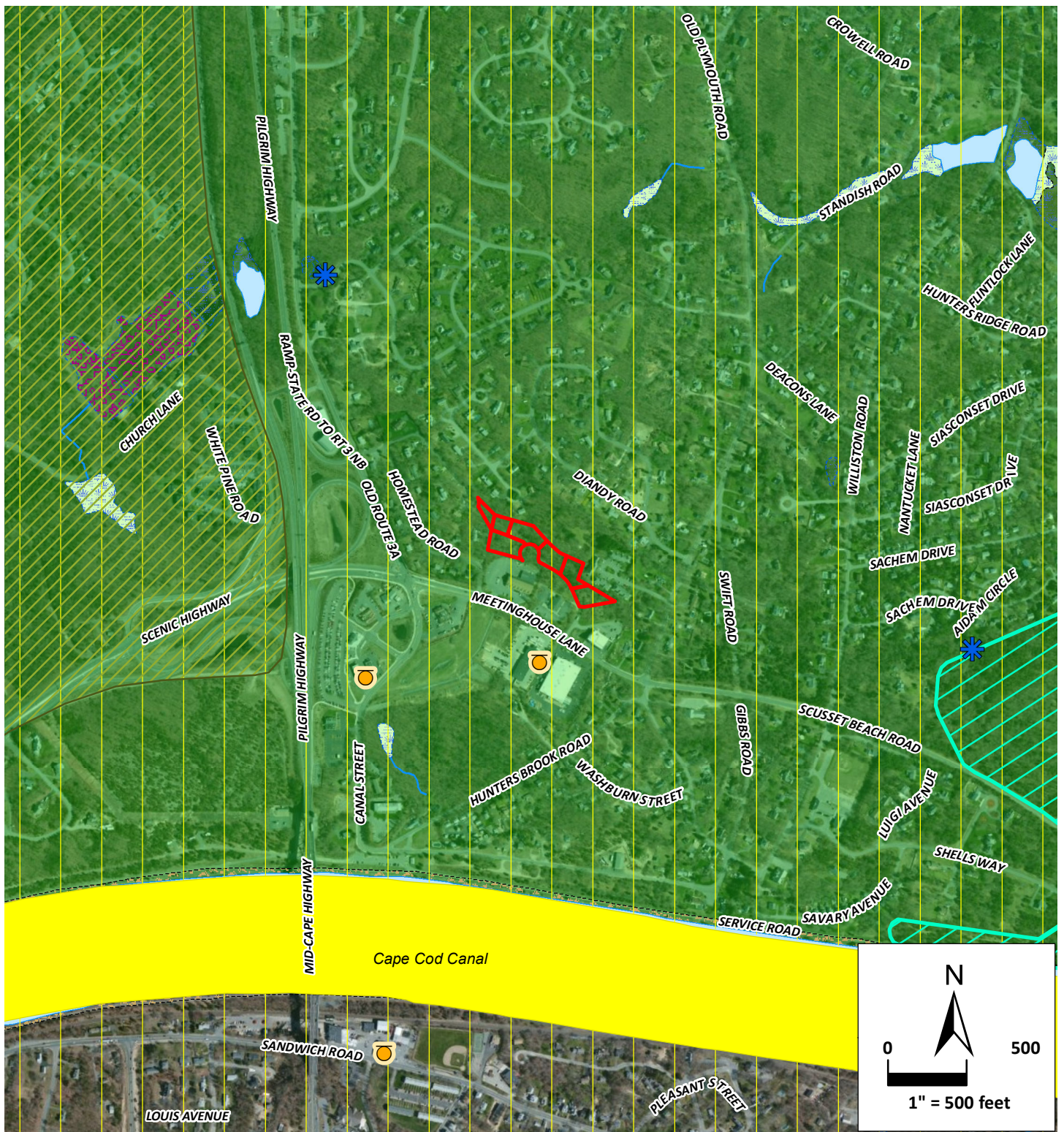
90 Route 6A • Unit 1 • Sandwich, MA 02563
508-833-8600 • horsleywitten.com



**FEMA's National Flood
Hazard Layer
Cape View Way
Bourne, MA**

Date: 6/13/2019

Figure 3



Document Path: H:\Projects\2019\19038 Cape View Way\19038A Survey-Environmental Services Cape View Way\GIS\Maps\Existing_Constraints_Update.mxd

Legend

*GIS Data - MassGIS

- | | | | | | |
|--|----------------------------------|--|-----------------------|--|---|
| | Subject Property | | Marsh/Bog | | NHESP Priority Habitats of Rare Species |
| | Parcels | | Wooded marsh | | NHESP Estimated Habitats of Rare Wildlife |
| | Underground Storage Tanks | | Open Water | | NHESP Certified Vernal Pools |
| | Sole Source Aquifer | | Beach/Dune | | ACECs |
| | 4A -Impaired - TMDL is completed | | Hydrologic Connection | | High Yield Aquifer |

Horsley Witten Group
Sustainable Environmental Solutions

90 Route 6A • Unit 1 • Sandwich, MA 02563
508-833-6600 • horsleywitten.com



Existing Constraints
Cape View Way
Bourne, MA

Date: 4/22/2021

Figure 4

APPENDIX A

Peer Review Letters and Response

Date September 27, 2021
To Bourne Zoning Board of Appeals
From Thomas C. Houston, PE, AICP
Project Cape View Way Comprehensive Permit Project
Subject Peer Review of the Second Submittal of Civil Engineering/Septic Design

Professional Services Corporation, PC (PSC) reviewed the First Submittal of the Site Plans, Stormwater, and related design for the Cape View Way Comprehensive Permit Project (Proposed Project) and issued our peer review memorandum on August 11, 2021.

We are now in receipt of as the Second Submittal of the Site Plans and Stormwater Report as well as the response to comments submitted by the engineer of record, the Horsley Witten Group, Inc. (HSG).

PSC's August 11th comments are restated herein in standard font, HSG's August 14th responses are restated in italic font, and PSC's evaluation of responses is provided in bold font. Comment numbers 1 through 62 correspond to the comment numbers in our August 11th memorandum. Comment numbers 63 through 79 have been added to summarize our review of the revised septic system design.

SECOND SUBMITTAL

- A. "Horsley Witten Group Memorandum Re Cape View Way Civil Engineering/Site Design Peer Review Responses," prepared by the Horsley Witten Group, Inc., dated September 14, 2021.



Memorandum
September 27, 2021
Page 2

- B. "Cape View Way Permitting Plans, Bourne Massachusetts, September 2021," prepared by the Horsley Witten Group, Inc, containing 23 sheets, signed and sealed September 13, 2021.
- C. Stormwater Analysis and Drainage Report, Cape View Way, Bourne, Massachusetts, prepared by the Horsley Witten Group, Inc., dated March 5, 2021, revised September 10, 2021.
- D. Cape View Bourne 40B Application Waivers Updated 210909.
- E. Preservation of Cape Code and Housing Assistance Corporation, Cape View Way 40B Project, Further Details Regarding the Requested Subdivision Regulation Waivers, May 13, 2021 (Revised September 9, 2021)
- F. Cape View Way Permitting Plans, Bourne Massachusetts, Landscape Rendering, prepared by the Horsley Witten Group, Inc. containing 21 sheets, dated March 5, 2021.
- G. Cape View Way, Bourne, Massachusetts, Existing Conditions, prepared by the Horsley Witten Group, Inc., dated June 2019.
- H. Photometric Study – Run 2 – King Luminare & Heper, prepared by speclines and manufacturer's literature.
- I. Town of Bourne Board of Appeals, Comprehensive Permit Application, Pursuant to MGL Ch. 40B § 20-23 and 760 CMR 56.00.
- J. Development Agreement by and between Preservation of Affordable Housing, Inc. ("POAH") and Housing Assistance Corporation ("HAC," and jointly with POAH, the "Developer") and the Bourne Housing Authority

REFERENCE

- A. Town of Bourne Zoning Bylaw, as most recently the special town meeting, October 2019, printed February 13, 2020.
- B. 2021 Approved Zoning Bylaws, Approved ATM 2021 zoning article for Lowland Regulations.
- C. Town of Bourne General Bylaws, Section 3.7 Wetland and Natural Resources Protection.



SUBDIVISION

The Applicants intend to modify the layout of Cape View Way which was created by the Meeting House Subdivision (1987) while combining the five of the original subdivision lots into a single parcel.

The status of the “Meetinghouse Place” subdivision should be researched to determine if the approved subdivision is valid and was recorded in the registry of deeds. The 1987 Planning Board Decision should be reviewed to determine if there are sunset provisions. If the subdivision has expired there may be the requirement to upgrade the subdivision to comply with the current Planning Board Rules and Regulations. It should be noted that the northwesterly segment of the subdivision roadway has a new alignment, and the cul-de-sac has a revised layout and is in a different location.

1. Determine if the “Meetinghouse Place” subdivision was recorded in the registry of deeds.

HWG: The “Meetinghouse Place” subdivision plan as endorsed by the Planning Board was duly recorded on August 12, 1987, in the Barnstable Registry of Deeds at Book 437, Page 50. A copy of the recorded subdivision plan is attached hereto as Exhibit A.

PSC: We sought information as to whether the Meeting House Subdivision (1987) was recorded and remains valid. Based upon the information provided in this response and in the response to Comment 2, we reach the position that the Meeting House Subdivision (1987) was recorded and remains valid. Under the pending Comprehensive Permit Application, the Applicant seeks to modify both the right-of-way and construction requirements of Cape View Way.

However, review of the Meeting House Subdivision (1987) reveals that the boundaries of the Subdivision extended beyond the land included in the current Comprehensive Permit application. The Meeting House Subdivision (1987) included lots 1 and 2 now owned by Gately as Trustee of the Ostek Family Irrevocable Trust (Ostek Lot) and used as the post office and lots 3, 4, and 5 which are owned by the Town and are used as Bourne Fire Department Station 3 (Town Lot). Further, no information is provided as to who owns the right-of-way of Cape View Way. Where the subdivision was never constructed and never accepted, the right-of-way may be owned by the 1987 developer, Equity Associates Trust. Alternatively, the right-of-way may be owned by the abutting lots to the centerline.



We believe that all parties having an ownership interest in the subdivision must be parties to the pending application for subdivision modification, either through written agreements consenting to the Applicant's petition or as co-applicants on the subdivision modification.

With respect to the Town Lot (fire station), we believe that agreements affecting interests which the Town may have in real property require a super majority vote of the Town meeting.

The submitted plan shows the existing Cape View Way right-of-way being terminated within the roadway segment abutting the Ostek Lot. Between the proposed point of termination and the west property line of the Ostek Lot land within the abandoned segment of the right-of-way is either owned by the Ostek Family Irrevocable Trust to the centerline of the right-of-way or it is owned by Equity Associates Trust for the full width of the right-of-way. This land is not available for incorporation into the Project Site.

These ownership interest issues can be resolved by agreement among the parties. Alternatively, a title opinion and potentially a land court decision may be required to establish ownership and further revision of the subdivision modification as currently proposed may be required to protect these ownership interests. The ZBA which in this instance has authority to grant subdivision approval or modification, can choose to require equitable resolution of these ownership issues prior to Decision.

Alternatively, the ZBA can issue a Decision on the subdivision as currently submitted and require clarification of ownership interests and potential further modification of the currently proposed subdivision modification to protect these interests prior to Building Permit as a Condition of Approval.

We recommend that the Board seek advice of Town Counsel in this matter.

Upon review of the Meeting House Subdivision (1987), we also note that an approximately 15-foot-wide strip of land has been added along the south boundary of original Lot 10. Please confirm that this lot boundary is accurately shown.

2. Determine if the 1987 Planning Board "Decision" contains sunset provisions which after a specified period either voids an unconstructed subdivision or requires upgrades to comply with the current Planning Board Rules and Regulations as a condition of extending the unconstructed subdivision.

HWG: The 1987 Subdivision Decision does not contain an automatic sunset provision and the 1987 Subdivision approval is still in force and effect. A copy of the June 30, 1987 Subdivision Decision is attached hereto as Exhibit B.



The June 30, 1987 Subdivision Decision has a condition that construction of the Meetinghouse Place Subdivision shall be completed within a two year period; however, the Town Clerk's Office provided us with the subdivision regulations that were in effect when the 1987 Subdivision was approved and the regulations, at that time, did not provide for automatic rescission of the approval of a subdivision due to lack of compliance with the construction schedule contained in the decision; and, instead, the regulations provided that, if the construction schedule imposed by the Planning Board was not satisfied "within seven years of the approval of the Definitive Plan," then that would simply "constitute reason for the Planning Board to consider rescission of such approval within the requirements and procedures of Section 81W, Ch.41. G.L." There is no evidence that the Planning Board took any steps to rescind the 1987 subdivision approval.

The subdivision regulations in effect when the 1987 Subdivision was approved did provide that a subdivision approval would be automatically rescinded if the endorsed subdivision plan was not recorded within six months of Planning Board approval; however, the 1987 Subdivision Plan was recorded on August 12, 1987, well within six months of the June 30, 1987 subdivision approval decision.

Subdivision Modification

The Applicants note that the Zoning Board of Appeals, acting under MGL c.40B, §§ 20-23, may modify, amend, or rescind the 1987 Subdivision Decision and the 1987 Subdivision Plan without regard to the statutory restrictions that would apply when a planning board acts to modify or amend or rescind a subdivision under MGL c.41, §81W. The Appeals Court has expressly concluded that MGL c.41, §81W "has no effect on a zoning board of appeals and in no way limits that board's authority under G.L. c.40B." Blue View Construction, Inc. v. Town of Franklin, et al., 70 Mass. App. Ct. 345, 353, review denied 450 Mass. 1105 (2007).

However, to avoid confusion and to provide full clarity for the record, the Applicants request that, when the Zoning Board of Appeals approves the proposed plan, that it do so using the following or similar language:

- *The plan approved under this decision (the "40B Plan") shall supersede the 1987 Subdivision Plan recorded at Barnstable Registry of Deeds Plan Book 437, Page 50 (the "1987 Plan") as follows:*
 - *The Lots 6-10 and Open Space Lot on the 1987 Plan shall be reconfigured as shown on the 40B Plan into one parcel (the "40B Parcel").*



- *The Way on the 1987 Plan shall be reconfigured as shown on the 40B Plan.*
- *The Way on the 1987 Subdivision, as reconfigured and approved under the 40B Plan, shall provide access only to the 40B Parcel and to the former 1987 Subdivision Lot 5 (said Lot 5 having been combined and merged with Lots 3 and 4 on the 1987 Plan (the site of the Bourne Fire Station at 51 Meetinghouse Road)).*
- *The Board determines that the Way shown on the 40B Plan approved hereunder provides sufficient access for the 40B Project and for the rear parking lot of the Bourne Fire Station at 51 Meetinghouse Road and that all frontage requirements that are necessary to support the Project and the Fire Station either are satisfied or are hereby waived.*
- *The June 30, 1987 Subdivision Decision is hereby modified to remove "Condition d" which provided that Lot 5 (i.e., now the rear parking area for the Fire Station) was restricted and "shall become a residential and not a business lot."*

PSC: Based on the information provided we reach the position that the 1987 subdivision was recorded and remains valid. Any subdivision modification should be subject to equitable resolution of property ownership issues. We take no exception to the proposed approval language. See evaluation of responses to Comments 1, 3, 4, 5, and 6.

3. Either apply to the Zoning Board of Appeals (acting as Planning Board) for a new definitive subdivision approval or for modifications to an approved subdivision if the subdivision remains valid. In either case the subdivision road is eligible to apply for approval, the issue is to identify the appropriate procedure.

HWG: See answer to comment 2 above.

PSC: The applicant has applied for modification of the Meeting House Subdivision (1987) which can be granted subject to equitable resolution of ownership issues. See evaluation of responses to Comments 1, 2, 4, 5, and 6.

4. In the drop off area at the main building entrance, revise the cul-de-sac island to accommodate fire apparatus and any large vehicles expected to use the site requires a new subdivision approval or modification.



HWG: The Applicant has included the emergency vehicle turning radius template with this memo to show that a fire truck is able to use the turnaround as well as a letter from Assistant Fire Chief Pelonzi regarding fire access at the proposed site.

PSC: Resolved.

5. As the subdivision roadway is unconstructed it cannot currently provide vital access. Therefore, procedurally the Applicants must petition to merge the subdivision lots under the subdivision process (with the ZBA acting as Planning Board). Given the incomplete construction of the subdivision road (no vital access), lots cannot be combined through the ANR or 81P process.

HWG: See response to comment 2 above.

PSC: Resolved; lots can be combined as shown on Sheet C-3 through subdivision modification.

6. Provide a subdivision plan complying with all requirements for recording in the registry of deeds.
 - a. Provide a signature block for the ZBA (serving as Planning Board) to endorse the plan.
 - b. Show metes and bounds for the Cape View Way layout. The general requirement of the registry of deeds is that sufficient geometric data must be provided to allow all points on the layout to be field located.
 - c. Show bounds to define the layout.
 - d. Record the approved plan in the Registry of Deeds.

HWG: The Applicant will provide a subdivision plan with all requirements for recording in the registry of deeds when the Site Plan Review is complete.

PSC: A subdivision modification can be granted subject to equitable resolution of the property ownership issues. See our evaluation of the response to Comment 1. In our opinion, only a single plan sheet showing the proposed subdivision "lot" need be prepared. Sheet 3 and serve as the basis for preparing the Definitive Subdivision Plan. The subdivision plan should be submitted prior to the ZBA prior to the vote to modify the existing Definitive Plan and prior to the ZBA vote on the overall project. We recommend seeking an opinion from Town Counsel as to whether separate notice is required prior to final action on the Definitive Subdivision Plan. Sheet C-3 of the plan set could be modified to serve as the Definitive Subdivision Plan with revisions which include the following:



- a. Add the title "Definitive Subdivision Plan"
- b. Provide a signature block for the ZBA (serving as Planning Board) to endorse the plan and the Town Clerk block.
- c. Show bounds (permanent monuments) to define the layout (PC, PT, and corner roundings).
- d. The new lot (all land outside the right-of-way) should be labeled as "Lot 1" with the area and area of upland stated.
- e. Show the Zoning District.
- f. The current lots be labeled as "Former Lot 86," "Former Lot 88," etc.
- g. The edge of right-of-way beyond the roadway terminus should be shown with dashed lines and the right-of-way labeled as "To Be Abandoned." Graphically, Lot 1 should be depicted so it is clear it includes the segment of the former right-of-way that is to be abandoned.
- h. Properties at 45 Meetinghouse Lane (original subdivision Lots 1 and 2) and 51 Meetinghouse Lane (original subdivision Lots 3, 4, and 5) should be graphically depicted so it is clear that they are included in the subdivision modification.
- i. Note that 51 Meetinghouse Lane (original subdivision Lots 3, 4, and 5) must be shown in their entirety.
- j. Graphically show the perimeter of the subdivision more prominently and adjust line weights for non-subdivision lots so it is clear what land is included in the subdivision.

Prior to building permit, the final modified Definitive Subdivision Plan should be recorded in the Registry of Deeds.

ZONING

The Applicants request waiver of certain provisions of the Town of Bourne Zoning Bylaws as follows: "Inspector of Buildings, Zoning Enforcement" (ZBL §1210), "Certification" (ZBL §1220), "Site Plan Special Permit Approval" (ZBL §1230), "Maximum Lot Coverage" (ZBL §2454), "Maximum Building Height" (ZBL §2455), "Enforcement.(ZBL §2460), "Subdivision Control Law Compliance" (ZBL §2498), "Rate of Development Scheduling" (ZBL §2640), "Exemptions.(ZBL §2650), "Table of" (*Parking*) Requirements" (ZBL §3320), "Number of Plants" (ZBL §3512(II)), "Parking Area Plantings" (ZBL §3513(IV)), "Natural Cover Removal" (ZBL §3570), "Earth Removal" (ZBL §4400)

In addition to requested waivers, additional waivers of strict compliance may be required.



7. Determine compliance or request waiver of strict compliance with the provisions of “Lot Shape” (ZBL §2480).

HWG: The perimeter of the lot is approximately 2,581 feet and the total area of the lot is 157,598 square feet. Therefore, the proposed project does not comply with the Lot Shape requirement (ZBL §2480). The Applicant will submit to ZBA a waiver from this requirement.

PSC: OK: waiver of strict compliance to be requested.

The Project Site is located in the R-40 Zoning District. The Town of Bourne Zoning Bylaw (ZBL) provides for single family residential and two-family use in the R-40 District (ZBL §2200). As a mid-rise multifamily residential use, the Proposed Project does not comply with the use and certain dimensional requirements of the R-40 District. The Applicants have requested waiver of certain provisions of the R-40 District. These waivers are necessary in order to allow the Proposed Project to be constructed as submitted. The Applicants zoning analysis and the waiver requests presume Cape View Way has the status of a way. See Comments 1 through 5.

The proposed project complies with the requirements of the R-40 District with respect to minimum lot area of 40,000 square feet (100,000+ square feet provided), the minimum frontage of 125 feet (125+ feet provided), the minimum side yard of 15 feet (15+ feet provided), and minimum usable open space of 20 percent (64% provided) (ZBL §2500).

8. The submittal states the usable open space provided is 64% of the lot area. Explain the apparent inconsistency of 47% total impervious materials coverage versus 68% total open space per the “Tabulation of Ground Area Coverages” in the Application.

HWG: The Applicant has reviewed this information and corrected it below and on the site plans. The areas have changed from the original submission due to the changes in the proposed subdivision plan.

PSC: Resolved; the “Tabulation of Ground Coverages” Table is revised to show total impervious coverage is 39%; total open space is 61%.

The applicants request waiver of strict compliance with the certain dimensional requirements of the R-40 District with respect to minimum front yard setback of 30 feet (10 feet provided), minimum rear yard of 15 feet (7.8 feet provided), maximum lot coverage of 20% (32% provided), and maximum building height of 35 feet (38.9 feet provided) (ZBL §2500).



STORMWATER

The site is provided with a stormwater management system that collects, treats, and infiltrates stormwater on site. Based upon on site wetlands, the Proposed Project is subject to the Massachusetts Wetlands Protection Act (MGL c. 131, § 40) and the stormwater management system must comply with the DEP Stormwater Standards and with the guidance of the Massachusetts Stormwater Handbook. The stormwater management system must also comply with Town of Bourne stormwater management requirements (unless waived) as set forth in the zoning bylaw and the Subdivision Rules and Regulations of the Planning Board.

Compliance with the Massachusetts Stormwater Standards

We evaluated the discussion of compliance the Massachusetts Stormwater Standards provided in the Stormwater Analysis and Drainage Report, and we conclude as follows:

Standard 1: No New Untreated Discharges or Erosion to Wetlands. There is no proposed discharge to wetlands.

HWG: No response required

PSC: No response is required.

Standard 2: Peak Rate Attenuation. Stormwater management system shall be designed so that post development peak discharge rates do not exceed pre-development peak discharge rates. The submitted Stormwater Analysis and Drainage Report tentatively demonstrates compliance. However, supplemental soils testing is required for final confirmation of compliance. See evaluation of response to Comment 11.

HWG: See response to Comment 11 below.

PSC: Resolved; peak rate attenuation will be confirmed by requiring a Massachusetts Soil Evaluator to confirm soil textures during construction and by redesign if soil textures observed during construction are not consistent with the submitted design.

Standard 3: Stormwater Recharge. Loss of the annual recharge to groundwater shall be eliminated or minimized through the use of infiltration measures, including environmentally sensitive site design, low impact development techniques, stormwater management best practices, and good operation and maintenance. As a minimum, the annual recharge from the post development site shall approximate the annual recharge from the pre-development site based on soil type. The standard is met when the stormwater management system is designed to infiltrate the required recharge volume as determined in accordance with the Massachusetts Stormwater Handbook. The stormwater management system. The submitted Stormwater



Analysis and Drainage Report tentatively demonstrates compliance. However, supplemental soils testing is required for final confirmation of compliance. See evaluation of response to Comment 11.

HWG: See response to Comment 11 below.

PSC: Resolved; soil texture to be verified during construction. See evaluation of response to Comment 11.

Standard 4: Water Quality. Stormwater management systems shall be designed to remove 80% of the average annual post-construction load of Total Suspended Solids (TSS). This Standard is met when: 1) suitable practices for source control and pollution prevention are identified in a long-term pollution prevention plan, and thereafter are implemented and maintained; 2) structural stormwater best management practices are sized to capture the required water quality volume determined in accordance with the Massachusetts Stormwater Handbook; and 3) pretreatment is provided in accordance with the Massachusetts Stormwater Handbook. The submitted Stormwater Analysis and Drainage Report tentatively demonstrates compliance; however, additional pretreatment must be provided for the CB 100 infiltration system.

HWG: A Flexstrom® Pure Permanent Inlet Protection has been added to all catchbasins to provide additional pre-treatment.

PSC: Refer to Comment 26.

Standard 5: Land Uses with Higher Potential Pollutant Loads (LUHPPLs). This standard is not applicable for the Project Site.

HWG: No response required.

PSC: No response required.

Standard 6: Critical Areas. The Project Site does not fall within a Critical Area as defined by the SWH and compliance with this standard is not required.

HWG: No response required.

PSC: No response required.

Standard 7: Redevelopment Project. This standard is not applicable for the Project Site.

HWG: No response required.

PSC: No response required.

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Controls: The Applicant has provided sufficient information to demonstrate compliance.

HWG: No response required.

PSC: No response required.



Standard 9: Operation and Maintenance Plan. The Applicant has provided sufficient information to demonstrate compliance.

HWG: No response required.

PSC: No response required.

Standard 10: Prohibition of Illicit Discharges. An Illicit Discharge Compliance Statement has not been submitted.

9. Submit or state the timing for submittal of an Illicit Discharge Prohibition Statement.

HWG: The Applicant has updated the Stormwater Report to include this statement.

PSC: Resolved; the stormwater report states that an Illicit Discharge Prohibition Statement provided in the SWPPP.

Soils

The natural Resource Conservation Service mapping provided in the Stormwater Report classifies most of the on-site soils as “Carver Loamy Sand, 3 to 8 percent slopes (259B)” and a portion in the south portion of the site as Hinkley Loamy Sand, 3 to 8 percent slopes (245B). Both of these soil groups are well drained and are classified as Hydrologic Soils Group A (HSG A).

Numerous test pits have been excavated on the site and show a reasonably consistent soil profile. With some exceptions, the test pits show surface layers of Sandy Loam underlain by Sand. Test Pits E and F located in the northwest portion of the site are an exception. They show upper layers of Sandy Loam underlain by Gley Silt Loam, which is underlain by Fine Sandy Loam and sand or sand.

The Stormwater Handbook specifically requires soil testing at the location of the infiltration Best Management Practice (BMP). The on-site stormwater management system includes 6 subsurface structures including 4 URC systems with “Stormtech MC-3500” units and 2 precast concrete Recharge Basin (RB) systems. For the Storm Tech MC 3500 units, the Stormwater Handbook bases test pit requirements on the requirements for infiltration trenches. For URC-1 five test pits are required and for URC-2, URC-3 and URC-4, two test pits are required for each. There are no test pits located at any of the six on site infiltration BMP's which is not in compliance with the Stormwater Handbook. Due uniformity of the sites soil profile, it may be possible to defer additional testing until the construction phase. We recommend that the Sandy Loam layers be removed down to the sand layers and the excavation backfilled with Title 5 sand in order to ensure long term operation of the infiltration BMP's. We recommend that removal of the Sandy Loam be verified on-site by the engineer of record. The requirement for



on-site observation of removal of the Sandy Loam layers can be combined with on-site verification of the textural classification of sand layers at lower levels. The Applicants assume some risk that the subsurface structures may have to be redesigned; however, there is room on-site for expansion of these BMPs if required.

10. Revise the drawings to require on-site observation of removal of the sandy loam layers and backfilling with Title 5 sand at each of the 6 subsurface structures during construction.

HWG: The Applicant has added the following note "A registered Massachusetts soil evaluator must assess soil at every subsurface infiltration structure prior to installation to ensure consistency with the design."

PSC: We recommend inclusion of a Condition of Approval in any favorable Decision requiring that a Massachusetts soil evaluator shall assess soil at every subsurface infiltration structure prior to installation to ensure consistency with the design and in any instance where sandy loam remains below the bottom of stone, it shall be replaced with Title 5 sand.

11. Revise the drawings to require on-site soil texture classification by a Massachusetts Soil Evaluator at each of the 6 subsurface structures during Construction and to require design revisions if location specific soil data is not consistent with the submitted design.

HWG: The Applicant has added the following note on sheet C-8: "On-site soil texture classification by a Massachusetts Soil Evaluator at each of the 6 subsurface structures will be conducted during Construction and to require design revisions if location specific soil data is not consistent with the submitted design."

PSC: Resolved.

Calculations.

Revise the HydroCAD calculations as follows:

12. Limit sheet flow length to 50 feet in determining the time of concentration.

HWG: The Applicant has revised the HydroCAD calculations to limit sheet flow to 50 feet.

PSC: Resolved.

13. Revise the first flush calculations using 1.7 inches per the subdivision regulations.



HWG: The Applicant has requested a waiver from this requirement. The Massachusetts Stormwater Management Handbook requires 1 inch for calculating the water quality volume.

PSC: For the rapidly permeable soils found at the Project Site, the Massachusetts Stormwater Handbook allows use of 1-inch in calculating the water quality volume. Given that 1-inch is now the standard in Massachusetts, waiver of strict compliance with the local standard of 1.7-inches can be considered.

14. Add flow path to the watershed maps.

HWG: The flows paths have been made more prominent, so they are visible on the drainage maps. The updated drainage maps are included in the revised Stormwater Report.

PSC: Resolved.

Infiltration structures.

Subsurface structure peak water elevations are shown on sheet 15. However, the data is not labeled to show the URC system for which the peak elevations are determined. The top row of the chart which appears to show elevations for URC-1 the elevations do not match the HydroCAD Reports. The “Underground Chambers, Design Storm Elevations” table on sheet 15 should be deleted and replaced with a new table on sheet C-8 or C-9.

15. Revise the “Underground Chambers, Design Storm Elevations” table on sheet 15 to include labels for the rows as URC-1, URC-2, URC-3, URC-4. Revise the WQv (for 1.7-inch) peak elevation and add the 2-yr. peak elevation. The elevations in the top row do not appear to match the HydroCAD calculations.

HWG: The Applicant has requested a waiver from the 1.7-inch WQv requirement. The Massachusetts Stormwater Management Handbook requires 1-inch for calculating the water quality volume.

PSC: The “Underground Chambers, Design Storm Elevations” table has been revised. Refer to Comment 13 with respect to the 1.7-inch requirement.

16. Supplement the URC “Specifications” table on Sheet 17 providing the elevations for the bottom of stone elevation, bottom of structure elevation, top of structure elevation, top of stone elevation. Alternatively, this information could be labeled for each structure on Sheets C-8 and C-9.

HWG: The Applicant has provided this information on Sheet C-19 in the revised plan set.



PSC: Resolved.

17. Due to the maintenance burden, revise structure URC-1 to provide a single isolator row.
HWG: The Applicant has revised URC-1 to provide a single isolator row.

PSC: Resolved.

18. A double-ring infiltrometer test was performed at TP-F which resulted in an infiltration rate of 7.0-inches/hour. This infiltration rate was used to design URC-3. Although contiguous to URC-3, subsurface structure URC-2 is designed with an infiltration rate of 8.27-inches per hour. Revise the design of URC-3 using an infiltration rate of 7.00-inches per hour or provide two test pits substantiating the design infiltration rate of 8.27-inches per hour.

HWG: The Applicant has revised the HydroCAD calculations to use an 8.27-inches per hour infiltration rate for the design of URC-3, which is consistent with the soils observed in this area.

PSC: There is only one test pit in the vicinity of URC-2, URC-3, and URC-4 which is not sufficient. However, soils though much of the site are consistent. Therefore, we have agreed to allow soils testing during construction along with revision of the infiltration structures if required in order to use the infiltration rates based on actual soil texture. If the subsurface structures have to be enlarged, there is sufficient room on-site to accommodate larger footprints.

19. Provide time to drain calculations for URC-1, URC-2, URC-3, URC-4.

HWG: The Applicant has added the time to drain calculations in the revised Stormwater Report.

PSC: Resolved; all these structures drain in less than 72 hours.

20. Revise the design of Bioretention Area 2 in order to accommodate the revised island geometry at the building entrance. See evaluation of response to Comment.

HWG: The Applicant has revised the HydroCAD calculations to include the revised island geometry (i.e., drop off zone). Bioretention Area 2 was oversized and revising the area is not required. Due to minor changes in the drainage areas for the roof and the turnaround area, URC-4 has been changed from 15 to 12 chambers.

PSC: Resolved.



21. Provide requirements for bulkheading subsurface structures until the site is fully stabilized.
HWG: The Applicant has added an additional note on sheet C-2 of the revised plan set.
PSC: Resolved.

Treatment BMPs

22. The Water Quality Volume used in the sizing of the Bioretention Areas and the Tree Trenches is based on the 1-inch rainfall, not the 1.7-inch rainfall required by the Planning Board Rules and Regulations (PBR §352 D 1).
HWG: The Massachusetts Stormwater Management Handbook requires 1 inch for calculating the water quality volume. The Applicant has requested a waiver from this requirement.
PSC: We acknowledge that the Stormwater Handbook uses 1-inch in calculating the water quality volume in rapidly permeable soils. Refer to Comment 13.
23. Label the Sidewalk Inlet Grate on sheets C-8 and C*9 and reference the detail on Sheet 16.
HWG: Labels have been added to the Sidewalk Inlet Grate on sheets C-6 and C-8 of the revised plan set.
PSC: Resolved.

Collection System

24. Label pipe diameters, materials, and slopes.
HWG: The Applicant has provided labels on the revised plan set.
PSC: Resolved.
25. Relocate DMH 200 and eliminate the acute reverse flow angle.
HWG: DMH 200 has been adjusted to reduce the reverse angle.
PSC: Resolved; stormdrain system revised and DMH 200 is eliminated.
26. The CB 100 – RB 101 – RB 102 system provides 25% TSS removal prior to discharge to the infiltration BMP whereas 44% TSS removal is required.
HWG: Flexstorm® Pure Permanent Inlet Protection inserts have been added to all catch basins to provide additional 25% TSS removal. The manufacturer information has been added to the appendices of the Stormwater Analysis and Drainage Report



PSC: No objective government agency evaluation has rated this product for TSS removal efficiency, and we have concerns about durability as the insert could be damaged by a conventional clamshell bucket. Consider installing a DMH with 4-ft. sump and hood between CB 100 and RB 101.

Stormwater Waivers

The proposed stormwater management system does not comply with the planning board rules and regulations. Revise the submittal to comply or request waiver of strict compliance with the following.

27. Water Quality Depth shall be 1.7 inches.

HWG: The Applicant had requested a waiver from this requirement. The Massachusetts Stormwater Management Handbook requires 1 inch for calculating the water quality volume.

PSC: We acknowledge that the Stormwater Handbook uses 1-inch in calculating the water quality volume in rapidly permeable soils. Refer to Comment 13.

28. Request waiver of requirements for RCP pipe (PBRR §352 A 7).

HWG: The Applicant requested this waiver in a supplemental submission submitted to ZBA on May 13, 2021.

PSC: Use of HDPE pipe is allowed on private site in many communities. Extra care must be used in installation to avoid deformation and sags in pipe lengths. However, waiver of strict compliance can be considered and would not adversely impact the functionality of the stormwater management system.

29. Request waiver of prohibition for subsurface structures (PBRR §352 D 3.b).

HWG: The Applicant requested this waiver in a supplemental submission submitted to ZBA on May 13, 2021.

PSC: Subsurface structures are commonly used, and, in our opinion, waiver of strict compliance can be considered and would not adversely impact the functionality of the stormwater management system.

SITE PLAN

30. The building domestic water service and the building water protection line, and the proposed fire hydrant are located in proximity (hereinafter the “three connections”). To



improve reliability and safety, add two 8-inch diameter gate valves, one of each site of the “three connections” to enable the domestic water service, the building water protection line, and the hydrant to be fed from either direction. Adjust the waterline location slightly in order to enable locating the valve boxes for both recommended gate valves within the pavement.

HWG: The Applicant agrees with the comment and has updated the Utility Plans accordingly.

PSC: Resolved.

31. Coordinate with the Fire Department and determine the following:

- a. Is a second on-site fire hydrant required.

HWG: A second fire hydrant has been added to the plans at approximately 470-feet from the intersection with Meetinghouse Lane to comply with the maximum separation distance of 500-feet.

PSC: Resolved.

- b. Is a PIV valve required where the fire service enters the building?

HWG: Based on communication with Assistance Fire Chief Pelonzi, a PIV is not required.

PSC: Resolved.

32. Research availability of record data or provide a fire flow test.

HWG: The NSWDC conducted a fire flow test on July 22, 2021, at two hydrants closest to the proposed site. A letter summarizing the fire flow test results, from Resilient CE to the North Sagamore Water District, dated July 27, 2021, is attached to this memo.

PSC: Resolved.

33. Specify bituminous coated cement lined ductile iron pipe.

HWG: The NSWDC allows the use of PVC pipe for water mains. The plans have been updated to note watermain as PVC.

PSC: Given that PVC watermains are the community standard, their use should be allowed on the site. Further, should an emergency repair be required, the Water District is likely to have spare pipe and fittings in stock.

34. Show the limits of the waterline to be abandoned and identify the point of connection for the watermain extension.



HWG: Based on discussion with the NSWDC, the existing tapping sleeve and gate will remain in Meetinghouse Lane. A new gate valve will be installed in close proximity to the existing gate valve. The new watermain will be brought into the site after the new gate valve. The plans have been updated with additional detail.

PSC: Resolved as the connection reportedly complies with NSWDC requirements.

35. Coordinate with the Water District and determine if a three-valve connection is required or if a tapping sleeve and valve is permitted on Homestead Road.

HWG: Based on discussion with the NSWDC, the connection on Homestead Road will be a cut-in connection. A new gate valve will be installed on the northwest portion of the existing Homestead Road water main. A second gate valve and hydrant will be installed on the new connection from the site.

PSC: Resolved as the revised connection reportedly complies with NSWDC requirements.

36. Show a supply line if natural gas service is available.

HWG: Natural gas service is not available. Electric heat is proposed.

PSC: Resolved.

37. If natural gas service is not available show the location and spill protection provisions for the heating oil storage tank. The oil storage tank must comply with Fire Department requirements.

HWG: Electric heat will be provided, therefore a heating oil storage tank is not required.

PSC: Resolved.

38. Show an emergency generator if proposed and provide visual and acoustical screening. The generator should be gas fired if natural gas service is available. The generator should be located to minimize noise impacts on residents and abutters. If not desired to power the entire building, an emergency generator may be required in order to operate the elevator and maintain handicapped accessibility to the second and third floors of the building.

HWG: The Applicant has added a location for a diesel or propane powered emergency generator (diesel) pad in between the proposed building and the upper parking lot.

PSC: Resolved.



39. Specify the material for vertical faced curbing. Although more expensive than precast concrete curb, vertical faced granite curb is recommended in the turnaround area due to restricted vehicle maneuvering and tight geometry for snow plowing.
HWG: The Applicant currently is proposing granite curb where sidewalks are located and in the parking lots. Asphalt berm is proposed for the island at the turn around and along the southern side of the access road. A similar application has been used at other POAH developments successfully.
PSC: Resolved.
40. Specify a 4" thick superpave pavement section with a 1½-inch thick surface course and a 2½-inch thick intermediate course. Increasing the surface course from 1¼-inch thick specified in the subdivision regulations allows for increased aggregate size and increased strength.
HWG: As the driveway will not be a public road and the parking lots are on private property; the Applicant does not believe a 4" pavement section is required and the typical 3" pavement thickness is sufficient. The Applicant will submit to ZBA a waiver from this requirement (Subdivision 326.e).
PSC: A pavement section consisting of a 1½-inch thick surface course and a 1½-inch thick intermediate course is commonly used and while having less long-term durability than a 4-inch-thick pavement, the 3-inch superpave pavement section can be allowed.
41. The Zoning Bylaw which proscribes requirements for site lighting, limits the max./min. ratio to 4.0 whereas the max./min. ratio provided on the "speclines" photometric plan for Driveway is 14.0, for Parking A is 25.5, and for Parking B is 24.5 (ZBL §3453 c)). However, illumination levels provided are similar to illumination levels provided in comparable developments.
HWG: The Illuminating Engineering Society recommends a uniformity ratio maximum of 15:1 for parking lots. The Applicant reviewed other possible configurations to reduce the max./min. ratio. Due to the maximum coverage requirement of the proposed leachfield, lighting cannot be sited within the parking lot. As mentioned in the comment, the proposed lighting is similar to what is used in comparable developments. The Applicant will request a waiver from this requirement.
PSC: Although not optimal, an excess max to min ratio can be allowed for the site lighting system to reduce cost.



SEPTIC SYSTEM

Our peer review memorandum on the First Submittal of the Site Plans included twenty-one comments (Comments 42 through 62) on the preliminary design of the on-site septic system as shown on the submitted plans. The septic system proposed was a Presby system, a proprietary passive soil absorption and treatment, system approved by DEP for general use. In evaluating our comments, Horsley Witten determined that the proposed system did not comply with the requirements of the DEP General Use Authorization. The Second Submittal has deleted the Presby system and now provides a conventional Title 5 system. *Therefore, we note that in particular, Comments 49 through 53, 57, 58, 61, and 62 are not applicable as the Presby system is no longer proposed.* Additional Comments have been added.

42. The conventional Title 5 system location is shown as an outline of dashed lines overlapping the Presby beds. The Presby's state approval letter requires that the site to support a conventional system (primary and reserve). It's not clear that the area must be in a different location on the property, but the rectangular space provided is not supported with design calculations to prove that the space shown represents the conventional system's primary and reserve.

HWG: Based on further review of the design requirements for the Presby Innovative/Alternative leaching field previously proposed, HW has redesigned the leaching area to a pressure dosed Title 5 leaching trench system. This comment is no longer applicable.

PSC: Comment no longer applicable.

43. The site evaluation data excludes percolation tests. Granted sandy soil percolation rates are predictable but this test data will be required for final approval.

HWG: Percolation tests were conducted in Test Pits (TP)-B and TP-5. Results are shown in the soil test pit logs located on sheet C-11.

PSC: See new Comment 64.

44. Redoximorphic features (mottles) was recorded in the soil profiles but in a different area not representing the soils underneath the soil absorption system.

HWG: Soils in the area of the soil absorption system were found to be sandy in nature with no redoximorphic features encountered. The redoximorphic features were isolated to the western portion of the site, TP-E and TP-F.



PSC: The overall site consists of Barnstable Sandy Loam and Carver Loamy Sand soils. Where the 2 soil conditions become independent within the lot has not been determined by current soil evaluations. Field observations have recognized this change to be somewhere between TP-F and TP-C. A single deep observation hole within Field #1 soil absorption system's footprint does not confirm redoximorphic features are isolated to the western portion of the site. The redoximorphic features are supported by a layer of silt loam with seepage observed at 116" (TP-E) and redoximorphic features observed above the layer of silt loam at 48" (TP-F) alluding to a possible seasonal perched water table. Until the required number of deep observation holes and percolation tests are performed and accepted by the Board of Health witness one cannot be certain that the system is located within soils represented by TP-C.

45. The plan does not provide a 100% reserve area.

HWG: The revised leaching trench system design will provide 100% reserve area.

PSC: Overall system design is revised.

46. The plan does not provide deep observation holes and percolation tests verifying a suitable location for the reserve area.

HWG: Additional soil testing acceptable to the Bourne Health Department will be provided for the revised leaching system trench design if necessary.

PSC: The original comment was intended for the Presby system design that has been abandoned by the design engineer. Also see new Comment 64.

47. The mound height is stated but calculations are not provided for groundwater mounding as required for systems over 2,000 gpd.

HWG: Groundwater mounding calculations are included on sheet C-14 the revised leaching system trench design. Depth to groundwater is estimated at elevation 10, over 40-feet below grade. HW does not believe mounding will affect the leaching trench system design.

PSC: Resolved. Note: The silt loam layer has not been officially omitted from Field #1 soil absorption system's footprint. A perched water table is considered a design variable

48. No information provided for the high groundwater elevations provided.



HWG: Regional groundwater contour data indicates a groundwater elevation of 10-ft, which is approximately 40-feet below grade at the site. No standing water was observed during soil testing. See image below from plan titled "Altitude of Water Table in Plymouth-Carver Area, Southeastern Massachusetts, November 30 – December 2, 1984, prepared by Bruce Hansen and Wayne Lapham, 1992".

PSC: The silt loam layer has not been officially omitted from Field #1 soil absorption system's footprint. A perched water table is considered a design variable.

Comments 49 through 53: These comments are specific to the Presby system which is no longer proposed. These comments are no longer applicable

54. No calculations provided for the pump chamber daily dose (6 doses daily minimum), emergency storage volume, and pressure line backflow volume.

HWG: The revised design includes detailed pressure dose calculations for the leaching trenches including head loss, required pump rate, float elevations and dosing volumes.

PSC: Resolved.

55. No pump specifications, inside dimensions for the pump chamber, actual dynamic head, pump performance curve (total dynamic head versus flow rate), and manufactured stated flow rate for the actual dynamic head calculated.

HWG: The revised design includes detailed pressure dose calculations for the leaching trenches including head loss, required pump rate, float elevations and dosing volumes.

PSC: Resolved.

Comments 56 through 58: These comments are specific to the Presby system which is no longer proposed. These comments are no longer applicable

59. No weep hole provided in the pressure line for backflow return to pump chamber.

HWG: The revised design includes a weep hole to allow backflow from the multizone valve to the pump chamber. HW is not proposing to drain the entire forcemain back to the pump chamber.

PSC: See new Comment 71.

60. Final grade provided above the pressure line length does not provide proper cover to provide protection from freezing. If buried deep the line will have a bow preventing



backflow to pump chamber due to both ends of the pressure line are at the same elevation.

HWG: HW will ensure that the forcemain is buried a minimum 4-feet below grade to protect from freezing. The dosing calculations for the revised pressure dosed leaching trenches incorporate the volume of the forcemain to ensure that the required dose volume is provided to the leaching trenches. HW is not aware of a requirement for the entire forcemain to drain back to the pump chamber with each pump dose. Distribution laterals in the proposed leaching trenches will be sloped to drain.

PSC: The original comment was directed to the Presby system design as presented. Also see new comments 69, 70 and 78.

Comments 61 and 62: These comments are specific to the Presby system which is no longer proposed. These comments are no longer applicable

ADDITIONAL SEPTIC COMMENTS BASED ON THE REVISED CONVENTIONAL DESIGN

63. Sheet C-11. Soil test data does not have a Board of Health witness identified. State and local regulations require a witness representative.

64. Sheet C-11. Sheet C-11. Percolation test results were added to section "Soil Test Pit Data" for TP-B and TP-6. Both tests were performed outside soil absorption system Field #1 and soil absorption system Field #2 footprints. Typically, percolation tests are required to be performed within the footprint. The minimum number of percolation tests for a soil absorption system sized for over 2,000 gallons per day has not been established as required by the state design requirements; Title 5, 310 CMR 15.000. State and local regulations require a Board of Health witness representative.

65. Sheet C-12. Soil Absorption System (SAS) is represented by two deep observation holes determined by the design engineer. Title 5 allows the Board of Health witness to determine if the minimum number of deep observations holes performed represent soils supporting the design. This decision also includes the number of percolation tests to represent soils supporting the design. For a SAS that discharges over 2,000 gallons per day, Title 5 requires additional percolation tests in addition to the required 2 percolation tests, spaced evenly over the proposed SAS. Both proposed fields exceed 2,000 gallons per day discharge and would be governed by this requirement.



66. Sheet C-13. Inner diameter (ID) measurements are not provided for the pump chamber to verify emergency storage volume and dose volume. Calculations for the emergency storage and dose volume is typically provided by the design engineer.
67. Sheet C-13. Septic tank, pump chamber, valve vault, and multizone valve manhole outer diameter measurements not provided. The schematic drawings are useful to verify final grade cover over components, force main lines, etc.
68. Sheet C-13. Multizone valve manhole detail. The pressured force mains dedicated to SAS field #1 and SAS field #2 should be reversed to be consistent with Sheet C-11. Sheet C-11 design supports left-side pipe exiting to serve field #2 and the right-side pipe exiting to serve field #1. Manhole detail is inconsistent with Sheet C-11.
69. Sheet C-13. Multizone valve manhole detail. Left-side piping is noted to provide a "45 elbow down" to provide freeze protection. Recommend adding a note to include the entire force main to be below 4' of cover prior to SAS field #2's manifold connection. The topography changes throughout the property. This note will provide installation guidance to protection the force main from freezing. The manifold is noted to be 4' minimum below final grade (Sheet C-14).
70. Sheet C-13. Multizone valve manhole detail. Right-side piping is noted to "slope away from multizone valve". No installation guidance to protect the force main pipe from freezing as it runs from the multizone valve manhole to the buried manifold set at a minimum 4' under final grade. Provide a similar 45-degree pipe requirement as required for the left-side including a continuous 4' cover that would provide protection for the pressured force main.
71. Sheet C-13. Wastewater system schedule of elevations. The valve vault's 4" drainpipe's elevation invert is not provided. The valve vault's 4" drainpipe elevation invert for the pump chamber is not provided. No specifications or manufacture provided for noted "swing check valve".
72. Sheet C-14. Vent system for the SAS is limited in detail. No schematics provided for the 4" PVC vent pipe lateral connection to the 4" PVC manifold. No information provided for type of 4" PVC piping required i.e., perforated 4" pipe for laterals and solid 4" PVC pipe for manifold.



73. Sheet C-14. No details are provided for vent pipe stack i.e., height above grade. No details for vent manifold i.e., negative pitch to allow sewer gas to escape.
74. Sheet C-14. No details are provided for reducing the 4" manifold pipe diameter to 1/8" diameter lateral. No details provided for force main connecting to the 4" manifold pipe diameter.
75. Sheet C-14. No perforated lateral details are provided for Field #1. The number of perforations in Field #1 laterals alternate from 14 holes to 13 holes for every other lateral. Offset spacing measurement from end of lateral is not provided for the 14 perforated lateral(s).
76. Sheet C-14. Field 1 - pressure distribution calculations. The length of manifold used (128') in calculation is inconsistent with the manifold length shown in Leaching Field 1's site plan.
77. Sheet C-14. No perforated lateral details, Field #2. The number of perforations in Field #2 laterals alternate from 13 holes to 12 holes for every other lateral. Offset spacing measurement from end of lateral is not provided for the 13 perforated lateral(s).
78. Sheet C-14. No detail provided for the lateral clean out. No drain hole provided to allow complete drainage of the 0.5 percent sloped lateral(s). Current perforations positioned at 5 and 7 o'clock will allow for some effluent to remain in piping. The depth of laterals is less than 4' with possible freezing due to liquid remaining and no 6 o'clock drain hole(s) provided.
79. There is a stamp on the plans stating, "permitting set only not for construction."
Describe the schedule for working drawings and provisions for review by the Town.

COMMENTS FROM THE TIA PEER REVIEW

Our review of the TIA for Cape View Way, gave rise to recommended site plan modifications. We restate these issues to ensure they are addressed in revised site plans. Revised site plans should address the following:

- Any sidewalk obstructions (signs, hydrants, etc.) to be placed to reserve a 48-inch-wide accessible path.



HWG: The Applicant has placed all obstructions outside the sidewalks, which are 60 inches wide.

PSC: Resolved.

- For walkways at the head of perpendicular parking space, widen the sidewalk to 7½-ft., provide parking bumper blocks, or providing a loam strip to maintain a minimum accessible route.

HWG: Handicapped parking spaces are not provided in this parking lot and to keep impervious cover to a minimum we believe the 5' dimensions is sufficient for this sidewalk and consistent with standard parking lot design.

PSC: We believe that a 5-ft. wide sidewalk at the head of perpendicular parking spaces cannot be relied upon to maintain an accessible route. The sidewalk can be widened or alternatively a grass strip or parking blocks can be provided to maintain the accessible route.

- Provide an outdoor bicycle rack be provided for visitors.

HWG: The Applicant has added a bicycle rack near the drop off area that will fit up to eight bicycles.

PSC: Resolved.

- For the 4 compact perpendicular parking spaces that are accessed from the pavement within the turnaround at the building entrance, provide an overall width of this parking bay (aisle plus parking space) of 42-ft. to ensure proper vehicle maneuvering.

HWG: The Applicant has updated the parking spaces to 60-degree angled parking. The width of the aisle behind these spaces is 17 feet, which exceeds the Bourne parking regulations requirement of 16 feet clear behind a 60-degree angled parking space.

PSC: Resolved.

- The turnaround with center island at the end of Cape View Way that has been adapted to serve as a drop-off at the building entrance. Modify the inner radius of the turnaround to accommodate a fire truck or the largest vehicle expected to regularly access the site.

HWG: The emergency vehicle turning radius template has been submitted along with a letter from Assistant Fire Chief Pelonzi to demonstrate the Bourne fire truck dimensions provided is able to use the turnaround.

PSC: Resolved.



Memorandum
September 27, 2021
Page 28

- Provide signs prohibiting parking along Cape View Way.
HWG: Based upon property management experience at other POAH facilities and to avoid sign clutter, the applicant prefers to not add the signs at this time. We suggest a condition be added to the approval that signs will be installed if illegal parking along the access drive becomes an issue.
PSC: Installation of “No Parking” signs (MUTCD R8-3) can be deferred; however, we recommend inclusion of a Condition of Approval in any favorable Decision requiring the property manager to write a letter to the Building Inspector one year after occupancy describing their efforts to monitoring parking demand.

Date August 11, 2021
To Bourne Zoning Board of Appeals
From Thomas C. Houston, PE, AICP
Project Cape View Way Comprehensive Permit Project
Subject Peer Review of Civil Engineering/Site Design

Professional Services Corporation, PC (PSC) reviewed the First Submittal of the Site Plans, Stormwater, and related design for the Cape View Way Comprehensive Permit Project (Proposed Project) on behalf of the Bourne Zoning Board of Appeals.

The Preservation of Affordable Housing, Inc.(POAH) and the Housing Assistance Corporation (HAC) (collectively the “Applicants”) propose to construct a 51-unit mid-rise multifamily residential building with a footprint of 27,000 sq.-ft. The 51 dwelling units have a total of 90 bedrooms comprised of 17 one-bedroom units, 29 two-bedroom units, and 5 three-bedroom units. The Proposed Project will provide rental units under the low-income housing tax credit program and all units will be affordable.

The Proposed Project is located on Cape View Way which is situated on the north side of Meetinghouse Lane between the Post Office and Bourne Fire Station 3. The 2.94-acre Project Site which is currently owned by the Bourne Housing Authority is comprised of 7 parcels, Assessing Map 6 parcel 0 and Assessing Map 7 Parcels 0, 6, 8, 10, 11, and 12 and lies within the R-40 Zoning District.

Cape View Way was a previously approved subdivision road which was never completed. The subdivision roadway layout will be modified and the former subdivision lots will be combined, and the project will be developed as a single lot. Currently, Cape View Way includes a paved roadway stub with the remainder unpaved. To serve the Proposed Project, construction of Cape View Way will be redesigned and completed providing a 24-ft. wide paved traveled with a



Memorandum
August 11, 2021
Page 2

5± ft. wide sidewalk on one side. A total of 85 parking spaces (69 standard parking spaces/12 compact parking spaces/4 accessible parking spaces) are provided to serve the 51 dwelling units.

Site improvements include utilities, a stormwater management system to collect, treat, and infiltrate stormwater, an on-site wastewater treatment system for 9,900 gallons per day, water distribution system, cable utilities, site lighting, and landscaping.

Overall, we find that the site plans prepared by the Horsley Witten Group, Inc. (Horsley Witten Group) are properly designed and generally comply with standard engineering practice. We offer the comments provided herein for consideration.

FIRST SUBMITTAL

- A. Cape View Way Permitting Plans, Bourne Massachusetts, prepared by the Horsley Witten Group, Inc, containing 21 sheets, dated March 5, 2021.
- B. Stormwater Analysis and Drainage Report, Cape View Way, Bourne, Massachusetts, prepared by the Horsley Witten Group, Inc., dated March 5, 2021.
- C. Cape View Way Permitting Plans, Bourne Massachusetts, Landscape Rendering, prepared by the Horsley Witten Group, Inc. containing 21 sheets, dated March 5, 2021.
- D. Cape View Way, Bourne, Massachusetts, Existing Conditions, prepared by the Horsley Witten Group, Inc., dated June 2019.
- E. Photometric Study – Run 2 – King Luminare & Heper, prepared by speclines and manufacturer's literature.
- F. Town of Bourne Board of Appeals, Comprehensive Permit Application, Pursuant to MGL Ch. 40B § 20-23 and 760 CMR 56.00.
- G. Development Agreement by and between Preservation of Affordable Housing, Inc. ("POAH") and Housing Assistance Corporation ("HAC," and jointly with POAH, the "Developer") and the Bourne Housing Authority

REFERENCE

- A. Town of Bourne Zoning Bylaw, as most recently the special town meeting, October 2019, printed February 13, 2020.



Memorandum
August 11, 2021
Page 3

- B. 2021 Approved Zoning Bylaws, Approved ATM 2021 zoning article for Lowland Regulations.
- C. Town of Bourne General Bylaws, Section 3.7 Wetland and Natural Resources Protection.

SUBDIVISION

The Applicants intend to modify the layout of Cape View Way created by the 1987 subdivision entitled "Meetinghouse Place" while combining the original subdivision lots into a single parcel.

The status of the "Meetinghouse Place" subdivision should be researched to determine if the approved subdivision is valid and was recorded in the registry of deeds. The 1987 Planning Board Decision should be reviewed to determine if there are sunset provisions. If the subdivision has expired there may be the requirement to upgrade the subdivision to comply with the current Planning Board Rules and Regulations. It should be noted that the northwesterly segment of the subdivision roadway has a new alignment, and the cul-de-sac has a revised layout and is in a different location.

1. Determine if the "Meetinghouse Place" subdivision was recorded in the registry of deeds.
2. Determine if the 1987 Planning Board "Decision" contains sunset provisions which after a specified period either voids an unconstructed subdivision or requires upgrades to comply with the current Planning Board Rules and Regulations as a condition of extending the unconstructed subdivision.
3. Either apply to the Zoning Board of Appeals (acting as Planning Board) for a new definitive subdivision approval or for modifications to an approved subdivision if the subdivision remains valid. In either case the subdivision road is eligible to apply for approval, the issue is to identify the appropriate procedure.
4. In the drop off area at the main building entrance, revise the cul-de-sac island to accommodate fire apparatus and any large vehicles expected to use the site requires a new subdivision approval or modification.
5. As the subdivision roadway is unconstructed it cannot currently provide vital access. Therefore, procedurally the Applicants must petition to merge the subdivision lots under the subdivision process (with the ZBA acting as Planning Board). Given the incomplete construction of the subdivision road (no vital access), lots cannot be combined through the ANR or 81P process.
6. Provide a subdivision plan complying with all requirements for recording in the registry of deeds.



Memorandum
August 11, 2021
Page 4

- a. Provide a signature block for the ZBA (serving as Planning Board) to endorse the plan.
- b. Show metes and bounds for the Cape View Way layout. The general requirement of the registry of deeds is that sufficient geometric data must be provided to allow all points on the layout to be field located.
- c. Show bounds to define the layout.
- d. Record the approved plan in the Registry of Deeds.

ZONING

The Applicants request waiver of certain provisions of the Town of Bourne Zoning Bylaws as follows: "Inspector of Buildings, Zoning Enforcement" (ZBL §1210), "Certification" (ZBL §1220), "Site Plan Special Permit Approval" (ZBL §1230), "Maximum Lot Coverage" (ZBL §2454), "Maximum Building Height" (ZBL §2455), "Enforcement.(ZBL §2460), "Subdivision Control Law Compliance" (ZBL §2498), "Rate of Development Scheduling" (ZBL §2640), "Exemptions.(ZBL §2650), "Table of" (*Parking*) Requirements" (ZBL §3320), "Number of Plants" (ZBL §3512(II)), "Parking Area Plantings" (ZBL §3513(IV)), "Natural Cover Removal" (ZBL §3570), "Earth Removal" (ZBL §4400)

In addition to requested waivers, additional waivers of strict compliance may be required.

7. Determine compliance or request waiver of strict compliance with the provisions of "Lot Shape" (ZBL §2480).

The Project Site is located in the R-40 Zoning District. The Town of Bourne Zoning Bylaw (ZBL) provides for single family residential and two-family use in the R-40 District (ZBL §2200). As a mid-rise multifamily residential use, the Proposed Project does not comply with the use and certain dimensional requirements of the R-40 District. The Applicants have requested waiver of certain provisions of the R-40 District. These waivers are necessary in order to allow the Proposed Project to be constructed as submitted. The Applicants zoning analysis and the waiver requests presume Cape View Way has the status of a way. See Comments 1 through 5.

The proposed project complies with the requirements of the R-40 District with respect to minimum lot area of 40,000 square feet (100,000+ square feet provided), the minimum frontage of 125 feet (125+ feet provided), the minimum side yard of 15 feet (15+ feet provided), and minimum usable open space of 20 percent (64% provided) (ZBL §2500).



8. The submittal states the usable open space provided is 64% of the lot area. Explain the apparent inconsistency of 47% total impervious materials coverage versus 68% total open space per the “Tabulation of Ground Area Coverages” in the Application.

The applicants request waiver of strict compliance with the certain dimensional requirements of the R-40 District with respect to minimum front yard setback of 30 feet (10 feet provided), minimum rear yard of 15 feet (7.8 feet provided), maximum lot coverage of 20% (32% provided), and maximum building height of 35 feet (38.9 feet provided) (ZBL §2500).

STORMWATER

The site is provided with a stormwater management system that collects, treats, and infiltrates stormwater on site. Based upon on site wetlands, the Proposed Project is subject to the Massachusetts Wetlands Protection Act (MGL c. 131, § 40) and the stormwater management system must comply with the DEP Stormwater Standards and with the guidance of the Massachusetts Stormwater Handbook. The stormwater management system must also comply with Town of Bourne stormwater management requirements (unless waived) as set forth in the zoning bylaw and the Subdivision Rules and Regulations of the Planning Board.

Compliance with the Massachusetts Stormwater Standards

We evaluated the discussion of compliance the Massachusetts Stormwater Standards provided in the Stormwater Analysis and Drainage Report, and we conclude as follows:

Standard 1: No New Untreated Discharges or Erosion to Wetlands. There is no proposed discharge to wetlands.

Standard 2: Peak Rate Attenuation. Stormwater management system shall be designed so that post development peak discharge rates do not exceed pre-development peak discharge rates. The submitted Stormwater Analysis and Drainage Report tentatively demonstrates compliance. However, supplemental soils testing is required for final confirmation of compliance. See Comment 11.

Standard 3: Stormwater Recharge. Loss of the annual recharge to groundwater shall be eliminated or minimized through the use of infiltration measures, including environmentally sensitive site design, low impact development techniques, stormwater management best practices, and good operation and maintenance. As a minimum, the annual recharge from the post development site shall approximate the annual recharge from the pre-development site based on soil type. The standard is met when the stormwater management system is designed



Memorandum
August 11, 2021
Page 6

to infiltrate the required recharge volume as determined in accordance with the Massachusetts Stormwater Handbook. The stormwater management system. The submitted Stormwater Analysis and Drainage Report tentatively demonstrates compliance. However, supplemental soils testing is required for final confirmation of compliance. See Comment 11.

Standard 4: Water Quality. Stormwater management systems shall be designed to remove 80% of the average annual post-construction load of Total Suspended Solids (TSS). This Standard is met when: 1) suitable practices for source control and pollution prevention are identified in a long-term pollution prevention plan, and thereafter are implemented and maintained; 2) structural stormwater best management practices are sized to capture the required water quality volume determined in accordance with the Massachusetts Stormwater Handbook; and 3) pretreatment is provided in accordance with the Massachusetts Stormwater Handbook. The submitted Stormwater Analysis and Drainage Report tentatively demonstrates compliance; however, additional pretreatment must be provided for the CB 100 infiltration system.

Standard 5: Land Uses with Higher Potential Pollutant Loads (LUHPPLs). This standard is not applicable for the Project Site.

Standard 6: Critical Areas. The Project Site does not fall within a Critical Area as defined by the SWH and compliance with this standard is not required.

Standard 7: Redevelopment Project. This standard is not applicable for the Project Site.

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Controls: The Applicant has provided sufficient information to demonstrate compliance.

Standard 9: Operation and Maintenance Plan. The Applicant has provided sufficient information to demonstrate compliance.

Standard 10: Prohibition of Illicit Discharges. An Illicit Discharge Compliance Statement has not been submitted.

9. Submit or state the timing for submittal of an Illicit Discharge Prohibition Statement.

Soils

The natural Resource Conservation Service mapping provided in the Stormwater Report classifies most of the on-site soils as "Carver Loamy Sand, 3 to 8 percent slopes (259B)" and a portion in the south portion of the site as Hinkley Loamy Sand, 3 to 8 percent slopes (245B).



Memorandum
August 11, 2021
Page 7

Both of these soil groups are well drained and are classified as Hydrologic Soils Group A (HSG A).

Numerous test pits have been excavated on the site and show a reasonably consistent soil profile. With some exceptions, the test pits show surface layers of Sandy Loam underlain by Sand. Test Pits E and F located in the northwest portion of the site are an exception. They show upper layers of Sandy Loam underlain by Gley Silt Loam, which is underlain by Fine Sandy Loam and sand or sand.

The Stormwater Handbook specifically requires soil testing at the location of the infiltration Best Management Practice (BMP). The on-site stormwater management system includes 6 subsurface structures including 4 URC systems with "Stormtech MC-3500" units and 2 precast concrete Recharge Basin (RB) systems. For the Storm Tech MC 3500 units, the Stormwater Handbook bases test pit requirements on the requirements for infiltration trenches. For URC-1 five test pits are required and for URC-2, URC-3 and URC-4, two test pits are required for each. There are no test pits located at any of the six on site infiltration BMP's which is not in compliance with the Stormwater Handbook. Due to uniformity of the site's soil profile, it may be possible to defer additional testing until the construction phase. We recommend that the Sandy Loam layers be removed down to the sand layers and the excavation backfilled with Title 5 sand in order to ensure long term operation of the infiltration BMP's. We recommend that removal of the Sandy Loam be verified on-site by the engineer of record. The requirement for on-site observation of removal of the Sandy Loam layers can be combined with on-site verification of the textural classification of sand layers at lower levels. The Applicants assume some risk that the subsurface structures may have to be redesigned; however, there is room on-site for expansion of these BMPs if required.

10. Revise the drawings to require on-site observation of removal of the sandy loam layers and backfilling with Title 5 sand at each of the 6 subsurface structures during construction.
11. Revise the drawings to require on-site soil texture classification by a Massachusetts Soil Evaluator at each of the 6 subsurface structures during Construction and to require design revisions if location specific soil data is not consistent with the submitted design.

Calculations.

Revise the HydroCAD calculations as follows:

12. Limit sheet flow length to 50 feet in determining the time of concentration.



13. Revise the first flush calculations using 1.7 inches per the subdivision regulations.

14. Add flow path to the watershed maps.

Infiltration structures.

Subsurface structure peak water elevations are shown on sheet 15. However, the data is not labeled to show the URC system for which the peak elevations are determined. The top row of the chart which appears to show elevations for URC-1 the elevations do not match the HydroCAD Reports. The “Underground Chambers, Design Storm Elevations” table on sheet 15 should be deleted and replaced with a new table on sheet C-8 or C-9.

15. Revise the “Underground Chambers, Design Storm Elevations” table on sheet 15 to include labels for the rows as URC-1, URC-2, URC-3, URC-4. Revise the WQv (for 1.7 inch) peak elevation and add the 2-yr. peak elevation. The elevations in the top row do not appear to match the HydroCAD calculations.

16. Supplement the URC “Specifications” table on Sheet 17 providing the elevations for the bottom of stone elevation, bottom of structure elevation, top of structure elevation, top of stone elevation. Alternatively, this information could be labeled for each structure on Sheets C-8 and C-9.

17. Due to the maintenance burden, revise structure URC-1 to provide a single isolator row.

18. A double-ring infiltrometer test was performed at TP-F which resulted in an infiltration rate of 7.0 inches/hour. This infiltration rate was used to design RRC-3. Although contiguous to RRC-3, subsurface structure RRC-2 is designed with an infiltration rate of 8.27 inches per hour. Revise the design of RRC-3 using an infiltration rate of 7.00 inches per hour or provide two test pits substantiating the design infiltration rate of 8.27 inches per hour.

19. Provide time to drain calculations for URC-1, URC-2, URC-3, URC-4.

20. Revise the design of Bioretention Area 2 in order to accommodate the revised island geometry at the building entrance. See Comment 4

21. Provide requirements for bulkheading subsurface structures until the site is fully stabilized.



Memorandum
August 11, 2021
Page 9

Treatment BMPs

22. The Water Quality Volume used in the sizing of the Bioretention Areas and the Tree Trenches is based on the 1-inch rainfall, not the 1.7-inch rainfall required by the Planning Board Rules and Regulations (PBRR §352 D 1).
23. Label the Sidewalk Inlet Grate on sheets C-8 and C*9 and reference the detail on Sheet 16.

Collection System

24. Label pipe diameters, materials, and slopes.
25. Relocate DMH 200 and eliminate the acute reverse flow angle.
26. The CB 100 – RB 101 – RB 102 system provides 25% TSS removal prior to discharge to the infiltration BMP whereas 44% TSS removal is required.

Stormwater Waivers

The proposed stormwater management system does not comply with the planning board rules and regulations. Revise the submittal to comply or request waiver of strict compliance with the following.

27. Water Quality Depth shall be 1.7 inches.
28. Request waiver of requirements for RCP pipe (PBRR §352 A 7).
29. Request waiver of prohibition for subsurface structures (PBRR §352 D 3.b).

SITE PLAN

30. The building domestic water service and the building water protection line, and the proposed fire hydrant are located in proximity (hereinafter the “three connections”). To improve reliability and safety, add two 8-inch diameter gate valves, one of each site of the “three connections” to enable the domestic water service, the building water protection line, and the hydrant to be fed from either direction. Adjust the waterline location slightly in order to enable locating the valve boxes for both recommended gate valves within the pavement.
31. Coordinate with the Fire Department and determine the following:
 - a. Is a second on-site fire hydrant required.



- b. Is a PIV valve required where the fire service enters the building?
- 32. Research availability of record data or provide a fire flow test.
- 33. Specify bituminous coated cement lined ductile iron pipe.
- 34. Show the limits of the waterline to be abandoned and identify the point of connection for the watermain extension.
- 35. Coordinate with the Water District and determine if a three-valve connection is required or if a tapping sleeve and valve is permitted on Homestead Road.
- 36. Show a supply line if natural gas service is available.
- 37. If natural gas service is not available show the location and spill protection provisions for the heating oil storage tank. The oil storage tank must comply with Fire Department requirements.
- 38. Show an emergency generator if proposed and provide visual and acoustical screening. The generator should be gas fired if natural gas service is available. The generator should be located to minimize noise impacts on residents and abutters. If not desired to power the entire building, an emergency generator may be required in order to operate the elevator and maintain handicapped accessibility to the second and third floors of the building.
- 39. Specify the material for vertical faced curbing. Although more expensive than precast concrete curb, vertical faced granite curb is recommended in the turnaround area due to restricted vehicle maneuvering and tight geometry for snow plowing.
- 40. Specify a 4" thick superpave pavement section with a 1½-inch thick surface course and a 2½-inch thick intermediate course. Increasing the surface course from 1¼-inch thick specified in the subdivision regulations allows for increased aggregate size and increased strength.
- 41. The Zoning Bylaw which proscribes requirements for site lighting, limits the max./min. ratio to 4.0 whereas the max./min. ratio provided on the "spec lines" photometric plan for Driveway is 14.0, for Parking A is 25.5, and for Parking B is 24.5 (ZBL §3453 c)) . However, illumination levels provided are similar to illumination levels provided in comparable developments .



SEPTIC SYSTEM

The septic system information provided is a preliminary design and will require additional design prior to final septic system approval.

42. The conventional Title 5 system location is shown as an outline of dashed lines overlapping the Presby beds. The Presby's state approval letter requires that the site to support a conventional system (primary and reserve). It's not clear that the area must be in a different location on the property, but the rectangular space provided is not supported with design calculations to prove that the space shown represents the conventional system's primary and reserve.
43. The site evaluation data excludes percolation tests. Granted sandy soil percolation rates are predictable but this test data will be required for final approval.
44. Redoximorphic features (mottles) was recorded in the soil profiles but in a different area not representing the soils underneath the soil absorption system.
45. The plan does not provide a 100% reserve area.
46. The plan does not provide deep observation holes and percolation tests verifying a suitable location for the reserve area.
47. The mound height is stated but calculations are not provided for groundwater mounding as required for systems over 2,000 gpd.
48. No information provided for the high groundwater elevations provided.
49. Bed #1 and Bed #2 will receive an unequal volume of effluent. The beds are two different sizes, one will receive more effluent than the other not providing equal distribution for the entire soil absorption system when dosed.
50. Details are missing for the vent manifolds exiting the double offset adapters.
51. Bed #1 vent manifold has no details.
52. Bed #2 vent manifold is not clear or presented.
53. The site plan offers a location for vent pipes north of the beds. No details provided how to get the pipes to the specified location. The manifold vent pipes for Bed #2 are located on the southern end of the bed and Bed #1 is located on the northern end.



54. No calculations provided for the pump chamber daily dose (6 doses daily minimum), emergency storage volume, and pressure line backflow volume.
55. No pump specifications, inside dimensions for the pump chamber, actual dynamic head, pump performance curve (total dynamic head versus flow rate), and manufactured stated flow rate for the actual dynamic head calculated.
56. Sheet 14 of 21. Sheet provides specifications for sewer manhole and wye connector that are unrelated to the current design. Should be omitted. Space used for current design details which would benefit the design.
57. Final grade cover over Bed #1 and #2 exceed state's maximum 3 feet of cover.
58. Pump chamber outlet elevation is the same for the inlet elevation for the main distribution box. Using the same elevation (no negative grade) will prevent the fluids in the pressure line to return to the pump chamber after each dose by gravity.
59. No weep hole provided in the pressure line for backflow return to pump chamber.
60. Final grade provided above the pressure line length does not provide proper cover to provide protection from freezing. If buried deep the line will have a bow preventing backflow to pump chamber due to both ends of the pressure line are at the same elevation.
61. Distribution box specifications lack 6" stone base or equivalent to provide a stable base, and the outlet distribution lines to be level for a minimum of the first 2' of the pipe lengths.
62. The Presby's state approval letter states the system shall be installed with differential venting for aeration and inspection access at end of each serial bed whenever the system is installed under impervious surfaces.

COMMENTS FROM THE TIA PEER REVIEW

Our review of the TIA for Cape View Way, gave rise to recommended site plan modifications. We restate these issues to ensure they are addressed in revised site plans. Revised site plans should address the following:

- Any sidewalk obstructions (signs, hydrants, etc.) to be placed to reserve a 48-inch-wide accessible path.



Memorandum
August 11, 2021
Page 13

- For walkways at the head of perpendicular parking space, widen the sidewalk to 7½ ft., provide parking bumper blocks, or providing a loam strip to maintain a minimum accessible route.
- Provide an outdoor bicycle rack be provided for visitors.
- For the 4 compact perpendicular parking spaces that are accessed from the pavement within the turnaround at the building entrance, provide an overall width of this parking bay (aisle plus parking space) of 42 ft. to ensure proper vehicle maneuvering.
- The turnaround with center island at the end of Cape View Way that has been adapted to serve as a drop-off at the building entrance. Modify the inner radius of the turnaround to accommodate a fire truck or the largest vehicle expected to regularly access the site.
- Provide signs prohibiting parking along Cape View Way.



MEMORANDUM

To: Town of Bourne Zoning Board of Appeals

From: Brian Kuchar, RLA, P.E.
Horsley Witten Group, Inc.

Date: September 14, 2021

Re: Cape View Way Civil Engineering/Site Design Peer Review Response

cc: Thomas C. Houston, P.E. AICP, Professional Consulting Services Corporation
Peter Freeman, Freeman Law Group LLC
Cory Fellows, Preservation of Affordable Housing

On behalf of the applicant, the Preservation of Affordable Housing (POAH), the Horsley Witten Group, Inc. (HW) is pleased to submit the following response to the comments received from the Town's peer review consultant, Professional Consulting Services Corporation, PC (PCS) on August 11, 2021.

We are also submitting the following documents:

1. Exhibit A – Recorded Subdivision Plan
2. Exhibit B - June 30, 1987 Subdivision Decision
3. Letter from Assistant Fire Chief Pelonzi
4. Revised Emergency Vehicle Turning Radius Plans and
5. Hydrant Flow Test Results, memo from ResilientCE
6. Revised Permitting Plans (Civil) dated September 2021 (23 sheets)
7. Revised Stormwater Analysis and Drainage Report revised September 2021, including the revised Stormwater Management Maintenance Plan revised September 2021
8. Revised Subdivision Regulations and Zoning Bylaw Waivers

RESPONSE TO COMMENTS

SUBDIVISION

The Applicants intend to modify the layout of Cape View Way created by the 1987 subdivision entitled "Meetinghouse Place" while combining the original subdivision lots into a single parcel.

The status of the "Meetinghouse Place" subdivision should be researched to determine if the approved subdivision is valid and was recorded in the registry of deeds. The 1987 Planning Board Decision should be reviewed to determine if there are sunset provisions. If the subdivision has expired there may be the requirement to upgrade the subdivision to comply with the current Planning Board Rules and Regulations. It should be noted that the northwesterly segment of the

subdivision roadway has a new alignment, and the cul-de-sac has a revised layout and is in a different location.

1. *Determine if the "Meetinghouse Place" subdivision was recorded in the registry of deeds.*

RESPONSE: The "Meetinghouse Place" subdivision plan as endorsed by the Planning Board was duly recorded on August 12, 1987 in the Barnstable Registry of Deeds at Book 437, Page 50. A copy of the recorded subdivision plan is attached hereto as Exhibit A.

2. *Determine if the 1987 Planning Board "Decision" contains sunset provisions which after a specified period either voids an unconstructed subdivision or requires upgrades to comply with the current Planning Board Rules and Regulations as a condition of extending the unconstructed subdivision.*

RESPONSE: The 1987 Subdivision Decision does not contain an automatic sunset provision and the 1987 Subdivision approval is still in force and effect. A copy of the June 30, 1987 Subdivision Decision is attached hereto as Exhibit B.

The June 30, 1987 Subdivision Decision has a condition that construction of the Meetinghouse Place Subdivision shall be completed within a two year period; however, the Town Clerk's Office provided us with the subdivision regulations that were in effect when the 1987 Subdivision was approved and the regulations, at that time, did not provide for automatic rescission of the approval of a subdivision due to lack of compliance with the construction schedule contained in the decision; and, instead, the regulations provided that, if the construction schedule imposed by the Planning Board was not satisfied "within seven years of the approval of the Definitive Plan," then that would simply "constitute reason for the Planning Board to consider rescission of such approval within the requirements and procedures of Section 81W, Ch.41. G.L." There is no evidence that the Planning Board took any steps to rescind the 1987 subdivision approval.

The subdivision regulations in effect when the 1987 Subdivision was approved did provide that a subdivision approval would be automatically rescinded if the endorsed subdivision plan was not recorded within six months of Planning Board approval; however, the 1987 Subdivision Plan was recorded on August 12, 1987, well within six months of the June 30, 1987 subdivision approval decision.

Subdivision Modification

The Applicants note that the Zoning Board of Appeals, acting under MGL c.40B, §§ 20-23, may modify, amend, or rescind the 1987 Subdivision Decision and the 1987 Subdivision Plan without regard to the statutory restrictions that would apply when a planning board acts to modify or amend or rescind a subdivision under MGL c.41, §81W. The Appeals Court has expressly concluded that MGL c.41, §81W "has no effect on a zoning board of appeals and in no way limits that board's authority under G.L. c.40B." *Blue View Construction, Inc. v. Town of Franklin, et al.*, 70 Mass. App. Ct. 345, 353, review denied 450 Mass. 1105 (2007).

However, to avoid confusion and to provide full clarity for the record, the Applicants request that, when the Zoning Board of Appeals approves the proposed plan, that it do so using the following or similar language:

- The plan approved under this decision (the “40B Plan”) shall supersede the 1987 Subdivision Plan recorded at Barnstable Registry of Deeds Plan Book 437, Page 50 (the “1987 Plan”) as follows:
 - The Lots 6-10 and Open Space Lot on the 1987 Plan shall be reconfigured as shown on the 40B Plan into one parcel (the “40B Parcel”).
 - The Way on the 1987 Plan shall be reconfigured as shown on the 40B Plan.
 - The Way on the 1987 Subdivision, as reconfigured and approved under the 40B Plan, shall provide access only to the 40B Parcel and to the former 1987 Subdivision Lot 5 (said Lot 5 having been combined and merged with Lots 3 and 4 on the 1987 Plan (the site of the Bourne Fire Station at 51 Meetinghouse Road).
 - The Board determines that the Way shown on the 40B Plan approved hereunder provides sufficient access for the 40B Project and for the rear parking lot of the Bourne Fire Station at 51 Meetinghouse Road and that all frontage requirements that are necessary to support the Project and the Fire Station either are satisfied or are hereby waived.
 - The June 30, 1987 Subdivision Decision is hereby modified to remove “Condition d” which provided that Lot 5 (i.e., now the rear parking area for the Fire Station) was restricted and “shall become a residential and not a business lot.”
3. *Either apply to the Zoning Board of Appeals (acting as Planning Board) for a new definitive subdivision approval or for modifications to an approved subdivision if the subdivision remains valid. In either case the subdivision road is eligible to apply for approval, the issue is to identify the appropriate procedure.*

RESPONSE: See answer to comment 2 above.

4. *In the drop off area at the main building entrance, revise the cul-de-sac island to accommodate fire apparatus and any large vehicles expected to use the site requires a new subdivision approval or modification.*

RESPONSE: The Applicant has included the emergency vehicle turning radius template with this memo to show that a fire truck is able to use the turnaround as well as a letter from Assistant Fire Chief Pelonzi regarding fire access at the proposed site.

5. *As the subdivision roadway is unconstructed it cannot currently provide vital access. Therefore, procedurally the Applicants must petition to merge the subdivision lots under the subdivision process (with the ZBA acting as Planning Board). Given the incomplete construction of the subdivision road (no vital access), lots cannot be combined through the ANR or 81P process.*

RESPONSE: See response to comment 2 above.

6. *Provide a subdivision plan complying with all requirements for recording in the registry of deeds.*
 - a. *Provide a signature block for the ZBA (serving as Planning Board) to endorse the plan.*
 - b. *Show metes and bounds for the Cape View Way layout. The general requirement of the registry of deeds is that sufficient geometric data must be provided to allow all points on the layout to be field located.*
 - c. *Show bounds to define the layout.*
 - d. *Record the approved plan in the Registry of Deeds.*

RESPONSE: The Applicant will provide a subdivision plan with all requirements for recording in the registry of deeds when the Site Plan Review is complete.

ZONING

The Applicants request waiver of certain provisions of the Town of Bourne Zoning Bylaws as follows: "Inspector of Buildings, Zoning Enforcement" (ZBL §1210), "Certification" (ZBL §1220), "Site Plan Special Permit Approval" (ZBL §1230), "Maximum Lot Coverage" (ZBL §2454), "Maximum Building Height" (ZBL §2455), "Enforcement.(ZBL §2460), "Subdivision Control Law Compliance" (ZBL §2498), "Rate of Development Scheduling" (ZBL §2640), "Exemptions.(ZBL §2650), "Table of" (Parking) Requirements" (ZBL §3320), "Number of Plants" (ZBL §3512(II)), "Parking Area Plantings" (ZBL §3513(IV)), "Natural Cover Removal" (ZBL §3570), "Earth Removal" (ZBL §4400)

In addition to requested waivers, additional waivers of strict compliance may be required.

7. *Determine compliance or request waiver of strict compliance with the provisions of "Lot Shape" (ZBL §2480).*

RESPONSE: The perimeter of the lot is approximately 2,581 feet and the total area of the lot is 157,598 square feet. Therefore, the proposed project does not comply with the Lot Shape requirement (ZBL §2480). The Applicant will submit to ZBA a waiver from this requirement.

The Project Site is located in the R-40 Zoning District. The Town of Bourne Zoning Bylaw (ZBL) provides for single family residential and two-family use in the R-40 District (ZBL §2200). As a mid-rise multifamily residential use, the Proposed Project does not comply with the use and certain dimensional requirements of the R-40 District. The Applicants have requested waiver of certain provisions of the R-40 District. These waivers are necessary in order to allow the

Proposed Project to be constructed as submitted. The Applicants zoning analysis and the waiver requests presume Cape View Way has the status of a way. See Comments 1 through 5.

The proposed project complies with the requirements of the R-40 District with respect to minimum lot area of 40,000 square feet (100,000+ square feet provided), the minimum frontage of 125 feet (125+ feet provided), the minimum side yard of 15 feet (15+ feet provided), and minimum usable open space of 20 percent (64% provided) (ZBL §2500).

8. *The submittal states the usable open space provided is 64% of the lot area. Explain the apparent inconsistency of 47% total impervious materials coverage versus 68% total open space per the "Tabulation of Ground Area Coverages" in the Application.*

RESPONSE: The Applicant has reviewed this information and corrected it below and on the site plans. The areas have changed from the original submission due to the changes in the proposed subdivision plan.

TABULATION OF GROUND AREA COVERAGES

COVERAGE TYPE	AREA (SQUARE FEET)	AREA (PERCENTAGE)
Impervious		
Building Area Coverage	20,700	13%
Pavement and Parking Area	40,419	26%
<u>Total Impervious Coverage</u>	61,119	39%
Open Space		
Play Area and Patio	5,460	3%
Remaining Open Space	91,019	58%
<u>Total Open Space</u>	96,479	61%
Total	157,598	100%

The applicants request waiver of strict compliance with the certain dimensional requirements of the R-40 District with respect to minimum front yard setback of 30 feet (10 feet provided), minimum rear yard of 15 feet (7.8 feet provided), maximum lot coverage of 20% (32% provided), and maximum building height of 35 feet (38.9 feet provided) (ZBL §2500).

STORMWATER

The site is provided with a stormwater management system that collects, treats, and infiltrates stormwater on site. Based upon on site wetlands, the Proposed Project is subject to the Massachusetts Wetlands Protection Act (MGL c. 131, § 40) and the stormwater management system must comply with the DEP Stormwater Standards and with the guidance of the Massachusetts Stormwater Handbook. The stormwater management system must also comply with Town of Bourne stormwater management requirements (unless waived) as set forth in the zoning bylaw and the Subdivision Rules and Regulations of the Planning Board.

Compliance with the Massachusetts Stormwater Standards

We evaluated the discussion of compliance the Massachusetts Stormwater Standards provided in the Stormwater Analysis and Drainage Report, and we conclude as follows:

Standard 1: No New Untreated Discharges or Erosion to Wetlands. There is no proposed discharge to wetlands.

RESPONSE: No response required.

Standard 2: Peak Rate Attenuation. Stormwater management system shall be designed so that post development peak discharge rates do not exceed pre-development peak discharge rates. The submitted Stormwater Analysis and Drainage Report tentatively demonstrates compliance. However, supplemental soils testing is required for final confirmation of compliance. See Comment 11.

RESPONSE: See response to Comment 11 below.

Standard 3: Stormwater Recharge. Loss of the annual recharge to groundwater shall be eliminated or minimized through the use of infiltration measures, including environmentally sensitive site design, low impact development techniques, stormwater management best practices, and good operation and maintenance. As a minimum, the annual recharge from the post development site shall approximate the annual recharge from the pre-development site based on soil type. The standard is met when the stormwater management system is designed to infiltrate the required recharge volume as determined in accordance with the Massachusetts Stormwater Handbook. The stormwater management system. The submitted Stormwater Analysis and Drainage Report tentatively demonstrates compliance. However, supplemental soils testing is required for final confirmation of compliance. See Comment 11.

RESPONSE: See response to Comment 11 below.

Standard 4: Water Quality. Stormwater management systems shall be designed to remove 80% of the average annual post-construction load of Total Suspended Solids (TSS). This Standard is met when: 1) suitable practices for source control and pollution prevention are identified in a long-term pollution prevention plan, and thereafter are implemented and maintained; 2) structural stormwater best management practices are sized to capture the required water quality volume determined in accordance with the Massachusetts Stormwater Handbook; and 3) pretreatment is provided in accordance with the Massachusetts Stormwater Handbook. The submitted Stormwater Analysis and Drainage Report tentatively demonstrates compliance; however, additional pretreatment must be provided for the CB 100 infiltration system.

RESPONSE: A Flexstrom® Pure Permanent Inlet Protection has been added to all catchbasins to provide additional pre-treatment.

Standard 5: Land Uses with Higher Potential Pollutant Loads (LUHPPLs). This standard is not applicable for the Project Site.

RESPONSE: No response required.

Standard 6: Critical Areas. The Project Site does not fall within a Critical Area as defined by the SWH and compliance with this standard is not required.

RESPONSE: No response required.

Standard 7: Redevelopment Project. This standard is not applicable for the Project Site.

RESPONSE: No response required.

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Controls: The Applicant has provided sufficient information to demonstrate compliance.

RESPONSE: No response required.

Standard 9: Operation and Maintenance Plan. The Applicant has provided sufficient information to demonstrate compliance.

RESPONSE: No response required.

Standard 10: Prohibition of Illicit Discharges. An Illicit Discharge Compliance Statement has not been submitted.

9. *Submit or state the timing for submittal of an Illicit Discharge Prohibition Statement.*

RESPONSE: The Applicant has updated the Stormwater Report to include this statement.

Soils

The natural Resource Conservation Service mapping provided in the Stormwater Report classifies most of the on-site soils as "Carver Loamy Sand, 3 to 8 percent slopes (259B)" and a portion in the south portion of the site as Hinkley Loamy Sand, 3 to 8 percent slopes (245B). Both of these soil groups are well drained and are classified as Hydrologic Soils Group A (HSG A).

Numerous test pits have been excavated on the site and show a reasonably consistent soil profile. With some exceptions, the test pits show surface layers of Sandy Loam underlain by Sand. Test Pits E and F located in the northwest portion of the site are an exception. They show upper layers of Sandy Loam underlain by Gley Silt Loam, which is underlain by Fine Sandy Loam and sand or sand.

The Stormwater Handbook specifically requires soil testing at the location of the infiltration Best Management Practice (BMP). The on-site stormwater management system includes 6 subsurface structures including 4 URC systems with "Stormtech MC-3500" units and 2 precast concrete Recharge Basin (RB) systems. For the Storm Tech MC 3500 units, the Stormwater Handbook bases test pit requirements on the requirements for infiltration trenches. For URC-1 five test pits are required and for URC-2, URC-3 and URC-4, two test pits are required for each. There are no test pits located at any of the six on site infiltration BMP's which is not in compliance with the Stormwater Handbook. Due uniformity of the sites soil profile, it may be possible to defer additional testing until the construction phase. We recommend that the Sandy Loam layers be removed down to the sand layers and the excavation backfilled with Title 5 sand in order to

ensure long term operation of the infiltration BMP's. We recommend that removal of the Sandy Loam be verified on-site by the engineer of record. The requirement for on-site observation of removal of the Sandy Loam layers can be combined with on-site verification of the textural classification of sand layers at lower levels. The Applicants assume some risk that the subsurface structures may have to be redesigned; however, there is room on-site for expansion of these BMPs if required.

- 10. Revise the drawings to require on-site observation of removal of the sandy loam layers and backfilling with Title 5 sand at each of the 6 subsurface structures during construction.*

RESPONSE: The Applicant has added the following note "A registered Massachusetts soil evaluator must assess soil at every subsurface infiltration structure prior to installation to ensure consistency with the design."

- 11. Revise the drawings to require on-site soil texture classification by a Massachusetts Soil Evaluator at each of the 6 subsurface structures during Construction and to require design revisions if location specific soil data is not consistent with the submitted design.*

RESPONSE: The Applicant has added the following note on sheet C-8: "On-site soil texture classification by a Massachusetts Soil Evaluator at each of the 6 subsurface structures will be conducted during Construction and to require design revisions if location specific soil data is not consistent with the submitted design."

Calculations

Revise the HydroCAD calculations as follows:

- 12. Limit sheet flow length to 50 feet in determining the time of concentration.*

RESPONSE: The Applicant has revised the HydroCAD calculations to limit sheet flow to 50 feet.

- 13. Revise the first flush calculations using 1.7 inches per the subdivision regulations.*

RESPONSE: The Applicant has requested a waiver from this requirement. The Massachusetts Stormwater Management Handbook requires 1 inch for calculating the water quality volume.

- 14. Add flow path to the watershed maps.*

RESPONSE: The flows paths have been made more prominent, so they are visible on the drainage maps. The updated drainage maps are included in the revised Stormwater Report.

Infiltration Structures

Subsurface structure peak water elevations are shown on sheet 15. However, the data is not labeled to show the URC system for which the peak elevations are determined. The top row of the chart which appears to show elevations for URC-1 the elevations do not match the HydroCAD

Reports. The “Underground Chambers, Design Storm Elevations” table on sheet 15 should be deleted and replaced with a new table on sheet C-8 or C-9.

15. *Revise the “Underground Chambers, Design Storm Elevations” table on sheet 15 to include labels for the rows as URC-1, URC-2, URC-3, URC-4. Revise the WQv (for 1.7 inch) peak elevation and add the 2-yr. peak elevation. The elevations in the top row do not appear to match the HydroCAD calculations.*

RESPONSE: The Applicant has requested a waiver from the 1.7-inch WQv requirement. The Massachusetts Stormwater Management Handbook requires 1 inch for calculating the water quality volume.

16. *Supplement the URC “Specifications” table on Sheet 17 providing the elevations for the bottom of stone elevation, bottom of structure elevation, top of structure elevation, top of stone elevation. Alternatively, this information could be labeled for each structure on Sheets C-8 and C-9.*

RESPONSE: The Applicant has provided this information on Sheet C-19 in the revised plan set.

17. *Due to the maintenance burden, revise structure URC-1 to provide a single isolator row.*

RESPONSE: The Applicant has revised URC-1 to provide a single isolator row.

18. *A double-ring infiltrometer test was performed at TP-F which resulted in an infiltration rate of 7.0 inches/hour. This infiltration rate was used to design URC-3. Although contiguous to URC-3, subsurface structure URC-2 is designed with an infiltration rate of 8.27 inches per hour. Revise the design of URC-3 using an infiltration rate of 7.00 inches per hour or provide two test pits substantiating the design infiltration rate of 8.27 inches per hour.*

RESPONSE: The Applicant has revised the HydroCAD calculations to use an 8.27 inches per hour infiltration rate for the design of URC-3, which is consistent with the soils observed in this area.

19. *Provide time to drain calculations for URC-1, URC-2, URC-3, URC-4.*

RESPONSE: The Applicant has added the time to drain calculations in the revised Stormwater Report.

20. *Revise the design of Bioretention Area 2 in order to accommodate the revised island geometry at the building entrance. See Comment 4*

RESPONSE: The Applicant has revised the HydroCAD calculations to include the revised island geometry (i.e., drop off zone). Bioretention Area 2 was oversized and revising the area is not required. Due to minor changes in the drainage areas for the roof and the turnaround area, URC-4 has been changed from 15 to 12 chambers.

21. *Provide requirements for bulkheading subsurface structures until the site is fully stabilized.*

RESPONSE: The Applicant has added an additional note on sheet C-2 of the revised plan set.

Treatment BMPs

22. *The Water Quality Volume used in the sizing of the Bioretention Areas and the Tree Trenches is based on the 1-inch rainfall, not the 1.7-inch rainfall required by the Planning Board Rules and Regulations (PBRR §352 D 1).*

RESPONSE: The Massachusetts Stormwater Management Handbook requires 1 inch for calculating the water quality volume. The Applicant has requested a waiver from this requirement.

23. *Label the Sidewalk Inlet Grate on sheets C-8 and C-9 and reference the detail on Sheet 16.*

RESPONSE: Labels have been added to the Sidewalk Inlet Grate on sheets C-6 and C-8 of the revised plan set.

Collection System

24. *Label pipe diameters, materials, and slopes.*

RESPONSE: The Applicant has provided labels on the revised plan set.

25. *Relocate DMH 200 and eliminate the acute reverse flow angle.*

RESPONSE: DMH 200 has been adjusted to reduce the reverse angle.

26. *The CB 100 – RB 101 – RB 102 system provides 25% TSS removal prior to discharge to the infiltration BMP whereas 44% TSS removal is required.*

RESPONSE: Flexstorm® Pure Permanent Inlet Protection inserts have been added to all catch basins to provide additional 25% TSS removal. The manufacturer information has been added to the appendices of the Stormwater Analysis and Drainage Report.

Stormwater Waivers

The proposed stormwater management system does not comply with the planning board rules and regulations. Revise the submittal to comply or request waiver of strict compliance with the following.

27. *Water Quality Depth shall be 1.7 inches.*

RESPONSE: The Applicant had requested a waiver from this requirement. The Massachusetts Stormwater Management Handbook requires 1 inch for calculating the water quality volume.

28. *Request waiver of requirements for RCP pipe (PBRR §352 A 7).*

RESPONSE: The Applicant requested this waiver in a supplemental submission submitted to ZBA on May 13, 2021.

29. Request waiver of prohibition for subsurface structures (PBRR §352 D 3.b).

RESPONSE: The Applicant requested this waiver in a supplemental submission submitted to ZBA on May 13, 2021.

SITE PLAN

30. The building domestic water service and the building water protection line, and the proposed fire hydrant are located in proximity (hereinafter the “three connections”). To improve reliability and safety, add two 8-inch diameter gate valves, one of each site of the “three connections” to enable the domestic water service, the building water protection line, and the hydrant to be fed from either direction. Adjust the waterline location slightly in order to enable locating the valve boxes for both recommended gate valves within the pavement.

RESPONSE: The Applicant agrees with the comment and has updated the Utility Plans accordingly.

31. Coordinate with the Fire Department and determine the following:

a. Is a second on-site fire hydrant required.

RESPONSE: A second fire hydrant has been added to the plans at approximately 470-feet from the intersection with Meetinghouse Lane to comply with the maximum separation distance of 500-feet.

b. Is a PIV valve required where the fire service enters the building?

RESPONSE: Based on communication with Assistance Fire Chief Pelonzi, a PIV is not required.

32. Research availability of record data or provide a fire flow test.

RESPONSE: The NSWDC conducted a fire flow test on July 22, 2021, at two hydrants closest to the proposed site. A letter summarizing the fire flow test results, from ResilientCE to the North Sagamore Water District, dated July 27, 2021, is attached to this memo.

33. Specify bituminous coated cement lined ductile iron pipe.

RESPONSE: The NSWDC allows the use of PVC pipe for water mains. The plans have been updated to note watermain as PVC.

34. Show the limits of the waterline to be abandoned and identify the point of connection for the watermain extension.

RESPONSE: Based on discussion with the NSWDC, the existing tapping sleeve and gate will remain in Meetinghouse Lane. A new gate valve will be installed in close proximity to the existing gate valve. The new watermain will be brought into the site after the new gate valve. The plans have been updated with additional detail.

35. *Coordinate with the Water District and determine if a three-valve connection is required or if a tapping sleeve and valve is permitted on Homestead Road.*

RESPONSE: Based on discussion with the NSWDC, the connection on Homestead Road will be a cut-in connection. A new gate valve will be installed on the northwest portion of the existing Homestead Road water main. A second gate valve and hydrant will be installed on the new connection from the site.

36. *Show a supply line if natural gas service is available.*

RESPONSE: Natural gas service is not available. Electric heat is proposed.

37. *If natural gas service is not available show the location and spill protection provisions for the heating oil storage tank. The oil storage tank must comply with Fire Department requirements.*

RESPONSE: Electric heat will be provided, therefore a heating oil storage tank is not required.

38. *Show an emergency generator if proposed and provide visual and acoustical screening. The generator should be gas fired if natural gas service is available. The generator should be located to minimize noise impacts on residents and abutters. If not desired to power the entire building, an emergency generator may be required in order to operate the elevator and maintain handicapped accessibility to the second and third floors of the building.*

RESPONSE: The Applicant has added a location for a diesel or propane powered emergency generator (diesel) pad in between the proposed building and the upper parking lot.

39. *Specify the material for vertical faced curbing. Although more expensive than precast concrete curb, vertical faced granite curb is recommended in the turnaround area due to restricted vehicle maneuvering and tight geometry for snow plowing.*

RESPONSE: The Applicant currently is proposing granite curb where sidewalks are located and in the parking lots. Asphalt berm is proposed for the island at the turn around and along the southern side of the access road. A similar application has been used at other POAH developments successfully.

40. *Specify a 4" thick superpave pavement section with a 1½-inch thick surface course and a 2½-inch thick intermediate course. Increasing the surface course from 1¼-inch thick specified in the subdivision regulations allows for increased aggregate size and increased strength.*

RESPONSE: As the driveway will not be a public road and the parking lots are on private property; the Applicant does not believe a 4" pavement section is required and the typical 3" pavement thickness is sufficient. The Applicant will submit to ZBA a waiver from this requirement (Subdivision 326.e).

41. *The Zoning Bylaw which proscribes requirements for site lighting, limits the max./min. ratio to 4.0 whereas the max./min. ratio provided on the "speclines" photometric plan for Driveway is 14.0, for Parking A is 25.5, and for Parking B is 24.5 (ZBL §3453 c)). However, illumination levels provided are similar to illumination levels provided in comparable developments.*

RESPONSE: The Illuminating Engineering Society recommends a uniformity ratio maximum of 15:1 for parking lots. The Applicant reviewed other possible configurations to reduce the max./min. ratio. Due to the maximum coverage requirement of the proposed leachfield, lighting cannot be sited within the parking lot. As mentioned in the comment, the proposed lighting is similar to what is used in comparable developments. The Applicant will request a waiver from this requirement.

SEPTIC SYSTEM

The septic system information provided is a preliminary design and will require additional design prior to final septic system approval.

RESPONSE: The plans have been updated and suitable for Title 5 Permitting.

42. *The conventional Title 5 system location is shown as an outline of dashed lines overlapping the Presby beds. The Presby's state approval letter requires that the site to support a conventional system (primary and reserve). It's not clear that the area must be in a different location on the property, but the rectangular space provided is not supported with design calculations to prove that the space shown represents the conventional system's primary and reserve.*

RESPONSE: Based on further review of the design requirements for the Presby Innovative/Alternative leaching field previously proposed, HW has redesigned the leaching area to a pressure dosed Title 5 leaching trench system. This comment is no longer applicable.

43. *The site evaluation data excludes percolation tests. Granted sandy soil percolation rates are predictable but this test data will be required for final approval.*

RESPONSE: Percolation tests were conducted in Test Pits (TP)-B and TP-5. Results are shown in the soil test pit logs located on sheet C-11.

44. *Redoximorphic features (mottles) was recorded in the soil profiles but in a different area not representing the soils underneath the soil absorption system.*

RESPONSE: Soils in the area of the soil absorption system were found to be sandy in nature with no redoximorphic features encountered. The redoximorphic features were isolated to the western portion of the site, TP-E and TP-F.

45. *The plan does not provide a 100% reserve area.*

RESPONSE: The revised leaching trench system design will provide 100% reserve area.

46. *The plan does not provide deep observation holes and percolation tests verifying a suitable location for the reserve area.*

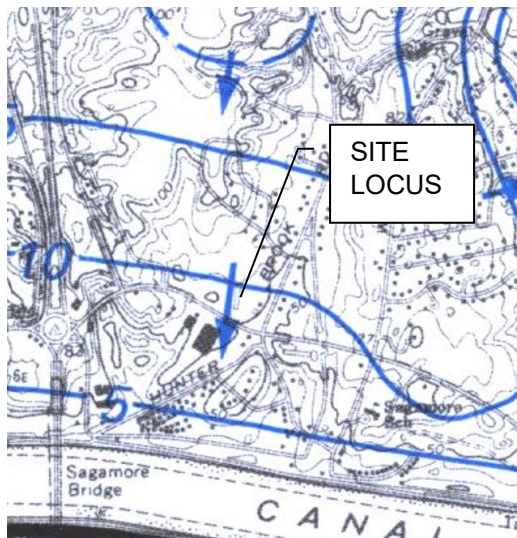
RESPONSE: Additional soil testing acceptable to the Bourne Health Department will be provided for the revised leaching system trench design if necessary.

47. *The mound height is stated but calculations are not provided for groundwater mounding as required for systems over 2,000 gpd.*

RESPONSE: Groundwater mounding calculations are included on sheet C-14 the revised leaching system trench design. Depth to groundwater is estimated at elevation 10, over 40-feet below grade. HW does not believe mounding will affect the leaching trench system design.

48. *No information provided for the high groundwater elevations provided.*

RESPONSE: Regional groundwater contour data indicates a groundwater elevation of 10-ft, which is approximately 40-feet below grade at the site. No standing water was observed during soil testing. See image below from plan titled "Altitude of Water Table in Plymouth-Carver Area, Southeastern Massachusetts, November 30 – December 2, 1984 prepared by Bruce Hansen and Wayne Lapham, 1992".



49. *Bed #1 and Bed #2 will receive an unequal volume of effluent. The beds are two different sizes, one will receive more effluent than the other not providing equal distribution for the entire soil absorption system when dosed.*

RESPONSE: This comment is not applicable as the Presby leaching field is no longer proposed.

50. *Details are missing for the vent manifolds exiting the double offset adapters.*

RESPONSE: This comment is not applicable as the Presby leaching field is no longer proposed.

51. *Bed #1 vent manifold has no details.*

RESPONSE: This comment is not applicable as the Presby leaching field is no longer proposed.

52. *Bed #2 vent manifold is not clear or presented.*

RESPONSE: This comment is not applicable as the Presby leaching field is no longer proposed.

53. *The site plan offers a location for vent pipes north of the beds. No details provided how to get the pipes to the specified location. The manifold vent pipes for Bed #2 are located on the southern end of the bed and Bed #1 is located on the northern end.*

RESPONSE: This comment is not applicable as the Presby leaching field is no longer proposed.

54. *No calculations provided for the pump chamber daily dose (6 doses daily minimum), emergency storage volume, and pressure line backflow volume.*

RESPONSE: The revised design includes detailed pressure dose calculations for the leaching trenches including head loss, required pump rate, float elevations and dosing volumes.

55. *No pump specifications, inside dimensions for the pump chamber, actual dynamic head, pump performance curve (total dynamic head versus flow rate) and manufactured stated flow rate for the actual dynamic head calculated.*

RESPONSE: The revised design includes detailed pressure dose calculations for the leaching trenches including head loss, required pump rate, float elevations and dosing volumes.

56. *Sheet 14 of 21. Sheet provides specifications for sewer manhole and wye connector that are unrelated to the current design. Should be omitted. Space used for current design details which would benefit the design.*

RESPONSE: The sewer wye connection and sewer manhole detail have been removed from the drawings.

57. *Final grade cover over Bed #1 and #2 exceed state's maximum 3 feet of cover.*

RESPONSE: This comment is not applicable as the Presby leaching field is no longer proposed.

58. *Pump chamber outlet elevation is the same for the inlet elevation for the main distribution box. Using the same elevation (no negative grade) will prevent the fluids in the pressure line to return to the pump chamber after each dose by gravity.*

RESPONSE: This comment is not applicable as the Presby leaching field is no longer proposed.

59. *No weep hole provided in the pressure line for backflow return to pump chamber.*

RESPONSE: The revised design includes a weep hole to allow backflow from the multizone valve to the pump chamber. HW is not proposing to drain the entire forcemain back to the pump chamber.

60. *Final grade provided above the pressure line length does not provide proper cover to provide protection from freezing. If buried deep the line will have a bow preventing backflow to pump chamber due to both ends of the pressure line are at the same elevation.*

RESPONSE: HW will ensure that the forcemain is buried a minimum 4-feet below grade to protect from freezing. The dosing calculations for the revised pressure dosed leaching trenches incorporate the volume of the forcemain to ensure that the required dose volume is provided to the leaching trenches. HW is not aware of a requirement for the entire forcemain to drain back to the pump chamber with each pump dose. Distribution laterals in the proposed leaching trenches will be sloped to drain.

61. *Distribution box specifications lack 6" stone base or equivalent to provide a stable base, and the outlet distribution lines to be level for a minimum of the first 2' of the pipe lengths.*

RESPONSE: This comment is not applicable as the Presby leaching field is no longer proposed.

62. *The Presby's state approval letter states the system shall be installed with differential venting for aeration and inspection access at end of each serial bed whenever the system is installed under impervious surfaces.*

RESPONSE: This comment is not applicable as the Presby leaching field is no longer proposed.

COMMENTS FROM THE TIA PEER REVIEW

Our review of the TIA for Cape View Way, gave rise to recommended site plan modifications. We restate these issues to ensure they are addressed in revised site plans. Revised site plans should address the following:

- Any sidewalk obstructions (signs, hydrants, etc.) to be placed to reserve a 48-inch-wide accessible path.

RESPONSE: The Applicant has placed all obstructions outside the sidewalks, which are 60 inches wide.

- *For walkways at the head of perpendicular parking space, widen the sidewalk to 7½ ft., provide parking bumper blocks, or providing a loam strip to maintain a minimum accessible route.*

RESPONSE: Handicapped parking spaces are not provided in this parking lot and to keep impervious cover to a minimum we believe the 5' dimensions is sufficient for this sidewalk and consistent with standard parking lot design.

- *Provide an outdoor bicycle rack be provided for visitors.*

RESPONSE: The Applicant has added a bicycle rack near the drop off area that will fit up to eight bicycles.

- *For the 4 compact perpendicular parking spaces that are accessed from the pavement within the turnaround at the building entrance, provide an overall width of this parking bay (aisle plus parking space) of 42 ft. to ensure proper vehicle maneuvering.*

RESPONSE: The Applicant has updated the parking spaces to 60-degree angled parking. The width of the aisle behind these spaces is 17 feet, which exceeds the Bourne parking regulations requirement of 16 feet clear behind a 60-degree angled parking space.

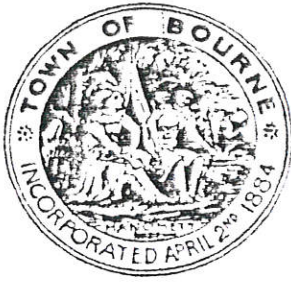
- *The turnaround with center island at the end of Cape View Way that has been adapted to serve as a drop-off at the building entrance. Modify the inner radius of the turnaround to accommodate a fire truck or the largest vehicle expected to regularly access the site.*

RESPONSE: The emergency vehicle turning radius template has been submitted along with a letter from Assistant Fire Chief Pelonzi to demonstrate the Bourne fire truck dimensions provided is able to use the turnaround.

- *Provide signs prohibiting parking along Cape View Way.*

RESPONSE: Based upon property management experience at other POAH facilities and to avoid sign clutter, the applicant prefers to not add the signs at this time. We suggest a condition be added to the approval that signs will be installed if illegal parking along the access drive becomes an issue.

EXHIBIT B



TOWN OF BOURNE, MASSACHUSETTS

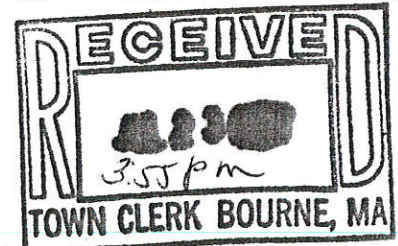
FORM D-1

CERTIFICATE OF APPROVAL OF A DEFINITIVE SUBDIVISION PLAN

June 30⁸⁷
....., 19.....

TO: Town Clerk

The Bourne Planning Board hereby certifies that at a meeting of said Board on June 25⁸⁷....., 19....., at which a majority and quorum were present, following a public hearing by the Board on June 4⁸⁷ June 25..... 19.87, pursuant to notice published in the ...Bourne Courier..... on May 20....., 19.87 and on May 27....., 19.87, it was (unanimously) VOTED: That a Subdivision Plan and Plan and Profile of a Subdivision Meetinghouse Place November 12, 1986 and revised called , dated June 25,....., 19.87 and designed by Doyle Engineering....., registered as an Engineer or Land Surveyor in Massachusetts, submitted for the Board's approval by Equity Associates Inc:...., applicant, be and hereby are approved on condition that prior to the Board's endorsement of its approval thereon the subdivider shall furnish guarantees to the Planning Board as provided in Section 266 of the Subdivision Regulations that except as otherwise expressly provided in Section 81-U of Chapter 41, G.L., no lot included in such plan shall be built upon or conveyed until the work on the ground necessary to serve such lot has been completed in the manner specified by the Subdivision Regulations of the Town of Bourne with the following specific qualifications:



- a. All such installation and construction shall be completed within 24 months of this date;
- b. All streets or ways shall be surfaced with at least a 2" binder course prior to application for occupancy permits for any structures served by such streets or ways:
- c. The driveway servicing lots 2 and 3 shall only be from Capeview Way
- d. Lot 5 shall become a residential and not a business lot
- e. There shall be a connection to the abutting Meadowood subdivision for adequate water pressure
- f. The Conservation Commission shall be notified of the wet area behind Lot 10
- g. The buffer zone between applicant and Mr. Tonello's land should be marked as open space on both the covenant and the deed and the 6"
- h. Picnic area must be adequately screened.

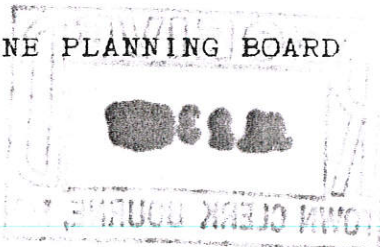
or a performance bond or other security in lieu of completion has been accepted by the Planning Board.

Respectfully submitted,

By: 

Chairman, Planning Board

BOURNE PLANNING BOARD





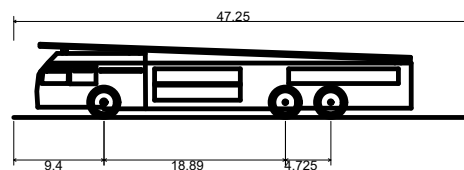
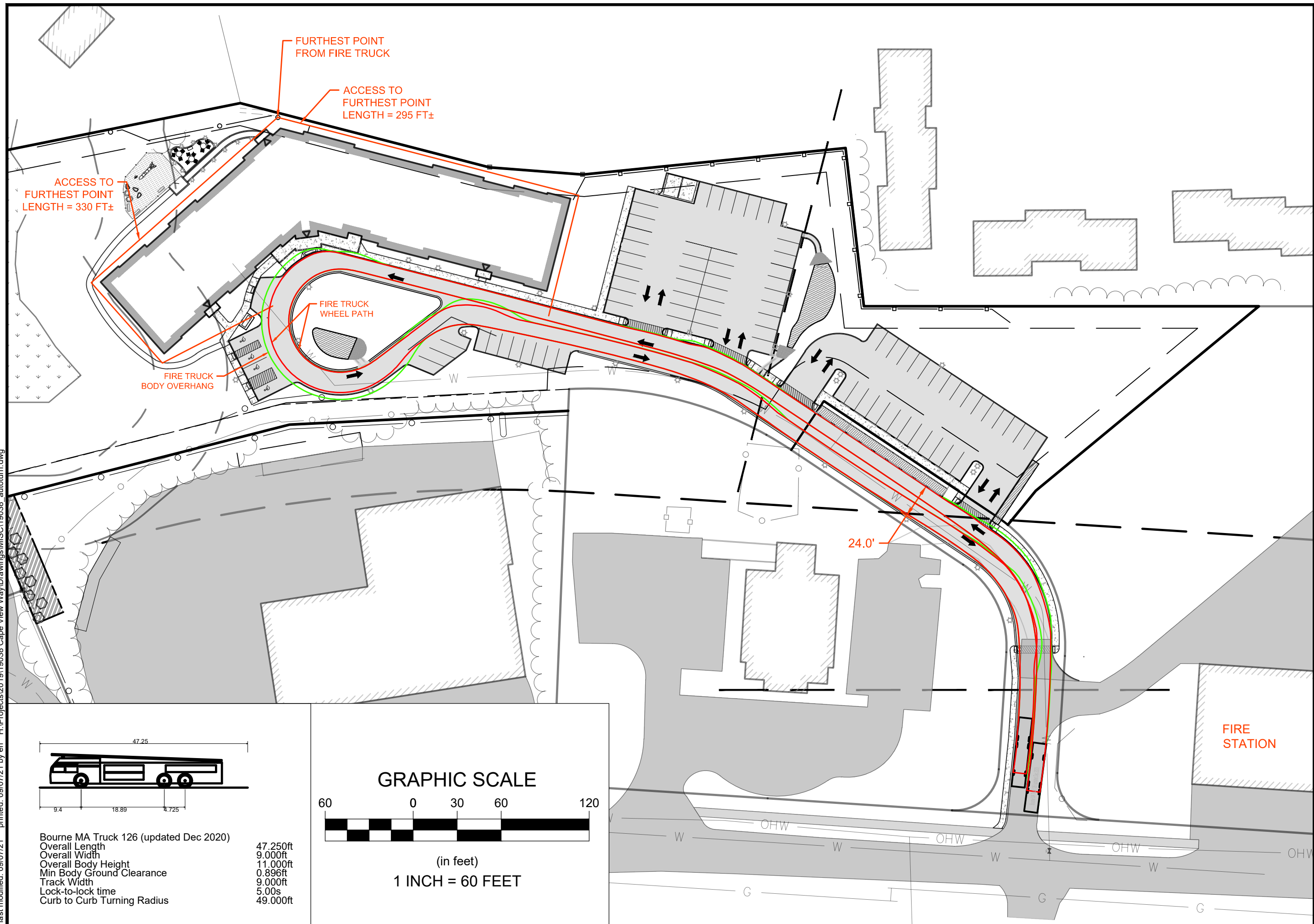
Town of Bourne
Fire/Rescue & Emergency
Services
51 Meetinghouse Lane
Sagamore Beach, MA 02562
508-759-4412



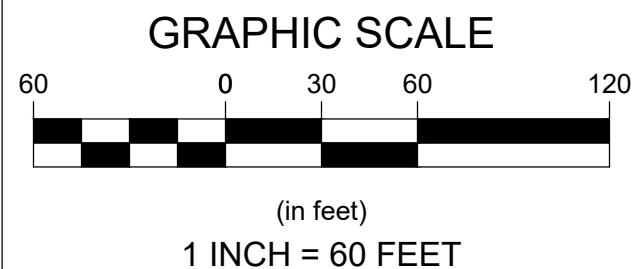
To: Cassie Hammond
From: David S. Pelonzi, Assistant Chief
Date: 09/10/2021
Subject: Cape View Way

Based on updated information I have received on the project above, I have the following comments to add to previous fire department comment:

- The new fire flow test report confirmed the previous test results. The water supply for structure will be sufficient.
- Even with site modifications, the updated emergency vehicle access plan still provides sufficient emergency access for fire department vehicles.
- This department does not require a post-indicator valve for the fire sprinkler system. NFPA 24-10 addresses valves controlling water supply for fire suppression. It will be up to the registered design professional to determine the appropriate valves for the system.



Bourne MA Truck 126 (updated Dec 2020)	
Overall Length	47.250ft
Overall Width	9.000ft
Overall Body Height	11.000ft
Min Body Ground Clearance	0.896ft
Track Width	9.000ft
Lock-to-lock time	5.00s
Curb to Curb Turning Radius	49.000ft



Survey, & Preliminary Layout Provided By Horsley Witten Group, Inc. 90 Route 6A Sandwich, MA 02563 Phone: (508) 833-6600 Fax: (508) 833-3150		Prepared For: PRESERVATION OF AFFORDABLE HOUSING 2 OLIVER STREET, SUITE 500 BOSTON, MA 02109 Phone: (617) 261-9898 Fax: ----		Plan Set: CAPE VIEW WAY PERMITTING PLANS BOURNE, MASSACHUSETTS		Plan Title: FIRE ACCESS									
Registration:															
Project Number: 19038															
Sheet Number: 1 of 1															
<div>Survey, & Preliminary Layout Provided By Horsley Witten Group, Inc. 90 Route 6A Sandwich, MA 02563 Phone: (508) 833-6600 Fax: (508) 833-3150</div>				<div>Prepared For: PRESERVATION OF AFFORDABLE HOUSING 2 OLIVER STREET, SUITE 500 BOSTON, MA 02109 Phone: (617) 261-9898 Fax: ----</div>				<div>Plan Set: CAPE VIEW WAY PERMITTING PLANS BOURNE, MASSACHUSETTS</div>				<div>Plan Title: FIRE ACCESS</div>			
Registration:															
Project Number: 19038															
Sheet Number: 1 of 1															

Ref: 8963

July 22, 2021

Ms. James Beyer, Chairman
Zoning Board of Appeals
Town of Bourne
24 Perry Avenue - Room 203
Buzzards Bay, MA 02532-3441

Attn: Ms. Cassie Hammond

Re: Response to Peer Review of the Transportation Impact Assessment (TIA)
Cape View Way Comprehensive Permit Project
Bourne, Massachusetts

Dear Chairman Beyer and Members of the Zoning Board of Appeals:

Vanasse & Associates, Inc. (VAI) is providing responses to the comments that were raised in the July 20, 2021 Peer Review memorandum prepared by Professional Services Corporation, PC (PSC) on behalf of the Zoning Board of Appeals (ZBA) in reference to the May 2021 *Transportation Impact Assessment* (the "May 2021 TIA") prepared by VAI in support of the proposed multifamily residential development to be located off Cape View Way in Bourne, Massachusetts (hereafter referred to as the "Project"). Listed below are the comments that were identified in the subject memorandum followed by our response on behalf of the Applicant.

STUDY METHODOLOGY

Comment: *In preparing the submitted Transportation Impact Assessment (TIA) Vanasse & Associates inc (VAi) consulted the Town of Bourne and utilized the MassDOT Transportation Impact Assessment (TIA) Guidelines. The TIA includes assessment of existing and future conditions and provision of recommendations for measures to mitigate traffic impacts. Intersection operations were evaluated using the procedures of the Highway Capacity Manual using in the Synchro® 11. Computer model. Overall, we find the methodology to be consistent with the MassDOT TIA Guidelines and standard engineering practice.*

Response: No response required.

TRANSPORTATION STUDY AREA

Comment: *The Transportation Study Area encompasses 3 intersections: the signalized Meetinghouse Lane/Route 3A/Canal Street Intersection, the unsignalized Meetinghouse Lane/Scusset Beach Road/Old Plymouth Road Intersection, and the unsignalized Meetinghouse Road/Cape View Way/54 Meetinghouse Lane Driveway Intersection which provides access to the Project Site. Given the magnitude of the traffic volumes generated by the Proposed Project, we consider the extent of the Transportation Study Area to be sufficient.*

Response: No response required.

TRAFFIC VOLUMES

Comment: *VAi obtained automatic traffic recorder (ATR) counts, manual turning movement counts (TMCs), vehicle classification counts, and vehicle speed data on Tuesday April 27th and Wednesday April 28th, which properly represent midweek conditions.*

Response: No response required.

TRAFFIC VOLUME ADJUSTMENTS

Comment: *In order to account for the reduced 2021 traffic volumes resulting from the Massachusetts Safer at Home Order and the Phased Reopening Massachusetts Plan, the counted traffic volumes were increased by 23.8%. We consider this adjustment to be sufficient.*

Traffic volume counts for the proposed project were taken in the month of April which is a below average month of the year for traffic volumes. Accordingly, the VAI increased the counted traffic volumes by 1.9% to adjust to Average Season traffic volumes based upon analysis of traffic volume data from MassDOT Continuous Count Station Number 708 located on the Mid Cape Highway in Bourne.

Although the Proposed Project falls below the threshold where compliance is required, the requirements for transportation impact assessment set forth in the Cape Cod Commission's Technical Bulletin 96-003 provides valuable guidance on methodologies appropriate for preparing transportation impact assessments in Bourne.¹ Technical Bulletin 96-003 requires an analysis of Existing, No Build, and Build traffic volumes for both Average Season and Peak Season cases.

To initially indicate the magnitude of the required Peak Season adjustment, we reviewed Monthly Traffic Volume data for MassDOT Count Station 708 on the Mid Cape Highway in Bourne. For consistency with the VAI analysis, we used 2019 traffic volume data.

The Monthly Average Daily Traffic Volume for the month of July 2019 was 80,269 vehicles. The Monthly Average Daily Traffic Volume for the month of April 2019 was 60,491 vehicles. In order to evaluate Peak Season traffic, the counted traffic volumes should be increased by an additional 31.7% or such other factor as VAI may develop. See Table 1.

¹¹Cape Cod Commission, Technical Bulletin 96-003, Guidelines for Transportation Impact Assessment.



Table 1 Recommended Traffic Volume Adjustments

	<i>Average Season</i>	<i>Peak Season</i>
<i>Seasonal Adjustment</i>	1.9%	31.7%
<i>COVID-19 Adjustment</i>	23.8%	23.8%
<i>Counted Volume</i>	6,426	6,426
<i>Adjusted Volume</i>	8,110	10,480

We recommend that Peak Season traffic volumes be developed and intersection operations be evaluated for the Peak Season traffic volumes in addition to the Average Season traffic volumes provided in the submitted TIA.

Response: As requested by PSC, an evaluation of peak-season traffic volumes and traffic operations for the roadways and intersections that were assessed in the May 2021 TIA was completed following the methodology outlined by PSC.² Figure 3A depicts 2021 Existing peak-month (July), peak-hour traffic volumes, with Figure 4A depicting 2028 No-Build (without the Project) peak-month peak-hour traffic volumes and Figure 7A depicting the corresponding 2028 Build (with the Project) peak-month peak-hour traffic volumes.

OTHER EXISTING CONDITIONS

Comment: *We find the VAI analysis of other existing conditions is consistent with the MassDOT TIA Guidelines and standard engineering practice. . A field inventory of pedestrian, bicycle, and public transportation facilities within the TSA was provided. Vehicle speed on Meetinghouse Lane was quantified from ATR data with 85th percentile speeds of 37 miles per hour eastbound and 36 miles per hour westbound. Vehicle crash rates were calculated for the three TSA intersections using data for the most recent 7-year period. The Meetinghouse Lane/Route 3A/Canal Street Intersection crash rate was below the State and District crash rates for signalized intersections and the Meetinghouse Road/Cape View Way/54 Meetinghouse Lane Driveway Intersection and Meetinghouse Lane/Scusset Beach Road/Old Plymouth Road Intersection crash rates were below the State and District crash rates for unsignalized intersections.*

Response: No response required.

FUTURE GROWTH AND NO-BUILD VOLUMES

Comment: *The VAI analysis of future growth and the 2028 No-Build Traffic Volumes is sufficient for an Average Season analysis but should be supplemented with a Peak Season analysis. VAI contacted the Town of Bourne and determined that there is no specific development by others that will impact the TSA. VAI evaluated traffic volume data from permanent counting stations located in Bourne and calculated an average traffic growth rate of 0.4%.*

²A slightly higher peak-season adjustment factor of 32.5 percent was used vs. 31.7 percent.



As a conservative analysis, VAI developed the 2028 No-Build traffic volumes using a 1% increase per year compounded annually for seven years as the background growth rate.

VAI contacted the town of Bourne and determined that there were no near-term roadway improvement projects impacting the TSA. Long term plans for replacement of the Sagamore bridge were noted.

Response: As described previously, Figure 7A depicts the 2028 No-Build (without the Project) peak-month peak-hour traffic volumes.

PROJECT GENERATED TRIPS

Comment: *The VAI trip generation calculations are consistent with the MassDOT TIA Guidelines and standard engineering practice. . For the 51 unit multifamily. residential development, trip generation was forecast using the trip generation rates for ITE Land Use Code 221 Multifamily Housing (Mid-Rise)³. The 51 residential units will generate 276 vehicle trips (138 entering 138 exiting) on a Weekday. The Project will generate 18 vehicle trips during the Weekday Morning Peak Hour (5 entering/13 exiting). The project will generate 23 vehicle trips during the Weekday Evening Peak Hour (14 entering/9 exiting).*

Response: No response required.

FUTURE BUILD TRAFFIC VOLUMES

Comment: *Trip distribution and assignment are consistent with the MassDOT TIA Guidelines and standard engineering practice. The trips generated by the Proposed Project were distributed and assigned to the roadway network in the TSA based upon analysis of US Census Journey to Work Data with the highest number of trips.(72% of entering trips/50% of exiting trips) assigned to the Scenic Highway west of the Meetinghouse Lane/Route 3A/Canal Street Intersection.*

Overall, the trips generated by the Proposed Project represent a relatively small addition to the existing traffic volumes in the TSA. Traffic volumes for the most heavily impacted roadway segment, the Scenic Highway west of the Meetinghouse Lane/Route 3A/ Canal Street Intersection increased by 7/10 of 1%.

Response: No response required.

³Institute of Transportation Engineers, Trip Generation Manual, Version 5.0 (Updates),10th Edition (September 2017)+Supplement (February 2020).



INTERSECTION OPERATIONS

Comment: *The analysis of intersection operations is sufficient for an Average Season conditions but should be supplemented with an analysis of Peak Season conditions.*

The submitted Average Season analysis is based on the methodology of the Highway Capacity Manual utilizing Synchro® 11 software and is sufficient.

VAi determined that the signalized Meetinghouse Lane/Route 3A/Canal Street Intersection operates at LOS C Weekday Morning (2021 Existing, 2028 No-Build, and the 2028 Build) and at LOS C (2021 Existing) or LOS D (2028 No-Build and 2028 Build) Weekday Evening. Comparing operations with the 2028 No-Build vs the 2028 Build traffic volumes, there is no change in level-of-service, the increase in control delay is less than 1 second, and 95th percentile queue lengths remain unchanged or increase by a maximum of 1 vehicle.

VAi determined that the Old Plymouth Road northbound approach to the unsignalized Meetinghouse Lane/Scusset Beach Road/Old Plymouth Road Intersection operates at LOS C Weekday Morning (2021 Existing, 2028 No-Build, and 2028 Build) and at LOS C (2021 Existing) or LOS D (2028 No-Build and the 2028 Build) Weekday Evening. The Old Plymouth Road southbound approach operates at LOS B during both the Weekday Morning and Weekday Evening (2021 Existing, 2028 No-Build, and 2028 Build). Comparing operations with the 2028 No-Build traffic volumes vs the 2028 Build traffic volumes, there is no change in level-of-service or 95th percentile queue lengths on either approach.

VAi determined that the Cape View Way approach to the Meetinghouse Road/Cape View Way/54 Meetinghouse Lane Driveway Intersection operates at LOS B Weekday Morning and at LOS C Weekday Evening (2021 Existing, 2028 No-Build, and 2028 Build). Comparing operations with the 2028 No-Build traffic volumes vs the 2028 Build traffic volumes, there is no change in level-of-service and the 95th percentile queues are zero.

Response: As requested, an assessment of traffic operations (motorist delays, vehicle queuing and levels of service) at the study area intersections was completed under peak-month (July) traffic volume conditions, the results of which are summarized in Tables 9A and 10A.

As can be seen in Table 9A, under peak-month conditions, the signalized intersection of Meetinghouse Lane at Canal Street and State Road was shown to operate at LOS C/D during the weekday morning peak-hour (vs. LOS C under average-month conditions) and at LOS F (vs. LOS C/D) during the weekday evening peak-hour. The addition of Project-related traffic to the intersection under peak-month conditions did not result in a change in level-of-service for any movement over No-Build conditions, with Project-related impacts defined by a predicted increase in overall average motorist delay of up to 1.2 seconds and in vehicle queuing of up to one (1) vehicle.



With the exception of the Old Plymouth Road northbound approach during the weekday evening peak-hour at the Meetinghouse Lane/Old Plymouth Road intersection, all movements at the unsignalized study area intersections were shown to operate at LOS D or better during the peak hours under peak-month conditions. Independent of the Project, the Old Plymouth Road northbound approach to Meetinghouse Lane was shown to operate over its design capacity (i.e., LOS “F”) during the weekday evening peak-hour under 2021 Existing peak-month conditions. Project-related impacts at the unsignalized study area intersections were defined as an increase in average motorist delay of up to 2.8 seconds and in vehicle queuing of up to one (1) vehicle.

SIGHT DISTANCE

Comment: *VAi correctly evaluated required Stopping Sight Distance (SSD) and desirable Intersection Sight Distance (ISD) using measured 85th percentile speed data obtained from Automatic Traffic Recorder (ATR) Counts. Measured SSD is greater than the required SSD on Meetinghouse Lane eastbound and westbound. Measured ISD is greater than the calculated ISD looking east and west from the Cape View Way approach.*

Response: No response required.

TIA RECOMMENDATIONS

Comment: *We concur with the VAI recommendations for project access including a 24-ft. pavement width, stop sign control at Meetinghouse Lane, signage, and a sidewalk.*

We also concur with the VAI recommendations for Transportation Demand Management (TDM), including designation of a transportation coordinator, posting public transportation service information, providing residents with a welcome packet that includes transportation information, constructing a sidewalk on Cape View Way, providing a central mailbox facility, and providing on site secure bicycle parking.

Response: No response required.

PEDESTRIAN AND BICYCLE ACCESS

Comment: *The site plan provides good pedestrian access with a walkway that connects the building entrance with the on-site parking areas and extends to meet the existing sidewalk on Meetinghouse Lane.*

The width of the proposed on-site walkway is not dimensioned but scales approximately 5 ft. Care must be taken not to place signposts, hydrants, and other obstructions that could restrict the accessible route. In two locations, the sidewalk is placed at the head of perpendicular parking spaces. Bumper overhang of 2 to 2½ feet can be accepted which would narrow the accessible route to an unacceptable 2½ to 3 ft. We recommend widening the sidewalk to 7½ ft. in these locations, providing parking bumper blocks, or providing a loam strip to maintain a minimum accessible route.



We concur with the VAI recommendation that secure indoor bicycle access be provided. Further, we recommend that an outdoor bicycle rack be provided for visitors.

Response: As requested by PSC, the Project proponent will review widening the sidewalk, providing parking bumper blocks, or including a loam strip to maintain a minimum accessible route. These accommodations will be shown on a subsequent revision of the Site Plans.

SITE ACCESS, CIRCULATION, AND PARKING

Comment 1: *There are 4 compact parking perpendicular parking spaces that are accessed from the pavement within the turnaround at the building entrance. The overall width of this parking bay is approximately 33 ft. (scaled) which will make accessing the parking space difficult. We recommend a minimum overall bay width of 42 ft. to ensure proper vehicle maneuvering.*

Response: As requested by PSC, the Project proponent will review the overall parking bay width and any adjustments will be reflected on a subsequent revision of the Site Plans.

Comment 2: *The turnaround with center island at the end of Cape View Way that has been adapted to serve as a drop-off at the building entrance has an outer diameter (scaled) of approximately 98 ft. and an inner diameter (scaled) of approximately 68 ft. The outer radius should be sufficient, but the inner radius should be reduced by widening the pavement in order to accommodate a fire truck or other large vehicles. An AASHTO S-BUS 40 design vehicle used by many fire departments to emulate their fire apparatus has a minimum outer turning diameter of approximately 85 ft. and a minimum inner turning diameter of approximately 50 ft. We recommend that a vehicle swept path plan be prepared to better define the required shape of the island. Consultation with the Fire Department is recommended to identify design vehicle requirements. In addition to accommodating fire apparatus, the size of the center island should be reduced as necessary in order to accommodate the largest non-emergency vehicle regularly using the turnaround.*

Response: A vehicle turning analysis will be prepared and provided by others under separate cover.

Comment 3: *Although the overall length of Cape View Way is only 650± ft., the potential to block emergency vehicle access is always a concern for a single entrance site. We recommend that signs be provided prohibiting parking along Cape View Way.*

Response: As requested by PSC, “No Parking” signs will be installed along Cape View Way. The signs will be reflected on a subsequent revision of the Site Plans.

Comment 4: *A total of 85 parking spaces (69 standard parking spaces/12 compact parking spaces/4 accessible parking spaces) are proposed to serve the 51 residences. We quantified peak parking demand based upon the Institute of Transportation Engineers (ITE) Parking Generation Manual⁴. For ITE Land Use 221 Multifamily Housing (Mid-Rise), peak period parking demand on a weekday in a general urban/suburban setting (no nearby rail transit)*

⁴⁴ITE Parking Generation Manual 5th Edition, January 2019, Institute of Transportation Engineers.



Ms. James Beyer, Chairman
Zoning Board of Appeals
Town of Bourne
July 22, 2021
Page 8 of 8

for 51 dwelling units is 60 parking spaces. The proposed 85 parking spaces should be sufficient. Although not anticipated, should additional parking ever be needed there are areas on-site where additional parking spaces could be added.

Response: No response required.

CONSTRUCTION MANAGEMENT PLAN

Comment: *A draft Construction Management Plan should be submitted that provides for minimization of overall construction phase vehicle trips including single occupant vehicle trips. Prior to construction, this draft plan can be refined through consultation with the Police Department and the Department of Public Works.*

Response: A draft Construction Traffic Management Plan (TMP) is attached and will be refined in consultation with the Police Department and the Department of Public Works as the Site Plans are advanced, and will include the use of police detail officers when appropriate and required by the Police Department.

We trust that this information is responsive to the comments that were provided by PSC concerning their review of the May 2021 TIA. If you should have any questions or would like to discuss our responses in more detail, please feel free to contact me.

Sincerely,

VANASSE & ASSOCIATES, INC.



Jeffrey S. Dirk, P.E., PTOE, FITE
Managing Partner

Professional Engineer in CT, MA, ME, NH, RI and VA

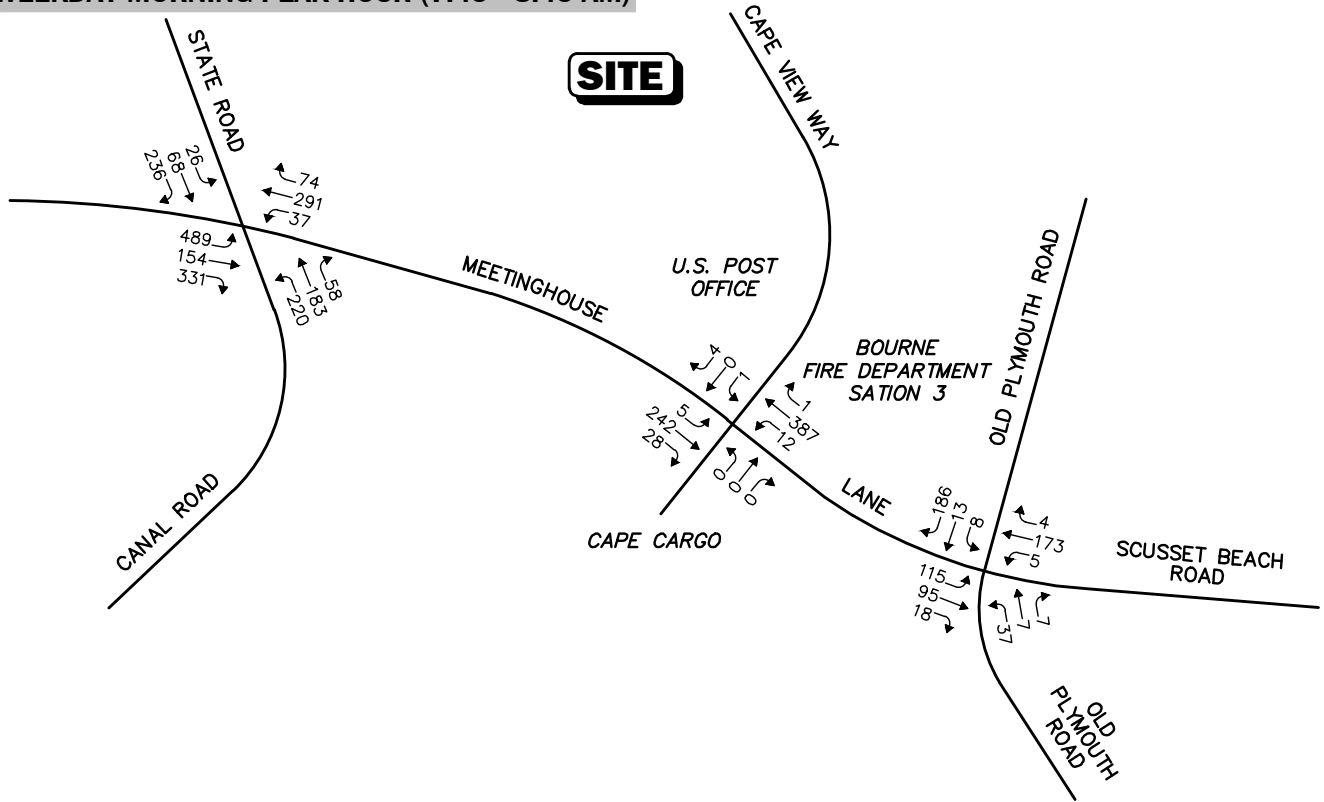
JSD/jsd

Attachments

cc: T. Houston, P.E., AICP – PSC (via email)
M. Jacob, AICP - Preservation of Affordable Housing, Inc. (via email)
P. Freeman, Esquire – Freeman Law Group (via email)



WEEKDAY MORNING PEAK HOUR (7:45 - 8:45 AM)



WEEKDAY EVENING PEAK HOUR (4:30 - 5:30 PM)

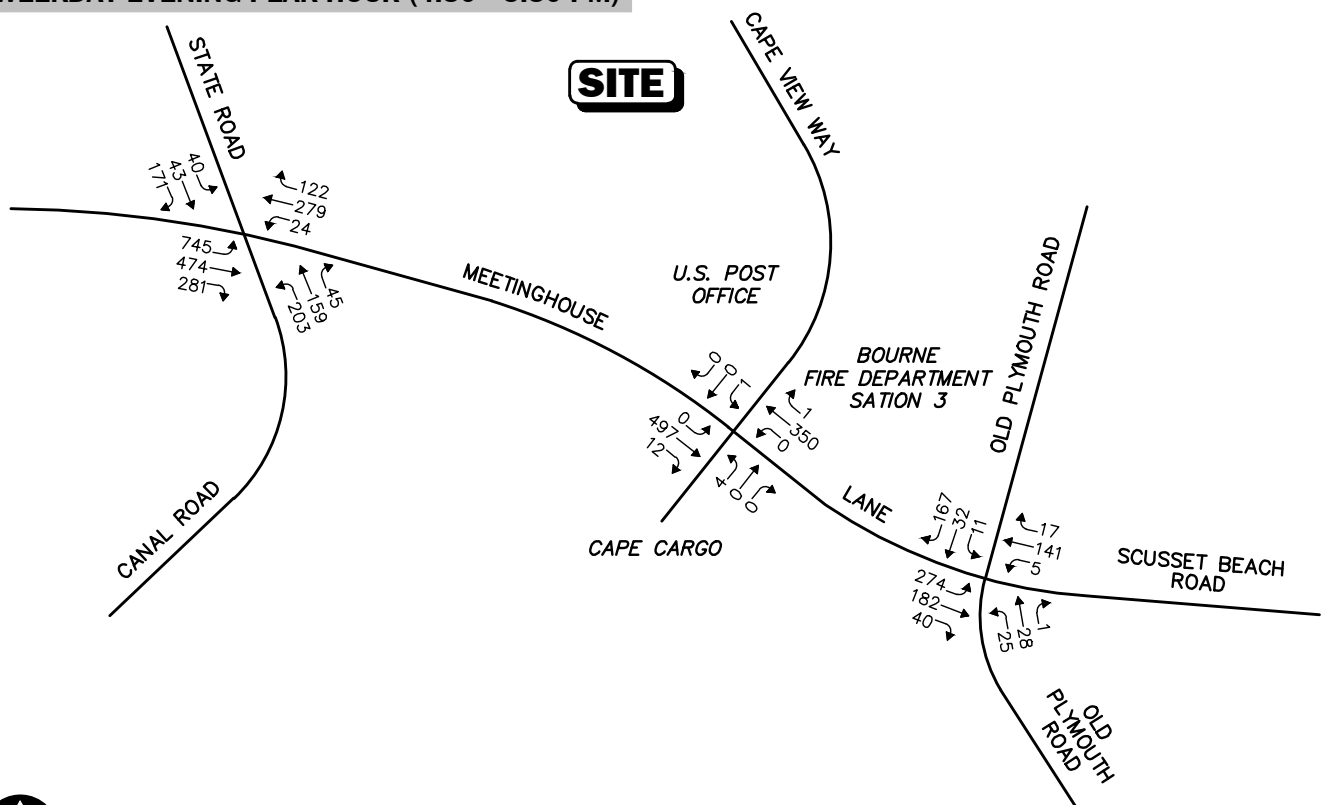
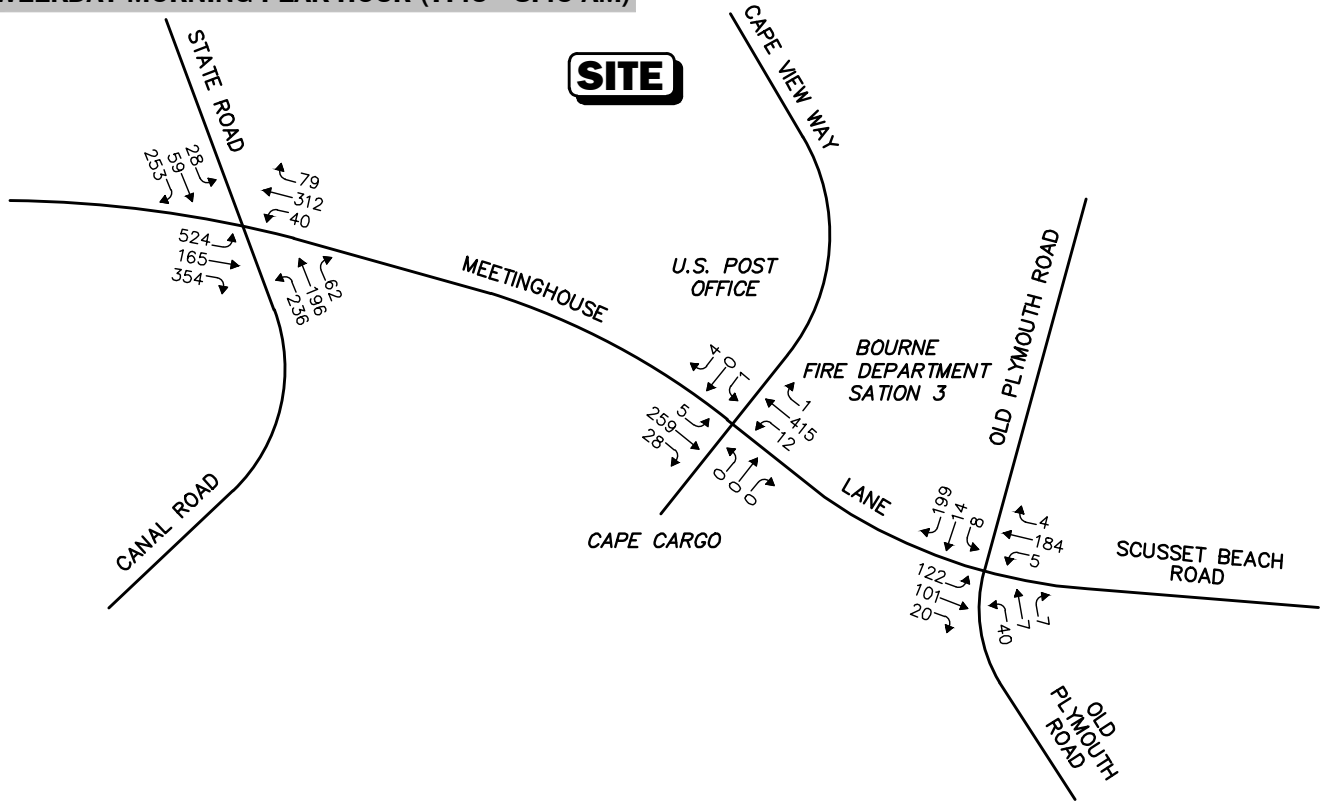


Figure 3A

2021 Existing
Peak-Month
Peak-Hour Traffic Volumes

WEEKDAY MORNING PEAK HOUR (7:45 - 8:45 AM)



WEEKDAY EVENING PEAK HOUR (4:30 - 5:30 PM)

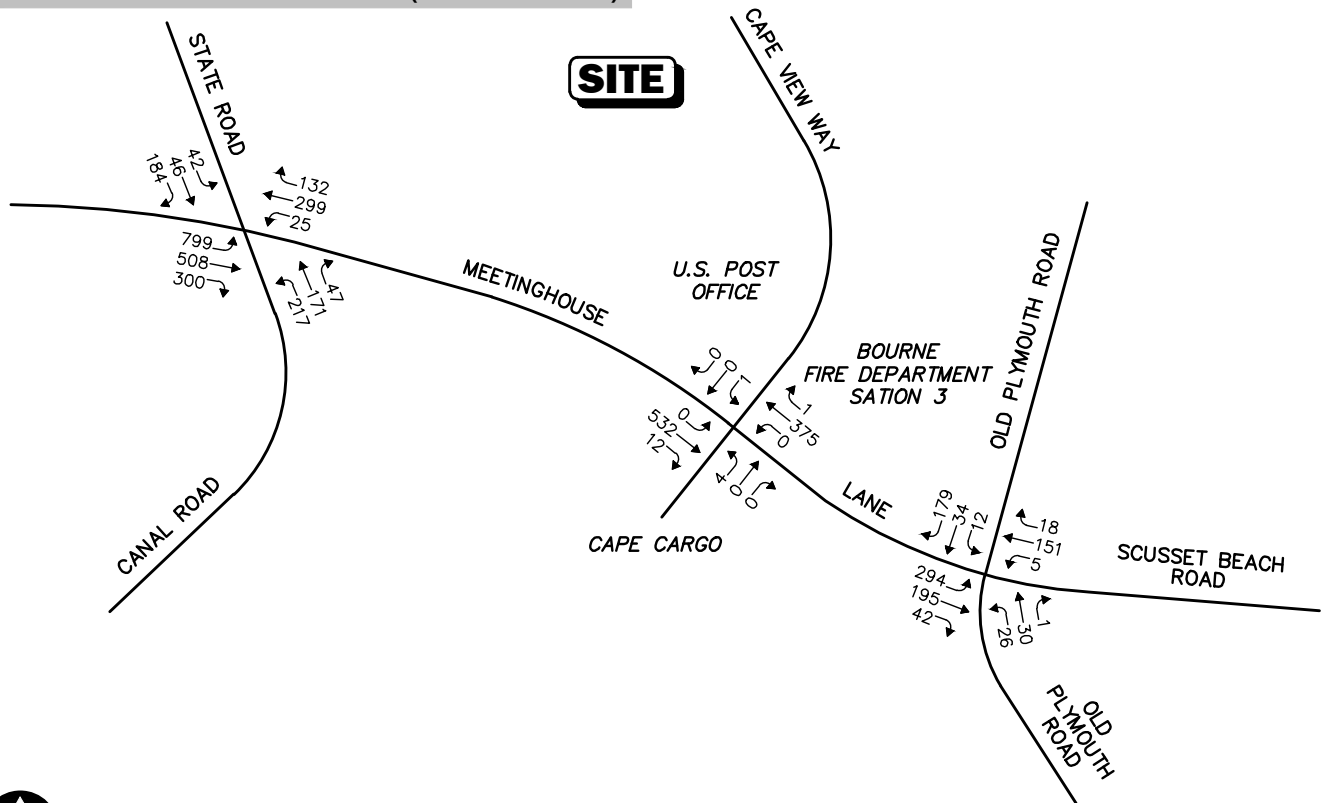
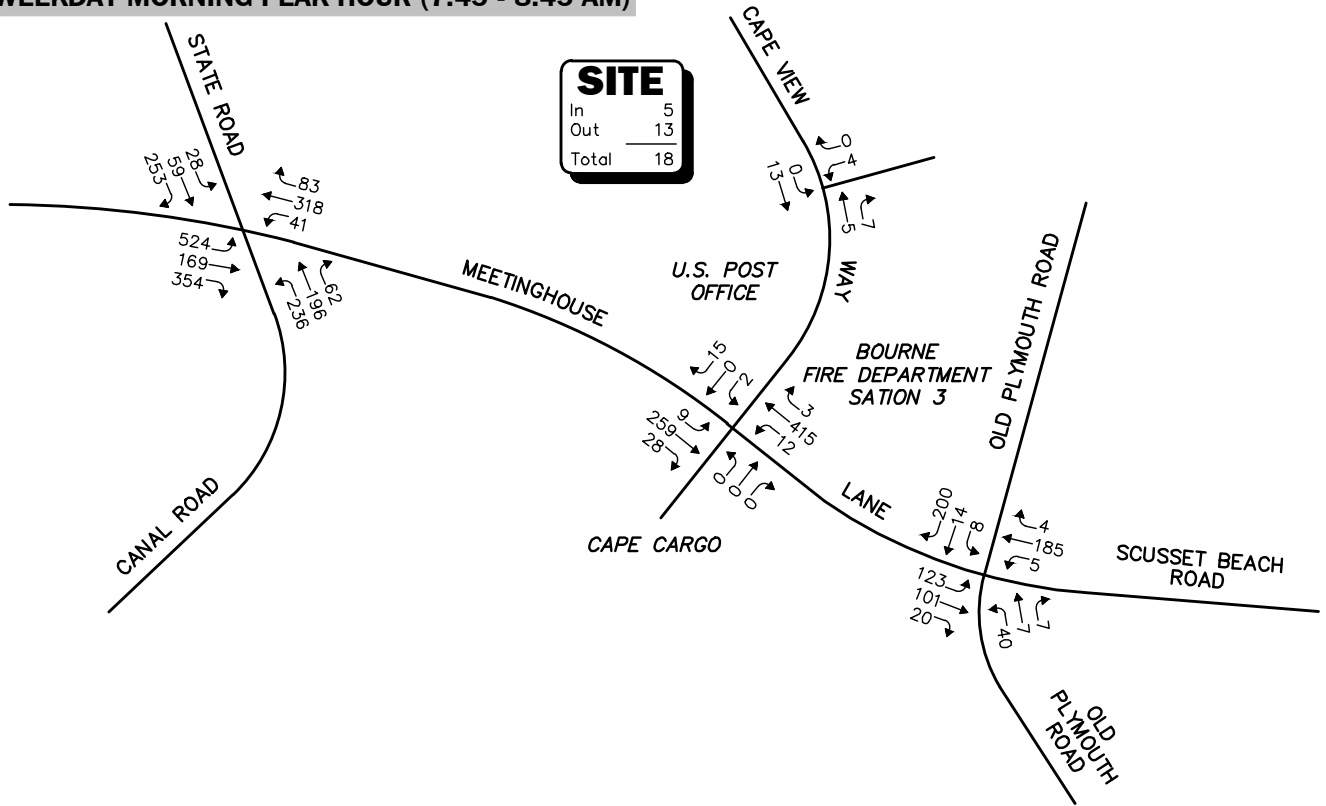


Figure 4A

2028 No-Build
Peak-Month
Peak-Hour Traffic Volumes

WEEKDAY MORNING PEAK HOUR (7:45 - 8:45 AM)



WEEKDAY EVENING PEAK HOUR (4:30 - 5:30 PM)

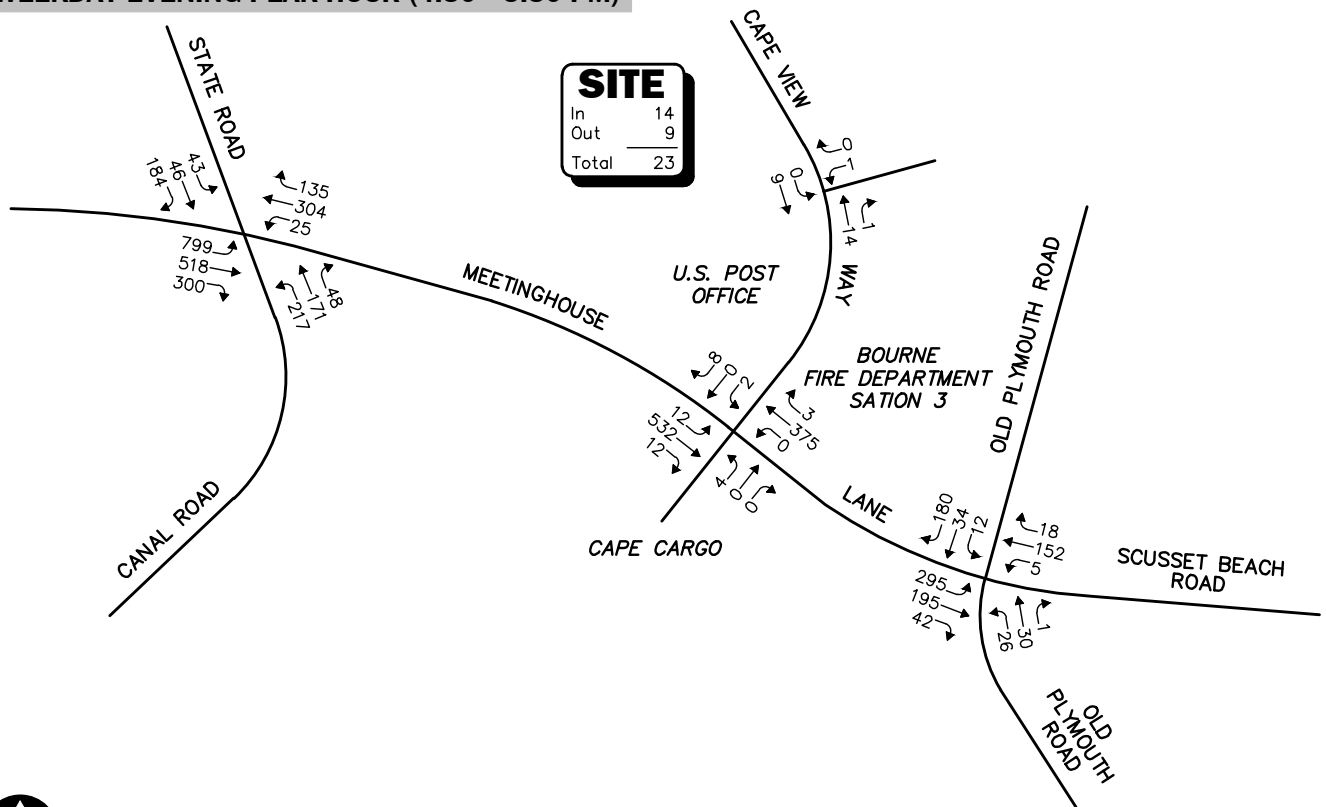


Figure 7A

2028 Build
Peak-Month
Peak-Hour Traffic Volumes

Table 9A
PEAK MONTH SIGNALIZED INTERSECTION LEVEL-OF-SERVICE AND VEHICLE QUEUE SUMMARY

Signalized Intersection/Peak-hour/Movement	2021 Existing				2028 No-Build				2028 Build			
	V/C ^a	Delay ^b	LOS ^c	Queue ^d 50 th /95 th	V/C	Delay	LOS	Queue 50 th /95 th	V/C	Delay	LOS	Queue 50 th /95 th
Meetinghouse Lane at Canal St at State Road												
<i>Weekday Morning:</i>												
Meetinghouse Lane EB LT	0.86	30.1	C	9/19 ^e	0.94	44.9	D	10/23 ^e	0.95	46.9	D	10/23 ^e
Meetinghouse Lane EB TH	0.15	8.2	A	2/3	0.16	8.1	A	2/4	0.16	8.0	A	2/4
Meetinghouse Lane EB RT	0.23	8.8	A	0/2	0.25	8.7	A	0/2	0.25	8.7	A	0/2
Meetinghouse Lane WB LT	0.05	7.7	A	1/1	0.06	7.5	A	1/1	0.06	7.5	A	1/1
Meetinghouse Lane WB TH/RT	0.80	42.5	D	9/14	0.82	43.1	D	10/16	0.81	42.6	D	10/16
Canal Street NB LT	0.98	85.6	F	6/13 ^e	1.06	111.9	F	7/15 ^e	1.08	116.7	F	7/16 ^e
Canal Street NB TH	0.46	32.6	C	5/8	0.50	34.1	C	5/9	0.50	34.7	C	5/9
Canal Street NB RT	0.04	28.6	C	0/1	0.04	29.6	C	0/1	0.04	30.2	C	0/1
State Road SB LT	0.12	29.4	C	1/2	0.14	30.5	C	1/2	0.14	31.1	C	1/2
State Road SB TH	0.42	43.3	D	2/4	0.38	43.8	D	2/4	0.38	44.5	D	2/4
State Road SB RT	0.18	41.2	D	0/3	0.19	42.3	D	0/3	0.19	42.9	D	0/3
Overall	--	34.8	C	--	--	41.2	D	--	--	42.1	D	--
<i>Weekday Evening:</i>												
Meetinghouse Lane EB LT	1.42	221.7	F	26/40 ^e	1.57	288.9	F	31/47 ^e	1.58	294.4	F	31/48 ^e
Meetinghouse Lane EB TH	0.46	9.9	A	7/11	0.49	10.1	B	7/12	0.49	10.1	B	8/12
Meetinghouse Lane EB RT	0.25	8.3	A	1/2	0.24	8.1	A	1/2	0.24	8.0	A	1/2
Meetinghouse Lane WB LT	0.06	7.1	A	1/1	0.06	7.1	A	1/1	0.06	7.0	A	1/1
Meetinghouse Lane WB TH/RT	0.81	41.8	D	10/16	0.83	42.2	D	11/18	0.83	42.2	D	11/18
Canal Street NB LT	0.94	76.7	E	5/12 ^e	1.02	101.3	F	6/15 ^e	1.02	104.3	F	6/15 ^e
Canal Street NB TH	0.42	33.5	C	4/8	0.46	35.3	D	5/8	0.46	35.7	D	5/8
Canal Street NB RT	0.03	29.9	C	0/1	0.03	31.2	C	0/1	0.03	31.6	C	0/1
State Road SB LT	0.18	31.3	C	1/3	0.21	32.9	C	1/3	0.22	33.4	C	1/3
State Road SB TH	0.31	43.8	D	2/3	0.33	45.2	D	2/3	0.33	45.6	D	2/3
State Road SB RT	0.13	42.4	D	0/2	0.14	43.8	D	0/2	0.14	44.2	D	0/2
Overall	--	84.2	F	--	--	107.3	F	--	--	108.5	F	--

^aVolume-to-capacity ratio.

^bControl (signal) delay per vehicle in seconds.

^cLevel-of-Service.

^dQueue length in vehicles.

^eVolume 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.

SB = southbound; EB = eastbound; WB = westbound; LT = left-turning movements; TH = through movements; RT = right-turning movements.

Table 10A

PEAK MONTH UNSIGNALIZED INTERSECTION LEVEL-OF-SERVICE AND VEHICLE QUEUE SUMMARY

Unsignalized Intersection/ Peak Hour/Movement	2020 Existing				2028 No-Build				2028 Build			
	Demand ^a	Delay ^b	LOS ^c	Queue ^d 95 th	Demand	Delay	LOS	Queue 95 th	Demand	Delay	LOS	Queue 95 th
Meetinghouse Lane at Old Plymouth Road												
<i>Weekday Morning:</i>												
Meetinghouse Lane EB LT/TH/RT	228	4.0	A	1	243	4.0	A	1	244	4.0	A	1
Meetinghouse Lane WB LT/TH/RT	182	0.2	A	0	193	0.2	A	0	194	0.2	A	0
Old Plymouth Road NB LT/TH/RT	51	22.3	C	1	54	25.5	D	2	54	25.7	D	2
Old Plymouth Road SB LT/TH/RT	207	11.9	B	2	221	12.3	B	2	222	12.4	B	2
<i>Weekday Evening:</i>												
Meetinghouse Lane EB LT/TH/RT	496	4.6	A	0	531	4.6	A	1	532	4.7	A	1
Meetinghouse Lane WB LT/TH/RT	163	0.2	A	0	174	0.2	A	0	175	0.2	A	0
Old Plymouth Road NB LT/TH/RT	54	56.1	F	3	57	82.1	F	3	57	82.1	F	4
Old Plymouth Road SB LT/TH/RT	210	20.3	C	3	225	25.0	D	4	226	25.3	D	4
Meetinghouse Lane at Cape View Way at 54 Meetinghouse Lane Driveway												
<i>Weekday Morning:</i>												
Meetinghouse Lane EB LT/TH/RT	275	0.1	A	0	292	0.1	A	0	296	0.3	A	0
Meetinghouse Lane WB LT/TH/RT	400	0.3	A	0	428	0.2	A	0	430	0.2	A	0
54 Meetinghouse Lane Driveway NB LT/TH/RT	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0
Cape View Way NB LT/TH/RT	5	12.0	B	1	5	12.3	B	1	18	12.5	B	1
<i>Weekday Evening:</i>												
Meetinghouse Lane EB LT/TH/RT	509	0.0	A	1	544	0.0	A	0	556	0.2	A	0
Meetinghouse Lane WB LT/TH/RT	351	0.0	A	0	376	0.0	A	0	378	0.0	A	0
54 Meetinghouse Lane Driveway NB LT/TH/RT	4	21.1	C	1	4	23.0	C	1	4	25.8	D	1
Cape View Way NB LT/TH/RT	1	21.3	C	1	1	22.0	C	1	10	22.0	C	1
Cape View Way at the Project Site Driveway												
<i>Weekday Morning:</i>												
Cape View Way WB LT/RT	--	--	--	--	--	--	--	--	4	8.6	A	0
Cape View Way NB TH/RT	--	--	--	--	--	--	--	--	12	0.0	A	0
Project Site Driveway SB LT/TH	--	--	--	--	--	--	--	--	13	0.0	A	0
<i>Weekday Evening:</i>												
Cape View Way WB LT/RT	--	--	--	--	--	--	--	--	1	8.6	A	0
Cape View Way NB TH/RT	--	--	--	--	--	--	--	--	15	0.0	A	0
Project Site Driveway SB LT/TH	--	--	--	--	--	--	--	--	9	0.0	A	0

^aDemand in vehicles per hour.

^bAverage control delay per vehicle (in seconds).

^cLevel-of-Service.

^dQueue length in vehicles.

NB = northbound; SB = southbound; EB = eastbound; WB = westbound; LT = left-turning movements; TH = through movements; RT = right-turning movements.

ATTACHMENTS

SEASONAL ADJUSTMENT DATA
CAPACITY ANALYSIS WORKSHEETS
CONSTRUCTION MANAGEMENT PLAN

ATTACHMENTS

SEASONAL ADJUSTMENT DATA
CAPACITY ANALYSIS WORKSHEETS

SEASONAL ADJUSTMENT DATA

Massachusetts Highway Department
708: Monthly Hourly Volume for April 2019

Location ID:	708
County:	Barnstable
Functional Class	2
Location:	MID-CAPE HIGHWAY

Seasonal Factor Group: Rec - East
Daily Factor Group:
Axle Factor Group: Rec - East
Growth Factor Group:

	0:00	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	TOTAL	QC Status	
1	236	159	141	221	548	1440	3830	4650	4443	3247	3123	3110	3147	3176	3769	4388	4768	4288	2741	1911	1345	952	569	411	56613	Accepted	
2	214	171	130	212	553	1400	3820	4756	4443	3364	3072	3137	3188	3229	3886	4747	4975	4664	2974	2073	1391	1047	636	423	58505	Accepted	
3	228	140	133	170	491	1192	3335	4428	4236	3284	2950	2979	3058	3229	3759	4522	4739	4408	2853	1995	1510	1071	692	415	55817	Accepted	
4	242	127	147	207	523	1357	3830	4894	4541	3667	3110	3329	3335	3547	4107	5001	5146	4944	3448	2224	1633	1118	784	476	61737	Accepted	
5	236	176	132	198	511	1247	3580	4629	4182	3451	3375	3621	3822	3952	4673	5633	5688	5442	4091	2576	1894	1383	980	670	66142	Accepted	
6	411	230	134	179	266	536	1306	2065	2720	3331	4040	4304	4495	4422	4387	4470	4419	3936	3218	2203	1868	1428	1163	617	56148	Accepted	
7	383	272	164	162	190	369	785	1489	2096	2920	3752	4268	4373	4485	4486	4588	4349	3678	2923	2165	1603	918	610	429	51457	Accepted	
8	200	125	132	204	561	1394	3663	4579	4255	3230	3091	3182	3228	3331	3690	4107	4491	4128	2633	1652	1221	874	542	333	54846	Accepted	
9	223	157	134	199	566	1417	3613	4986	4537	3648	3196	3107	3170	3219	3771	4441	4881	4705	3277	1982	1501	1055	601	390	58776	Accepted	
10	221	128	130	198	488	1320	3711	4963	4593	3626	3099	3263	3331	3423	4010	4734	4903	4912	3247	2046	1521	1133	618	457	60075	Accepted	
11	244	149	162	186	547	1349	3747	4875	4492	4003	3494	3427	3612	3721	4414	5351	5474	5221	3732	2270	1623	1193	830	548	64664	Accepted	
12	340	220	174	205	482	1256	3488	4643	4190	3842	3749	3898	4205	4460	4891	5640	5797	5569	4685	3080	2019	1423	1053	610	69919	Accepted	
13	389	221	170	175	267	555	1214	2070	2764	3428	3997	4504	4729	4336	4507	4544	4246	3781	2955	2149	1674	1381	979	648	55683	Accepted	
14	439	248	168	163	123	412	749	1374	2133	3043	3956	4500	4498	4487	4168	4750	4435	3928	2978	2187	1467	891	696	430	52223	Accepted	
15	258	164	144	209	418	1006	2541	3173	3162	3077	3397	3716	3700	3667	3829	4104	4302	3922	2728	1879	1417	934	684	387	52818	Accepted	
16	237	152	150	201	506	1350	3552	4470	4322	4039	3989	4204	4243	3965	4450	5038	5505	5140	3378	2302	1750	1123	739	391	65196	Accepted	
17	263	160	150	189	468	1362	3482	4538	4510	4160	4066	4380	4394	4310	4698	5495	5594	5276	3371	2508	1801	1247	817	509	67748	Accepted	
18	282	164	156	207	493	1266	3454	4514	4355	3953	3981	4379	4456	4477	4772	5120	5822	5576	3786	2252	1928	1296	878	624	68191	Accepted	
19	306	245	162	199	442	1075	3047	3998	3943	3874	4373	4696	4867	5096	5296	5352	5813	5395	4460	2520	2041	1467	1037	794	70498	Accepted	
20	364	241	169	172	246	502	1147	1980	2694	3541	4211	4792	4898	4702	4579	4530	4253	3737	2933	2184	1691	1300	1095	651	56612	Accepted	
21	373	257	142	133	129	291	569	946	1596	2822	4275	5323	5580	5397	4478	4178	4511	4909	5047	4145	2592	1305	675	394	60067	Accepted	
22	189	132	129	207	585	1511	3896	5010	4252	3718	3631	3829	3891	3673	4180	4536	4841	4493	2694	1743	1322	984	627	383	60456	Accepted	
23	251	163	177	189	528	1441	3762	4952	4569	3828	3300	3305	3486	3546	4169	5041	5343	4815	3123	2110	1424	948	736	535	61741	Accepted	
24	241	154	146	191	509	1475	3799	4916	4610	3811	3322	3587	3722	3724	4189	4870	5175	4999	3262	2359	1859	1182	734	485	63321	Accepted	
25	216	160	136	239	549	1470	3926	4986	4743	3997	3763	3840	3775	4226	4621	5379	5670	5427	3656	2417	1814	1363	925	659	67957	Accepted	
26																											
27	410	240	156	205	269	623	1432	2271	2999	3994	4334	4808	4881	4720	4520	4780	4433	3932	3033	2291	1854	1534	1111	787	59617	Accepted	
28	498	345	174	166	198	377	868	1497	2358	3403	4384	5098	5018	5067	4885	4815	4470	3535	2793	2200	1552	974	601	377	55653	Accepted	
29	283	153	165	255	594	1603	4074	5097	4585	3740	3537	3735	3627	3533	4155	4840	5180	4759	3160	2079	1380	985	649	415	62583	Accepted	
30	272	165	156	200	508	1355	3709	4817	4534	3680	3321	3293	3494	3668	4200	4962	5261	4599	3327	1958	1422	979	666	418	60964	Accepted	
																										April Average	60553
																										2019 AADT	61701
																										Seasonal Adjustment	1.019

Massachusetts Highway Department

708: Monthly Hourly Volume for July 2019

Location ID:	708
County:	Barnstable
Functional Class	2
Location:	MID-CAPE HIGHWAY

Seasonal Factor Group:	Rec - East
Daily Factor Group:	
Axle Factor Group:	Rec - East
Growth Factor Group:	

	0:00	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	TOTAL	QC Status
1																										
2																										
3																										
4																										
5																										
6																										
7																										
8																										
9																										
10	402	202	182	266	668	1672	3521	4870	4451	4957	4810	4952	4755	4729	5093	5535	5892	5719	4213	3235	2734	2158	1371	714	77101	Accepted
11	406	261	217	281	682	1624	3454	4726	4802	4749	5104	5286	5111	5007	5444	5565	5739	5494	4571	3795	2958	2380	1652	861	80169	Accepted
12	514	270	240	266	510	1338	2682	3711	4208	4240	5203	5638	5830	5330	5423	5470	5564	5095	4591	4127	3832	3164	1981	1345	80572	Accepted
13	726	467	245	268	500	914	2280	4430	5741	6061	5692	5324	4694	4670	4758	4702	4999	4842	4188	3605	3314	2949	2108	1333	78810	Accepted
14	675	422	254	256	344	723	1528	2770	4243	5334	5614	5522	5480	5065	5218	5315	5162	5227	4967	4535	4349	3983	1937	928	79851	Accepted
15	405	291	242	363	987	2364	4399	5305	5200	5106	5600	5670	5551	4814	5187	5512	5692	5604	4486	3330	2686	1864	1192	748	82598	Accepted
16	421	265	180	324	795	1819	3643	4919	4892	4679	4802	4876	4690	4528	4966	5147	6052	5232	4298	3203	2658	1969	1310	763	76431	Accepted
17	484	244	221	255	659	1617	3486	4773	4973	4689	5127	5150	4942	4756	5058	5547	5865	5238	3911	3190	2696	1910	1157	678	76626	Accepted
18	467	267	275	273	668	1501	3175	4468	4508	4765	4798	5364	5167	5184	5389	5467	6034	5408	4541	3888	3011	2210	1731	1159	79718	Accepted
19	691	326	230	311	660	1487	3165	4380	4844	5038	5293	5375	4984	5003	4891	5355	5497	5566	5098	4582	4424	3729	2202	1512	84643	Accepted
20	784	471	328	364	555	1054	2474	4586	5697	5761	5658	5365	4821	4702	4822	5024	4850	4785	3791	3425	3405	2956	2092	1299	79069	Accepted
21	677	415	292	309	395	704	1540	2912	4352	5356	5572	5585	5237	5117	5120	5236	4903	4237	4300	4517	4385	4141	2700	955	78957	Accepted
22	395	237	236	397	1060	2524	4465	5342	5194	4953	5409	5523	5651	5523	5414	5927	6110	5381	3802	3080	2390	1791	1234	601	82639	Accepted
23	361	229	220	284	688	1665	3188	4451	4280	4316	4262	4164	4257	4585	4925	5011	5740	5225	4244	3215	2408	1917	1214	788	71637	Accepted
24	421	256	215	223	690	1669	3612	4815	4918	4812	5127	5272	4938	4869	5072	5472	5609	5625	4566	3444	3017	2432	1631	872	79577	Accepted
25	446	236	238	224	693	1684	3507	4890	5099	4914	4873	5184	5180	5135	5647	6190	6243	6122	5373	4162	3709	2722	2181	1233	85885	Accepted
26	713	323	260	321	695	1532	3305	4801	5114	5232	5390	5314	5151	5025	5235	5283	5620	5552	5230	4914	4396	3407	2298	1527	86638	Accepted
27	779	469	293	303	527	1069	2449	4863	6041	6089	6161	6070	4993	4683	4728	4928	5063	5176	4349	3777	3641	2958	2211	1510	83130	Accepted
28	729	423	274	220	378	723	1537	2821	4342	5513	5887	5606	5577	5612	5282	5216	5185	5136	5255	4908	4581	4177	2484	968	82834	Accepted
29	523	279	225	393	1012	2398	4377	5245	5203	4935	5347	5635	5595	5526	5048	3842	5573	5781	5193	3559	2773	2084	1289	678	82513	Accepted
30	351	205	219	265	744	1734	3558	4873	5025	4868	4824	5064	4849	4755	4995	5599	5543	5372	4154	3273	2735	2013	1263	735	77016	Accepted
31	499	259	218	301	697	1674	3309	4731	4731	4736	4921	5188	4827	4820	5225	5297	5537	5322	4196	3326	2633	2075	1401	845	76768	Accepted

July Average 80145

2019 Average Count Data – Sta. 708

April ADT: 60,491

July ADT: 80,269

Seasonal Adjustment

$$\frac{80,145}{60,491} = 0.325$$

CAPACITY ANALYSIS WORKSHEETS

Meetinghouse Lane at State Road at Canal Street
























Meetinghouse Lane at Old Plymouth Road at Scusset Beach Road

Meetinghouse Lane at Cape View Road at 54 Meetinghouse Lane Driveway

Cape View Road at the Project Site Driveway

Meetinghouse Lane at State Road at Canal Street

2021 Existing Weekday Morning Peak Hour
1: Canal Rd/State Rd & Meetinghouse Ln

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	489	154	331	37	291	74	220	183	58	26	68	236
Future Volume (vph)	489	154	331	37	291	74	220	183	58	26	68	236
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			0.850		0.969				0.850			0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1787	1845	1538	1805	1734	0	1752	1881	1615	1805	1845	1599
Flt Permitted	0.224			0.651			0.419			0.552		
Satd. Flow (perm)	421	1845	1538	1237	1734	0	773	1881	1615	1049	1845	1599
Satd. Flow (RTOR)			360		9				83			281
Adj. Flow (vph)	532	167	360	40	313	80	253	210	67	31	81	281
Lane Group Flow (vph)	532	167	360	40	393	0	253	210	67	31	81	281
Turn Type	pm+pt	NA	Perm	custom	NA		pm+pt	NA	Perm	custom	NA	Perm
Protected Phases	7	4			8		5	2			6	
Permitted Phases	4		4	7 8			2		2	5 6		6
Detector Phase	7	4	4	7 8	8		5	2	2	5 6	6	6
Switch Phase												
Minimum Initial (s)	1.0	1.0	1.0		1.0		1.0	1.0	1.0		1.0	1.0
Minimum Split (s)	8.0	8.0	8.0		8.0		8.0	8.0	8.0		8.0	8.0
Total Split (s)	33.0	111.0	111.0		78.0		14.0	37.0	37.0		23.0	23.0
Total Split (%)	19.4%	65.3%	65.3%		45.9%		8.2%	21.8%	21.8%		13.5%	13.5%
Maximum Green (s)	26.0	104.0	104.0		71.0		7.0	30.0	30.0		16.0	16.0
Yellow Time (s)	4.0	4.0	4.0		4.0		4.0	4.0	4.0		4.0	4.0
All-Red Time (s)	3.0	3.0	3.0		3.0		3.0	3.0	3.0		3.0	3.0
Lost Time Adjust (s)	0.0	0.0	0.0		0.0		0.0	0.0	0.0		0.0	0.0
Total Lost Time (s)	7.0	7.0	7.0		7.0		7.0	7.0	7.0		7.0	7.0
Lead/Lag	Lead				Lag		Lead				Lag	Lag
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0	3.0		3.0		3.0	3.0	3.0		3.0	3.0
Recall Mode	None	None	None		None		None	None	None		None	None
Walk Time (s)												
Flash Dont Walk (s)												
Pedestrian Calls (#/hr)												
v/c Ratio	0.86	0.15	0.33	0.05	0.81		0.98	0.46	0.15	0.12	0.43	0.67
Control Delay	33.2	8.8	1.8	8.3	46.1		89.0	36.8	5.9	32.8	50.8	14.2
Queue Delay	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	33.2	8.8	1.8	8.3	46.1		89.0	36.8	5.9	32.8	50.8	14.2
Queue Length 50th (ft)	206	41	0	9	224		140	112	0	15	48	0
Queue Length 95th (ft)	#465	78	34	25	355		#324	197	23	41	97	58
Internal Link Dist (ft)		363			464			190			202	
Turn Bay Length (ft)	190		190	100			310		50	100		100
Base Capacity (vph)	617	1804	1512	1209	1251		258	572	548	319	299	494
Starvation Cap Reductn	0	0	0	0	0		0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0		0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0		0	0	0	0	0	0
Reduced v/c Ratio	0.86	0.09	0.24	0.03	0.31		0.98	0.37	0.12	0.10	0.27	0.57
Intersection Summary												
Cycle Length: 170												

2021 Existing Weekday Morning Peak Hour
1: Canal Rd/State Rd & Meetinghouse Ln

Lane Group	Ø9
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Lane Util. Factor	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Satd. Flow (RTOR)	
Adj. Flow (vph)	
Lane Group Flow (vph)	
Turn Type	
Protected Phases	9
Permitted Phases	
Detector Phase	
Switch Phase	
Minimum Initial (s)	1.0
Minimum Split (s)	22.0
Total Split (s)	22.0
Total Split (%)	13%
Maximum Green (s)	20.0
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)	7.0
Flash Dont Walk (s)	13.0
Pedestrian Calls (#/hr)	0
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
Queue Length 50th (ft)	
Queue Length 95th (ft)	
Internal Link Dist (ft)	
Turn Bay Length (ft)	
Base Capacity (vph)	
Starvation Cap Reductn	
Spillback Cap Reductn	
Storage Cap Reductn	
Reduced v/c Ratio	
Intersection Summary	

2021 Existing Weekday Morning Peak Hour

1: Canal Rd/State Rd & Meetinghouse Ln

Actuated Cycle Length: 99.6








Natural Cycle: 120

Control Type: Actuated-Uncoordinated

95th percentile volume exceeds capacity, queue may be longer.
























Queue shown is maximum after two cycles.

Splits and Phases: 1: Canal Rd/State Rd & Meetinghouse Ln

 Ø2		 Ø4				 Ø9	
37 s		111 s				22 s	
 Ø5	 Ø6	 Ø7		 Ø8			
14 s	23 s	33 s		78 s			
























2021 Existing Weekday Morning Peak Hour

1: Canal Rd/State Rd & Meetinghouse Ln

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	489	154	331	37	291	74	220	183	58	26	68	236
Future Volume (vph)	489	154	331	37	291	74	220	183	58	26	68	236
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	7.0	7.0	7.0	7.0	7.0		7.0	7.0	7.0	7.0	7.0	7.0
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
Frt	1.00	1.00	0.85	1.00	0.97		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1787	1845	1538	1805	1734		1752	1881	1615	1805	1845	1599
Flt Permitted	0.22	1.00	1.00	0.65	1.00		0.42	1.00	1.00	0.55	1.00	1.00
Satd. Flow (perm)	421	1845	1538	1238	1734		774	1881	1615	1049	1845	1599
Peak-hour factor, PHF	0.92	0.92	0.92	0.93	0.93	0.93	0.87	0.87	0.87	0.84	0.84	0.84
Adj. Flow (vph)	532	167	360	40	313	80	253	210	67	31	81	281
RTOR Reduction (vph)	0	0	139	0	6	0	0	0	51	0	0	252
Lane Group Flow (vph)	532	167	221	40	387	0	253	210	16	31	81	29
Heavy Vehicles (%)	1%	3%	5%	0%	6%	7%	3%	1%	0%	0%	3%	1%
Turn Type	pm+pt	NA	Perm	custom	NA		pm+pt	NA	Perm	custom	NA	Perm
Protected Phases	7	4			8		5	2			6	
Permitted Phases	4		4	7 8			2		2	5 6		6
Actuated Green, G (s)	61.0	61.0	61.0	61.0	27.7		24.4	24.4	24.4	24.4	10.3	10.3
Effective Green, g (s)	61.0	61.0	61.0	61.0	27.7		24.4	24.4	24.4	24.4	10.3	10.3
Actuated g/C Ratio	0.61	0.61	0.61	0.61	0.28		0.25	0.25	0.25	0.25	0.10	0.10
Clearance Time (s)	7.0	7.0	7.0		7.0		7.0	7.0	7.0		7.0	7.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0		3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	619	1132	943	759	483		259	461	396	257	191	165
v/s Ratio Prot	c0.23	0.09			0.22		c0.07	0.11			0.04	
v/s Ratio Perm	c0.30		0.14	0.03			c0.17		0.01	0.03		0.02
v/c Ratio	0.86	0.15	0.23	0.05	0.80		0.98	0.46	0.04	0.12	0.42	0.18
Uniform Delay, d1	18.7	8.2	8.7	7.7	33.3		36.7	31.9	28.6	29.2	41.8	40.7
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	11.4	0.1	0.1	0.0	9.2		49.0	0.7	0.0	0.2	1.5	0.5
Delay (s)	30.1	8.2	8.8	7.7	42.5		85.6	32.6	28.6	29.4	43.3	41.2
Level of Service	C	A	A	A	D		F	C	C	C	D	D
Approach Delay (s)		19.4			39.3			57.4			40.7	
Approach LOS		B			D			E			D	
Intersection Summary												
HCM 2000 Control Delay			34.8			HCM 2000 Level of Service			C			
HCM 2000 Volume to Capacity ratio			1.02									
Actuated Cycle Length (s)			99.4			Sum of lost time (s)			30.0			
Intersection Capacity Utilization			86.0%			ICU Level of Service			E			
Analysis Period (min)			15									
c Critical Lane Group												

2021 Existing Weekday Evening Peak Hour
1: Canal Rd/State Rd & Meetinghouse Ln

Peak Month Volumes

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	745	474	331	24	279	122	203	159	45	40	43	171
Future Volume (vph)	745	474	331	24	279	122	203	159	45	40	43	171
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			0.850		0.954				0.850			0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1787	1863	1599	1805	1795	0	1787	1881	1615	1805	1900	1599
Flt Permitted	0.187			0.398			0.405			0.598		
Satd. Flow (perm)	352	1863	1599	756	1795	0	762	1881	1615	1136	1900	1599
Satd. Flow (RTOR)			327		16				83			206
Adj. Flow (vph)	847	539	376	27	310	136	231	181	51	48	52	206
Lane Group Flow (vph)	847	539	376	27	446	0	231	181	51	48	52	206
Turn Type	pm+pt	NA	Perm	custom	NA		pm+pt	NA	Perm	custom	NA	Perm
Protected Phases	7	4			8		5	2			6	
Permitted Phases	4		4	7 8			2		2	5 6		6
Detector Phase	7	4	4	7 8	8		5	2	2	5 6	6	6
Switch Phase												
Minimum Initial (s)	1.0	1.0	1.0		1.0		1.0	1.0	1.0		1.0	1.0
Minimum Split (s)	8.0	8.0	8.0		8.0		8.0	8.0	8.0		8.0	8.0
Total Split (s)	33.0	111.0	111.0		78.0		14.0	37.0	37.0		23.0	23.0
Total Split (%)	19.4%	65.3%	65.3%		45.9%		8.2%	21.8%	21.8%		13.5%	13.5%
Maximum Green (s)	26.0	104.0	104.0		71.0		7.0	30.0	30.0		16.0	16.0
Yellow Time (s)	4.0	4.0	4.0		4.0		4.0	4.0	4.0		4.0	4.0
All-Red Time (s)	3.0	3.0	3.0		3.0		3.0	3.0	3.0		3.0	3.0
Lost Time Adjust (s)	0.0	0.0	0.0		0.0		0.0	0.0	0.0		0.0	0.0
Total Lost Time (s)	7.0	7.0	7.0		7.0		7.0	7.0	7.0		7.0	7.0
Lead/Lag	Lead				Lag		Lead				Lag	Lag
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0	3.0		3.0		3.0	3.0	3.0		3.0	3.0
Recall Mode	None	None	None		None		None	None	None		None	None
Walk Time (s)												
Flash Dont Walk (s)												
Pedestrian Calls (#/hr)												
v/c Ratio	1.42	0.46	0.33	0.06	0.82		0.94	0.42	0.12	0.18	0.31	0.63
Control Delay	221.0	11.3	2.3	7.8	44.6		82.1	37.8	3.1	35.5	50.1	15.7
Queue Delay	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	221.0	11.3	2.3	7.8	44.6		82.1	37.8	3.1	35.5	50.1	15.7
Queue Length 50th (ft)	~640	160	11	6	251		131	99	0	25	32	0
Queue Length 95th (ft)	#1006	256	45	18	392		#307	181	11	58	70	53
Internal Link Dist (ft)		363			464			190			202	
Turn Bay Length (ft)	190		190	100			310		50	100		100
Base Capacity (vph)	597	1817	1568	737	1289		246	568	546	343	306	430
Starvation Cap Reductn	0	0	0	0	0		0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0		0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0		0	0	0	0	0	0
Reduced v/c Ratio	1.42	0.30	0.24	0.04	0.35		0.94	0.32	0.09	0.14	0.17	0.48
Intersection Summary												
Cycle Length: 170												

2021 Existing Weekday Evening Peak Hour
1: Canal Rd/State Rd & Meetinghouse Ln

Peak Month Volumes

Lane Group	Ø9
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Lane Util. Factor	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Satd. Flow (RTOR)	
Adj. Flow (vph)	
Lane Group Flow (vph)	
Turn Type	
Protected Phases	9
Permitted Phases	
Detector Phase	
Switch Phase	
Minimum Initial (s)	1.0
Minimum Split (s)	22.0
Total Split (s)	22.0
Total Split (%)	13%
Maximum Green (s)	20.0
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)	7.0
Flash Dont Walk (s)	13.0
Pedestrian Calls (#/hr)	0
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
Queue Length 50th (ft)	
Queue Length 95th (ft)	
Internal Link Dist (ft)	
Turn Bay Length (ft)	
Base Capacity (vph)	
Starvation Cap Reductn	
Spillback Cap Reductn	
Storage Cap Reductn	
Reduced v/c Ratio	
Intersection Summary	

2021 Existing Weekday Evening Peak Hour 1: Canal Rd/State Rd & Meetinghouse Ln

Peak Month Volumes

Actuated Cycle Length: 100.3

Natural Cycle: 150

Control Type: Actuated-Uncoordinated








~ 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.

Splits and Phases: 1: Canal Rd/State Rd & Meetinghouse Ln

 Ø2		 Ø4				 Ø9	
37 s		111 s				22 s	
 Ø5	 Ø6	 Ø7		 Ø8			
14 s	23 s	33 s		78 s			
























2021 Existing Weekday Evening Peak Hour
1: Canal Rd/State Rd & Meetinghouse Ln

Peak Month Volumes

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	745	474	331	24	279	122	203	159	45	40	43	171
Future Volume (vph)	745	474	331	24	279	122	203	159	45	40	43	171
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	7.0	7.0	7.0	7.0	7.0		7.0	7.0	7.0	7.0	7.0	7.0
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
Frt	1.00	1.00	0.85	1.00	0.95		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1787	1863	1599	1805	1795		1787	1881	1615	1805	1900	1599
Flt Permitted	0.19	1.00	1.00	0.40	1.00		0.40	1.00	1.00	0.60	1.00	1.00
Satd. Flow (perm)	352	1863	1599	757	1795		761	1881	1615	1136	1900	1599
Peak-hour factor, PHF	0.88	0.88	0.88	0.90	0.90	0.90	0.88	0.88	0.88	0.83	0.83	0.83
Adj. Flow (vph)	847	539	376	27	310	136	231	181	51	48	52	206
RTOR Reduction (vph)	0	0	121	0	11	0	0	0	39	0	0	188
Lane Group Flow (vph)	847	539	255	27	435	0	231	181	12	48	52	18
Heavy Vehicles (%)	1%	2%	1%	0%	1%	1%	1%	1%	0%	0%	0%	1%
Turn Type	pm+pt	NA	Perm	custom	NA		pm+pt	NA	Perm	custom	NA	Perm
Protected Phases	7	4			8		5	2			6	
Permitted Phases	4		4	7 8			2		2	5 6		6
Actuated Green, G (s)	63.1	63.1	63.1	63.1	29.8		23.0	23.0	23.0	23.0	8.9	8.9
Effective Green, g (s)	63.1	63.1	63.1	63.1	29.8		23.0	23.0	23.0	23.0	8.9	8.9
Actuated g/C Ratio	0.63	0.63	0.63	0.63	0.30		0.23	0.23	0.23	0.23	0.09	0.09
Clearance Time (s)	7.0	7.0	7.0		7.0		7.0	7.0	7.0		7.0	7.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0		3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	598	1174	1007	477	534		247	432	371	261	168	142
v/s Ratio Prot	c0.37	0.29			0.24		c0.07	0.10			0.03	
v/s Ratio Perm	c0.52		0.16	0.04			c0.15		0.01	0.04		0.01
v/c Ratio	1.42	0.46	0.25	0.06	0.81		0.94	0.42	0.03	0.18	0.31	0.13
Uniform Delay, d1	24.6	9.6	8.1	7.1	32.6		37.1	32.9	29.9	31.0	42.7	42.0
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	197.1	0.3	0.1	0.0	9.3		39.6	0.7	0.0	0.3	1.1	0.4
Delay (s)	221.7	9.9	8.3	7.1	41.8		76.7	33.5	29.9	31.3	43.8	42.4
Level of Service	F	A	A	A	D		E	C	C	C	D	D
Approach Delay (s)		111.3			39.9			54.7			40.9	
Approach LOS		F			D			D			D	
Intersection Summary												
HCM 2000 Control Delay			84.2			HCM 2000 Level of Service			F			
HCM 2000 Volume to Capacity ratio			1.47									
Actuated Cycle Length (s)			100.1			Sum of lost time (s)			30.0			
Intersection Capacity Utilization			101.3%			ICU Level of Service			G			
Analysis Period (min)			15									
c Critical Lane Group												

2021 Existing Weekday Morning Peak Hour
1: Canal Rd/State Rd & Meetinghouse Ln

Peak Month Volumes

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	524	165	354	40	312	79	236	196	62	28	59	253
Future Volume (vph)	524	165	354	40	312	79	236	196	62	28	59	253
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			0.850		0.970				0.850			0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1787	1845	1538	1805	1735	0	1752	1881	1615	1805	1845	1599
Flt Permitted	0.209			0.644			0.422			0.517		
Satd. Flow (perm)	393	1845	1538	1224	1735	0	778	1881	1615	982	1845	1599
Satd. Flow (RTOR)			385		9				83			301
Adj. Flow (vph)	570	179	385	43	335	85	271	225	71	33	70	301
Lane Group Flow (vph)	570	179	385	43	420	0	271	225	71	33	70	301
Turn Type	pm+pt	NA	Perm	custom	NA		pm+pt	NA	Perm	custom	NA	Perm
Protected Phases	7	4			8		5	2			6	
Permitted Phases	4		4	7 8			2		2	5 6		6
Detector Phase	7	4	4	7 8	8		5	2	2	5 6	6	6
Switch Phase												
Minimum Initial (s)	1.0	1.0	1.0		1.0		1.0	1.0	1.0		1.0	1.0
Minimum Split (s)	8.0	8.0	8.0		8.0		8.0	8.0	8.0		8.0	8.0
Total Split (s)	33.0	111.0	111.0		78.0		14.0	37.0	37.0		23.0	23.0
Total Split (%)	19.4%	65.3%	65.3%		45.9%		8.2%	21.8%	21.8%		13.5%	13.5%
Maximum Green (s)	26.0	104.0	104.0		71.0		7.0	30.0	30.0		16.0	16.0
Yellow Time (s)	4.0	4.0	4.0		4.0		4.0	4.0	4.0		4.0	4.0
All-Red Time (s)	3.0	3.0	3.0		3.0		3.0	3.0	3.0		3.0	3.0
Lost Time Adjust (s)	0.0	0.0	0.0		0.0		0.0	0.0	0.0		0.0	0.0
Total Lost Time (s)	7.0	7.0	7.0		7.0		7.0	7.0	7.0		7.0	7.0
Lead/Lag	Lead				Lag		Lead				Lag	Lag
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0	3.0		3.0		3.0	3.0	3.0		3.0	3.0
Recall Mode	None	None	None		None		None	None	None		None	None
Walk Time (s)												
Flash Dont Walk (s)												
Pedestrian Calls (#/hr)												
v/c Ratio	0.94	0.16	0.35	0.06	0.82		1.07	0.50	0.16	0.14	0.38	0.70
Control Delay	46.4	8.7	1.8	8.2	46.7		112.9	38.9	6.7	34.4	50.7	14.8
Queue Delay	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	46.4	8.7	1.8	8.2	46.7		112.9	38.9	6.7	34.4	50.7	14.8
Queue Length 50th (ft)	247	43	0	10	242		~170	124	0	17	42	0
Queue Length 95th (ft)	#559	84	35	26	385		#380	217	27	44	89	60
Internal Link Dist (ft)		363			464			190			202	
Turn Bay Length (ft)	190		190	100			310		50	100		100
Base Capacity (vph)	605	1785	1501	1184	1231		254	562	541	293	294	508
Starvation Cap Reductn	0	0	0	0	0		0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0		0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0		0	0	0	0	0	0
Reduced v/c Ratio	0.94	0.10	0.26	0.04	0.34		1.07	0.40	0.13	0.11	0.24	0.59
Intersection Summary												
Cycle Length: 170												

2021 Existing Weekday Morning Peak Hour
1: Canal Rd/State Rd & Meetinghouse Ln

Peak Month Volumes

Lane Group	Ø9
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Lane Util. Factor	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Satd. Flow (RTOR)	
Adj. Flow (vph)	
Lane Group Flow (vph)	
Turn Type	
Protected Phases	9
Permitted Phases	
Detector Phase	
Switch Phase	
Minimum Initial (s)	1.0
Minimum Split (s)	22.0
Total Split (s)	22.0
Total Split (%)	13%
Maximum Green (s)	20.0
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)	7.0
Flash Dont Walk (s)	13.0
Pedestrian Calls (#/hr)	0
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
Queue Length 50th (ft)	
Queue Length 95th (ft)	
Internal Link Dist (ft)	
Turn Bay Length (ft)	
Base Capacity (vph)	
Starvation Cap Reductn	
Spillback Cap Reductn	
Storage Cap Reductn	
Reduced v/c Ratio	
Intersection Summary	

2021 Existing Weekday Morning Peak Hour
1: Canal Rd/State Rd & Meetinghouse Ln

Peak Month Volumes

Actuated Cycle Length: 101.4

Natural Cycle: 150

Control Type: Actuated-Uncoordinated








~ 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.

Splits and Phases: 1: Canal Rd/State Rd & Meetinghouse Ln

 Ø2	 Ø4	 Ø9
37 s	111 s	22 s
 Ø5	 Ø7	
14 s	33 s	
 Ø6	 Ø8	
23 s	78 s	
























2021 Existing Weekday Morning Peak Hour
1: Canal Rd/State Rd & Meetinghouse Ln

Peak Month Volumes

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	524	165	354	40	312	79	236	196	62	28	59	253
Future Volume (vph)	524	165	354	40	312	79	236	196	62	28	59	253
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	7.0	7.0	7.0	7.0	7.0		7.0	7.0	7.0	7.0	7.0	7.0
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
Frt	1.00	1.00	0.85	1.00	0.97		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1787	1845	1538	1805	1735		1752	1881	1615	1805	1845	1599
Flt Permitted	0.21	1.00	1.00	0.64	1.00		0.42	1.00	1.00	0.52	1.00	1.00
Satd. Flow (perm)	393	1845	1538	1224	1735		778	1881	1615	982	1845	1599
Peak-hour factor, PHF	0.92	0.92	0.92	0.93	0.93	0.93	0.87	0.87	0.87	0.84	0.84	0.84
Adj. Flow (vph)	570	179	385	43	335	85	271	225	71	33	70	301
RTOR Reduction (vph)	0	0	146	0	6	0	0	0	54	0	0	271
Lane Group Flow (vph)	570	179	239	43	414	0	271	225	17	33	70	30
Heavy Vehicles (%)	1%	3%	5%	0%	6%	7%	3%	1%	0%	0%	3%	1%
Turn Type	pm+pt	NA	Perm	custom	NA		pm+pt	NA	Perm	custom	NA	Perm
Protected Phases	7	4			8		5	2			6	
Permitted Phases	4		4	7 8			2		2	5 6		6
Actuated Green, G (s)	62.9	62.9	62.9	62.9	29.6		24.3	24.3	24.3	24.3	10.2	10.2
Effective Green, g (s)	62.9	62.9	62.9	62.9	29.6		24.3	24.3	24.3	24.3	10.2	10.2
Actuated g/C Ratio	0.62	0.62	0.62	0.62	0.29		0.24	0.24	0.24	0.24	0.10	0.10
Clearance Time (s)	7.0	7.0	7.0		7.0		7.0	7.0	7.0		7.0	7.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0		3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	606	1146	955	760	507		255	451	387	235	185	161
v/s Ratio Prot	c0.24	0.10			0.24		c0.07	0.12			0.04	
v/s Ratio Perm	c0.34		0.16	0.04			c0.18		0.01	0.03		0.02
v/c Ratio	0.94	0.16	0.25	0.06	0.82		1.06	0.50	0.04	0.14	0.38	0.19
Uniform Delay, d1	22.0	8.0	8.6	7.5	33.3		38.0	33.2	29.5	30.2	42.5	41.7
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	22.9	0.1	0.1	0.0	9.8		73.9	0.9	0.0	0.3	1.3	0.6
Delay (s)	44.9	8.1	8.7	7.5	43.1		111.9	34.1	29.6	30.5	43.8	42.3
Level of Service	D	A	A	A	D		F	C	C	C	D	D
Approach Delay (s)		26.8			39.8			70.7			41.6	
Approach LOS		C			D			E			D	
Intersection Summary												
HCM 2000 Control Delay			41.2			HCM 2000 Level of Service			D			
HCM 2000 Volume to Capacity ratio			1.11									
Actuated Cycle Length (s)			101.2			Sum of lost time (s)			30.0			
Intersection Capacity Utilization			90.0%			ICU Level of Service			E			
Analysis Period (min)			15									
c Critical Lane Group												

2028 No Build Weekday Evening Peak Hour
1: Canal Rd/State Rd & Meetinghouse Ln

Peak Month Volumes

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	799	508	300	25	299	132	217	171	47	42	46	184
Future Volume (vph)	799	508	300	25	299	132	217	171	47	42	46	184
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			0.850		0.954				0.850			0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1787	1863	1599	1805	1795	0	1787	1881	1615	1805	1900	1599
Flt Permitted	0.173			0.375			0.410			0.563		
Satd. Flow (perm)	325	1863	1599	712	1795	0	771	1881	1615	1070	1900	1599
Satd. Flow (RTOR)			277		16				83			222
Adj. Flow (vph)	908	577	341	28	332	147	247	194	53	51	55	222
Lane Group Flow (vph)	908	577	341	28	479	0	247	194	53	51	55	222
Turn Type	pm+pt	NA	Perm	custom	NA		pm+pt	NA	Perm	custom	NA	Perm
Protected Phases	7	4			8		5	2			6	
Permitted Phases	4		4	7 8			2		2	5 6		6
Detector Phase	7	4	4	7 8	8		5	2	2	5 6	6	6
Switch Phase												
Minimum Initial (s)	1.0	1.0	1.0		1.0		1.0	1.0	1.0		1.0	1.0
Minimum Split (s)	8.0	8.0	8.0		8.0		8.0	8.0	8.0		8.0	8.0
Total Split (s)	33.0	111.0	111.0		78.0		14.0	37.0	37.0		23.0	23.0
Total Split (%)	19.4%	65.3%	65.3%		45.9%		8.2%	21.8%	21.8%		13.5%	13.5%
Maximum Green (s)	26.0	104.0	104.0		71.0		7.0	30.0	30.0		16.0	16.0
Yellow Time (s)	4.0	4.0	4.0		4.0		4.0	4.0	4.0		4.0	4.0
All-Red Time (s)	3.0	3.0	3.0		3.0		3.0	3.0	3.0		3.0	3.0
Lost Time Adjust (s)	0.0	0.0	0.0		0.0		0.0	0.0	0.0		0.0	0.0
Total Lost Time (s)	7.0	7.0	7.0		7.0		7.0	7.0	7.0		7.0	7.0
Lead/Lag	Lead				Lag		Lead				Lag	Lag
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0	3.0		3.0		3.0	3.0	3.0		3.0	3.0
Recall Mode	None	None	None		None		None	None	None		None	None
Walk Time (s)												
Flash Dont Walk (s)												
Pedestrian Calls (#/hr)												
v/c Ratio	1.57	0.49	0.30	0.06	0.83		1.02	0.46	0.12	0.21	0.33	0.65
Control Delay	287.1	11.6	2.5	7.7	45.1		102.6	40.2	3.5	37.8	52.1	15.9
Queue Delay	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	287.1	11.6	2.5	7.7	45.1		102.6	40.2	3.5	37.8	52.1	15.9
Queue Length 50th (ft)	~760	178	14	6	278		~151	110	0	27	34	0
Queue Length 95th (ft)	#1172	284	48	19	432		#366	201	13	64	75	54
Internal Link Dist (ft)		363			464			190			202	
Turn Bay Length (ft)	190		190	100			310		50	100		100
Base Capacity (vph)	579	1791	1548	684	1252		243	552	532	314	297	437
Starvation Cap Reductn	0	0	0	0	0		0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0		0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0		0	0	0	0	0	0
Reduced v/c Ratio	1.57	0.32	0.22	0.04	0.38		1.02	0.35	0.10	0.16	0.19	0.51
Intersection Summary												
Cycle Length: 170												

2028 No Build Weekday Evening Peak Hour
1: Canal Rd/State Rd & Meetinghouse Ln

Peak Month Volumes

Lane Group	Ø9
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Lane Util. Factor	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Satd. Flow (RTOR)	
Adj. Flow (vph)	
Lane Group Flow (vph)	
Turn Type	
Protected Phases	9
Permitted Phases	
Detector Phase	
Switch Phase	
Minimum Initial (s)	1.0
Minimum Split (s)	22.0
Total Split (s)	22.0
Total Split (%)	13%
Maximum Green (s)	20.0
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)	7.0
Flash Dont Walk (s)	13.0
Pedestrian Calls (#/hr)	0
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
Queue Length 50th (ft)	
Queue Length 95th (ft)	
Internal Link Dist (ft)	
Turn Bay Length (ft)	
Base Capacity (vph)	
Starvation Cap Reductn	
Spillback Cap Reductn	
Storage Cap Reductn	
Reduced v/c Ratio	
Intersection Summary	

2028 No Build Weekday Evening Peak Hour 1: Canal Rd/State Rd & Meetinghouse Ln

Peak Month Volumes

Actuated Cycle Length: 103.4

Natural Cycle: 150

Control Type: Actuated-Uncoordinated








~ 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.
























Splits and Phases: 1: Canal Rd/State Rd & Meetinghouse Ln

 Ø2	 Ø4	 Ø9
37 s	111 s	22 s
 Ø5	 Ø7	
14 s	33 s	
 Ø6	 Ø8	
23 s	78 s	

2028 No Build Weekday Evening Peak Hour
























Peak Month Volumes

1: Canal Rd/State Rd & Meetinghouse Ln

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	799	508	300	25	299	132	217	171	47	42	46	184
Future Volume (vph)	799	508	300	25	299	132	217	171	47	42	46	184
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	7.0	7.0	7.0	7.0	7.0		7.0	7.0	7.0	7.0	7.0	7.0
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
Frt	1.00	1.00	0.85	1.00	0.95		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1787	1863	1599	1805	1795		1787	1881	1615	1805	1900	1599
Flt Permitted	0.17	1.00	1.00	0.38	1.00		0.41	1.00	1.00	0.56	1.00	1.00
Satd. Flow (perm)	326	1863	1599	713	1795		770	1881	1615	1070	1900	1599
Peak-hour factor, PHF	0.88	0.88	0.88	0.90	0.90	0.90	0.88	0.88	0.88	0.83	0.83	0.83
Adj. Flow (vph)	908	577	341	28	332	147	247	194	53	51	55	222
RTOR Reduction (vph)	0	0	100	0	11	0	0	0	41	0	0	202
Lane Group Flow (vph)	908	577	241	28	468	0	247	194	12	51	55	20
Heavy Vehicles (%)	1%	2%	1%	0%	1%	1%	1%	1%	0%	0%	0%	1%
Turn Type	pm+pt	NA	Perm	custom	NA		pm+pt	NA	Perm	custom	NA	Perm
Protected Phases	7	4			8		5	2			6	
Permitted Phases	4		4	7 8			2		2	5 6		6
Actuated Green, G (s)	65.9	65.9	65.9	65.9	32.6		23.3	23.3	23.3	23.3	9.2	9.2
Effective Green, g (s)	65.9	65.9	65.9	65.9	32.6		23.3	23.3	23.3	23.3	9.2	9.2
Actuated g/C Ratio	0.64	0.64	0.64	0.64	0.32		0.23	0.23	0.23	0.23	0.09	0.09
Clearance Time (s)	7.0	7.0	7.0		7.0		7.0	7.0	7.0		7.0	7.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0		3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	580	1189	1021	455	567		243	424	364	241	169	142
v/s Ratio Prot	c0.40	0.31			0.26		c0.07	0.10			0.03	
v/s Ratio Perm	c0.60		0.15	0.04			c0.16		0.01	0.05		0.01
v/c Ratio	1.57	0.49	0.24	0.06	0.83		1.02	0.46	0.03	0.21	0.33	0.14
Uniform Delay, d1	26.1	9.8	7.9	7.0	32.7		39.3	34.5	31.2	32.5	44.1	43.3
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	262.8	0.3	0.1	0.1	9.5		62.0	0.8	0.0	0.4	1.1	0.5
Delay (s)	288.9	10.1	8.1	7.1	42.2		101.3	35.3	31.2	32.9	45.2	43.8
Level of Service	F	B	A	A	D		F	D	C	C	D	D
Approach Delay (s)		148.3			40.3			67.9			42.3	
Approach LOS		F			D			E			D	
Intersection Summary												
HCM 2000 Control Delay			107.3			HCM 2000 Level of Service			F			
HCM 2000 Volume to Capacity ratio			1.62									
Actuated Cycle Length (s)			103.2			Sum of lost time (s)			30.0			
Intersection Capacity Utilization			106.7%			ICU Level of Service			G			
Analysis Period (min)			15									
c Critical Lane Group												

2028 Build Weekday Morning Peak Hour
1: Canal Rd/State Rd & Meetinghouse Ln

Peak Month Volumes

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	524	169	354	41	318	83	236	196	62	28	59	253
Future Volume (vph)	524	169	354	41	318	83	236	196	62	28	59	253
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			0.850		0.969				0.850			0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1787	1845	1538	1805	1734	0	1752	1881	1615	1805	1845	1599
Flt Permitted	0.207			0.641			0.424			0.512		
Satd. Flow (perm)	389	1845	1538	1218	1734	0	782	1881	1615	973	1845	1599
Satd. Flow (RTOR)			385		9				83			301
Adj. Flow (vph)	570	184	385	44	342	89	271	225	71	33	70	301
Lane Group Flow (vph)	570	184	385	44	431	0	271	225	71	33	70	301
Turn Type	pm+pt	NA	Perm	custom	NA		pm+pt	NA	Perm	custom	NA	Perm
Protected Phases	7	4			8		5	2			6	
Permitted Phases	4		4	7 8			2		2	5 6		6
Detector Phase	7	4	4	7 8	8		5	2	2	5 6	6	6
Switch Phase												
Minimum Initial (s)	1.0	1.0	1.0		1.0		1.0	1.0	1.0		1.0	1.0
Minimum Split (s)	8.0	8.0	8.0		8.0		8.0	8.0	8.0		8.0	8.0
Total Split (s)	33.0	111.0	111.0		78.0		14.0	37.0	37.0		23.0	23.0
Total Split (%)	19.4%	65.3%	65.3%		45.9%		8.2%	21.8%	21.8%		13.5%	13.5%
Maximum Green (s)	26.0	104.0	104.0		71.0		7.0	30.0	30.0		16.0	16.0
Yellow Time (s)	4.0	4.0	4.0		4.0		4.0	4.0	4.0		4.0	4.0
All-Red Time (s)	3.0	3.0	3.0		3.0		3.0	3.0	3.0		3.0	3.0
Lost Time Adjust (s)	0.0	0.0	0.0		0.0		0.0	0.0	0.0		0.0	0.0
Total Lost Time (s)	7.0	7.0	7.0		7.0		7.0	7.0	7.0		7.0	7.0
Lead/Lag	Lead				Lag		Lead				Lag	Lag
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0	3.0		3.0		3.0	3.0	3.0		3.0	3.0
Recall Mode	None	None	None		None		None	None	None		None	None
Walk Time (s)												
Flash Dont Walk (s)												
Pedestrian Calls (#/hr)												
v/c Ratio	0.95	0.16	0.35	0.06	0.82		1.08	0.51	0.16	0.14	0.38	0.70
Control Delay	47.9	8.6	1.8	8.1	46.2		116.3	39.8	6.8	35.3	51.7	14.9
Queue Delay	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	47.9	8.6	1.8	8.1	46.2		116.3	39.8	6.8	35.3	51.7	14.9
Queue Length 50th (ft)	253	45	0	10	251		~177	127	0	17	43	0
Queue Length 95th (ft)	#569	85	34	27	395		#391	222	27	45	90	60
Internal Link Dist (ft)		363			464			190			202	
Turn Bay Length (ft)	190		190	100			310		50	100		100
Base Capacity (vph)	601	1776	1495	1173	1215		252	555	535	287	290	505
Starvation Cap Reductn	0	0	0	0	0		0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0		0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0		0	0	0	0	0	0
Reduced v/c Ratio	0.95	0.10	0.26	0.04	0.35		1.08	0.41	0.13	0.11	0.24	0.60
Intersection Summary												
Cycle Length: 170												

2028 Build Weekday Morning Peak Hour
1: Canal Rd/State Rd & Meetinghouse Ln

Peak Month Volumes

Lane Group	Ø9
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Lane Util. Factor	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Satd. Flow (RTOR)	
Adj. Flow (vph)	
Lane Group Flow (vph)	
Turn Type	
Protected Phases	9
Permitted Phases	
Detector Phase	
Switch Phase	
Minimum Initial (s)	1.0
Minimum Split (s)	22.0
Total Split (s)	22.0
Total Split (%)	13%
Maximum Green (s)	20.0
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)	7.0
Flash Dont Walk (s)	13.0
Pedestrian Calls (#/hr)	0
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
Queue Length 50th (ft)	
Queue Length 95th (ft)	
Internal Link Dist (ft)	
Turn Bay Length (ft)	
Base Capacity (vph)	
Starvation Cap Reductn	
Spillback Cap Reductn	
Storage Cap Reductn	
Reduced v/c Ratio	
Intersection Summary	

2028 Build Weekday Morning Peak Hour
1: Canal Rd/State Rd & Meetinghouse Ln

Peak Month Volumes

Actuated Cycle Length: 102.8

Natural Cycle: 150

Control Type: Actuated-Uncoordinated








~ 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.

Splits and Phases: 1: Canal Rd/State Rd & Meetinghouse Ln

 Ø2 37 s		 Ø4 111 s		 Ø9 22 s
 Ø5 14 s	 Ø6 23 s	 Ø7 33 s	 Ø8 78 s	
























2028 Build Weekday Morning Peak Hour
1: Canal Rd/State Rd & Meetinghouse Ln

Peak Month Volumes

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	524	169	354	41	318	83	236	196	62	28	59	253
Future Volume (vph)	524	169	354	41	318	83	236	196	62	28	59	253
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	7.0	7.0	7.0	7.0	7.0		7.0	7.0	7.0	7.0	7.0	7.0
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
Frt	1.00	1.00	0.85	1.00	0.97		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1787	1845	1538	1805	1734		1752	1881	1615	1805	1845	1599
Flt Permitted	0.21	1.00	1.00	0.64	1.00		0.42	1.00	1.00	0.51	1.00	1.00
Satd. Flow (perm)	389	1845	1538	1219	1734		781	1881	1615	973	1845	1599
Peak-hour factor, PHF	0.92	0.92	0.92	0.93	0.93	0.93	0.87	0.87	0.87	0.84	0.84	0.84
Adj. Flow (vph)	570	184	385	44	342	89	271	225	71	33	70	301
RTOR Reduction (vph)	0	0	144	0	6	0	0	0	54	0	0	271
Lane Group Flow (vph)	570	184	241	44	425	0	271	225	17	33	70	30
Heavy Vehicles (%)	1%	3%	5%	0%	6%	7%	3%	1%	0%	0%	3%	1%
Turn Type	pm+pt	NA	Perm	custom	NA		pm+pt	NA	Perm	custom	NA	Perm
Protected Phases	7	4			8		5	2			6	
Permitted Phases	4		4	7 8			2		2	5 6		6
Actuated Green, G (s)	64.2	64.2	64.2	64.2	30.9		24.4	24.4	24.4	24.4	10.3	10.3
Effective Green, g (s)	64.2	64.2	64.2	64.2	30.9		24.4	24.4	24.4	24.4	10.3	10.3
Actuated g/C Ratio	0.63	0.63	0.63	0.63	0.30		0.24	0.24	0.24	0.24	0.10	0.10
Clearance Time (s)	7.0	7.0	7.0		7.0		7.0	7.0	7.0		7.0	7.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0		3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	601	1154	962	762	522		252	447	384	231	185	160
v/s Ratio Prot	c0.24	0.10			0.24		c0.07	0.12			0.04	
v/s Ratio Perm	c0.35		0.16	0.04			c0.18		0.01	0.03		0.02
v/c Ratio	0.95	0.16	0.25	0.06	0.81		1.08	0.50	0.04	0.14	0.38	0.19
Uniform Delay, d1	22.6	8.0	8.5	7.5	33.2		38.6	33.9	30.1	30.8	43.2	42.3
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	24.3	0.1	0.1	0.0	9.4		78.2	0.9	0.0	0.3	1.3	0.6
Delay (s)	46.9	8.0	8.7	7.5	42.6		116.7	34.7	30.2	31.1	44.5	42.9
Level of Service	D	A	A	A	D		F	C	C	C	D	D
Approach Delay (s)		27.7			39.4			73.4			42.2	
Approach LOS		C			D			E			D	
Intersection Summary												
HCM 2000 Control Delay			42.1			HCM 2000 Level of Service			D			
HCM 2000 Volume to Capacity ratio			1.11									
Actuated Cycle Length (s)			102.6			Sum of lost time (s)			30.0			
Intersection Capacity Utilization			90.6%			ICU Level of Service			E			
Analysis Period (min)			15									
c Critical Lane Group												

2028 Build Weekday Evening Peak Hour
1: Canal Rd/State Rd & Meetinghouse Ln

Peak Month Volumes

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	799	518	300	25	304	135	217	171	48	43	46	184
Future Volume (vph)	799	518	300	25	304	135	217	171	48	43	46	184
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			0.850		0.954				0.850			0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1787	1863	1599	1805	1795	0	1787	1881	1615	1805	1900	1599
Flt Permitted	0.170			0.368			0.410			0.561		
Satd. Flow (perm)	320	1863	1599	699	1795	0	771	1881	1615	1066	1900	1599
Satd. Flow (RTOR)			272		16				83			222
Adj. Flow (vph)	908	589	341	28	338	150	247	194	55	52	55	222
Lane Group Flow (vph)	908	589	341	28	488	0	247	194	55	52	55	222
Turn Type	pm+pt	NA	Perm	custom	NA		pm+pt	NA	Perm	custom	NA	Perm
Protected Phases	7	4			8		5	2			6	
Permitted Phases	4		4	7 8			2		2	5 6		6
Detector Phase	7	4	4	7 8	8		5	2	2	5 6	6	6
Switch Phase												
Minimum Initial (s)	1.0	1.0	1.0		1.0		1.0	1.0	1.0		1.0	1.0
Minimum Split (s)	8.0	8.0	8.0		8.0		8.0	8.0	8.0		8.0	8.0
Total Split (s)	33.0	111.0	111.0		78.0		14.0	37.0	37.0		23.0	23.0
Total Split (%)	19.4%	65.3%	65.3%		45.9%		8.2%	21.8%	21.8%		13.5%	13.5%
Maximum Green (s)	26.0	104.0	104.0		71.0		7.0	30.0	30.0		16.0	16.0
Yellow Time (s)	4.0	4.0	4.0		4.0		4.0	4.0	4.0		4.0	4.0
All-Red Time (s)	3.0	3.0	3.0		3.0		3.0	3.0	3.0		3.0	3.0
Lost Time Adjust (s)	0.0	0.0	0.0		0.0		0.0	0.0	0.0		0.0	0.0
Total Lost Time (s)	7.0	7.0	7.0		7.0		7.0	7.0	7.0		7.0	7.0
Lead/Lag	Lead				Lag		Lead				Lag	Lag
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0	3.0		3.0		3.0	3.0	3.0		3.0	3.0
Recall Mode	None	None	None		None		None	None	None		None	None
Walk Time (s)												
Flash Dont Walk (s)												
Pedestrian Calls (#/hr)												
v/c Ratio	1.58	0.49	0.30	0.06	0.84		1.02	0.46	0.13	0.22	0.33	0.65
Control Delay	292.0	11.6	2.6	7.7	45.2		104.5	40.6	3.8	38.4	52.6	16.0
Queue Delay	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	292.0	11.6	2.6	7.7	45.2		104.5	40.6	3.8	38.4	52.6	16.0
Queue Length 50th (ft)	~769	183	15	6	286		~153	111	0	28	35	0
Queue Length 95th (ft)	#1185	293	49	19	443		#369	203	14	65	76	54
Internal Link Dist (ft)		363			464			190			202	
Turn Bay Length (ft)	190		190	100			310		50	100		100
Base Capacity (vph)	575	1785	1543	670	1243		241	548	529	310	295	436
Starvation Cap Reductn	0	0	0	0	0		0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0		0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0		0	0	0	0	0	0
Reduced v/c Ratio	1.58	0.33	0.22	0.04	0.39		1.02	0.35	0.10	0.17	0.19	0.51
Intersection Summary												
Cycle Length: 170												

2028 Build Weekday Evening Peak Hour
1: Canal Rd/State Rd & Meetinghouse Ln

Peak Month Volumes

Lane Group	Ø9
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Lane Util. Factor	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Satd. Flow (RTOR)	
Adj. Flow (vph)	
Lane Group Flow (vph)	
Turn Type	
Protected Phases	9
Permitted Phases	
Detector Phase	
Switch Phase	
Minimum Initial (s)	1.0
Minimum Split (s)	22.0
Total Split (s)	22.0
Total Split (%)	13%
Maximum Green (s)	20.0
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)	7.0
Flash Dont Walk (s)	13.0
Pedestrian Calls (#/hr)	0
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
Queue Length 50th (ft)	
Queue Length 95th (ft)	
Internal Link Dist (ft)	
Turn Bay Length (ft)	
Base Capacity (vph)	
Starvation Cap Reductn	
Spillback Cap Reductn	
Storage Cap Reductn	
Reduced v/c Ratio	
Intersection Summary	

2028 Build Weekday Evening Peak Hour
1: Canal Rd/State Rd & Meetinghouse Ln

Peak Month Volumes

Actuated Cycle Length: 104.2

Natural Cycle: 150

Control Type: Actuated-Uncoordinated








~ 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.

Splits and Phases: 1: Canal Rd/State Rd & Meetinghouse Ln

 Ø2	 Ø4	 Ø9
37 s	111 s	22 s
 Ø5	 Ø7	
14 s	33 s	
 Ø6	 Ø8	
23 s	78 s	

2028 Build Weekday Evening Peak Hour
1: Canal Rd/State Rd & Meetinghouse Ln

Peak Month Volumes

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	799	518	300	25	304	135	217	171	48	43	46	184
Future Volume (vph)	799	518	300	25	304	135	217	171	48	43	46	184
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	7.0	7.0	7.0	7.0	7.0		7.0	7.0	7.0	7.0	7.0	7.0
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
Frt	1.00	1.00	0.85	1.00	0.95		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1787	1863	1599	1805	1794		1787	1881	1615	1805	1900	1599
Flt Permitted	0.17	1.00	1.00	0.37	1.00		0.41	1.00	1.00	0.56	1.00	1.00
Satd. Flow (perm)	320	1863	1599	700	1794		770	1881	1615	1065	1900	1599
Peak-hour factor, PHF	0.88	0.88	0.88	0.90	0.90	0.90	0.88	0.88	0.88	0.83	0.83	0.83
Adj. Flow (vph)	908	589	341	28	338	150	247	194	55	52	55	222
RTOR Reduction (vph)	0	0	98	0	11	0	0	0	43	0	0	202
Lane Group Flow (vph)	908	589	243	28	477	0	247	194	12	52	55	20
Heavy Vehicles (%)	1%	2%	1%	0%	1%	1%	1%	1%	0%	0%	0%	1%
Turn Type	pm+pt	NA	Perm	custom	NA		pm+pt	NA	Perm	custom	NA	Perm
Protected Phases	7	4			8		5	2			6	
Permitted Phases	4		4	7 8			2		2	5 6		6
Actuated Green, G (s)	66.7	66.7	66.7	66.7	33.4		23.3	23.3	23.3	23.3	9.2	9.2
Effective Green, g (s)	66.7	66.7	66.7	66.7	33.4		23.3	23.3	23.3	23.3	9.2	9.2
Actuated g/C Ratio	0.64	0.64	0.64	0.64	0.32		0.22	0.22	0.22	0.22	0.09	0.09
Clearance Time (s)	7.0	7.0	7.0		7.0		7.0	7.0	7.0		7.0	7.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0		3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	576	1194	1025	448	576		241	421	361	238	168	141
v/s Ratio Prot	c0.40	0.32			0.27		c0.07	0.10			0.03	
v/s Ratio Perm	c0.61		0.15	0.04			c0.16		0.01	0.05		0.01
v/c Ratio	1.58	0.49	0.24	0.06	0.83		1.02	0.46	0.03	0.22	0.33	0.14
Uniform Delay, d1	26.4	9.8	7.9	7.0	32.6		39.7	34.9	31.6	32.9	44.5	43.7
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	267.7	0.3	0.1	0.1	9.6		64.6	0.8	0.0	0.5	1.1	0.5
Delay (s)	294.1	10.1	8.0	7.0	42.2		104.3	35.7	31.6	33.4	45.6	44.2
Level of Service	F	B	A	A	D		F	D	C	C	D	D
Approach Delay (s)		150.0			40.3			69.4			42.7	
Approach LOS		F			D			E			D	
Intersection Summary												
HCM 2000 Control Delay			108.5			HCM 2000 Level of Service			F			
HCM 2000 Volume to Capacity ratio			1.63									
Actuated Cycle Length (s)			104.0			Sum of lost time (s)			30.0			
Intersection Capacity Utilization			107.2%			ICU Level of Service			G			
Analysis Period (min)			15									
c Critical Lane Group												

Meetinghouse Lane at Old Plymouth Road at Scusset Beach Road

2021 Existing Weekday Morning Peak Hour
3: Old Plymouth Rd & Meetinghouse Ln/Scusset Beach Rd

Intersection												
Int Delay, s/veh	7											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	115	95	18	5	173	4	37	7	7	8	13	186
Future Vol, veh/h	115	95	18	5	173	4	37	7	7	8	13	186
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	90	90	90	85	85	85	68	68	68	95	95	95
Heavy Vehicles, %	1	5	0	0	2	0	5	0	50	0	0	2
Mvmt Flow	128	106	20	6	204	5	54	10	10	8	14	196
Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	209	0	0	126	0	0	696	593	116	601	601	207
Stage 1	-	-	-	-	-	-	372	372	-	219	219	-
Stage 2	-	-	-	-	-	-	324	221	-	382	382	-
Critical Hdwy	4.11	-	-	4.1	-	-	7.15	6.5	6.7	7.1	6.5	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.15	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.15	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.209	-	-	2.2	-	-	3.545	4	3.75	3.5	4	3.318
Pot Cap-1 Maneuver	1368	-	-	1473	-	-	352	421	821	415	417	833
Stage 1	-	-	-	-	-	-	642	622	-	788	726	-
Stage 2	-	-	-	-	-	-	682	724	-	645	616	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1368	-	-	1473	-	-	241	377	821	369	373	833
Mov Cap-2 Maneuver	-	-	-	-	-	-	241	377	-	369	373	-
Stage 1	-	-	-	-	-	-	577	559	-	708	722	-
Stage 2	-	-	-	-	-	-	509	720	-	562	554	-
Approach	EB			WB			NB			SB		
HCM Control Delay, s	4			0.2			22.3			11.9		
HCM LOS							C			B		
Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1				
Capacity (veh/h)	282	1368	-	-	1473	-	-	740				
HCM Lane V/C Ratio	0.266	0.093	-	-	0.004	-	-	0.294				
HCM Control Delay (s)	22.3	7.9	0	-	7.5	0	-	11.9				
HCM Lane LOS	C	A	A	-	A	A	-	B				
HCM 95th %tile Q(veh)	1	0.3	-	-	0	-	-	1.2				

2021 Existing Weekday Evening Peak Hour
3: Old Plymouth Rd & Meetinghouse Ln/Scusset Beach Rd

Peak Month Volumes

Intersection												
Int Delay, s/veh	10.7											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	274	182	40	5	141	17	25	28	1	11	32	167
Future Vol, veh/h	274	182	40	5	141	17	25	28	1	11	32	167
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	92	92	92	84	84	84	82	82	82	88	88	88
Heavy Vehicles, %	0	0	0	0	0	0	0	0	0	0	0	0
Mvmt Flow	298	198	43	6	168	20	30	34	1	13	36	190

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	188	0	0	241	0	0	1119	1016	220	1023	1027	178
Stage 1	-	-	-	-	-	-	816	816	-	190	190	-
Stage 2	-	-	-	-	-	-	303	200	-	833	837	-
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	1398	-	-	1337	-	-	186	240	825	216	236	870
Stage 1	-	-	-	-	-	-	374	393	-	816	747	-
Stage 2	-	-	-	-	-	-	711	739	-	366	385	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	1398	-	-	1337	-	-	100	180	825	149	177	870
Mov Cap-2 Maneuver	-	-	-	-	-	-	100	180	-	149	177	-
Stage 1	-	-	-	-	-	-	281	296	-	614	743	-
Stage 2	-	-	-	-	-	-	526	735	-	243	290	-

Approach	EB			WB			NB			SB		
HCM Control Delay, s	4.6			0.2			56.1			20.3		
HCM LOS							F			C		

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	133	1398	-	-	1337	-	-	470
HCM Lane V/C Ratio	0.495	0.213	-	-	0.004	-	-	0.508
HCM Control Delay (s)	56.1	8.3	0	-	7.7	0	-	20.3
HCM Lane LOS	F	A	A	-	A	A	-	C
HCM 95th %tile Q(veh)	2.3	0.8	-	-	0	-	-	2.8

2021 Existing Weekday Morning Peak Hour
3: Old Plymouth Rd & Meetinghouse Ln/Scusset Beach Rd

Peak Month Volumes

Intersection												
Int Delay, s/veh	7.4											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	122	101	20	5	184	4	40	7	7	8	14	199
Future Vol, veh/h	122	101	20	5	184	4	40	7	7	8	14	199
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	90	90	90	85	85	85	68	68	68	95	95	95
Heavy Vehicles, %	1	5	0	0	2	0	5	0	50	0	0	2
Mvmt Flow	136	112	22	6	216	5	59	10	10	8	15	209

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	221	0	0	134	0	0	738	628	123	636	637	219
Stage 1	-	-	-	-	-	-	395	395	-	231	231	-
Stage 2	-	-	-	-	-	-	343	233	-	405	406	-
Critical Hdwy	4.11	-	-	4.1	-	-	7.15	6.5	6.7	7.1	6.5	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.15	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.15	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.209	-	-	2.2	-	-	3.545	4	3.75	3.5	4	3.318
Pot Cap-1 Maneuver	1354	-	-	1463	-	-	330	402	814	393	398	821
Stage 1	-	-	-	-	-	-	624	608	-	776	717	-
Stage 2	-	-	-	-	-	-	666	716	-	626	601	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	1354	-	-	1463	-	-	217	357	814	347	353	821
Mov Cap-2 Maneuver	-	-	-	-	-	-	217	357	-	347	353	-
Stage 1	-	-	-	-	-	-	556	542	-	691	713	-
Stage 2	-	-	-	-	-	-	483	712	-	540	535	-

Approach	EB			WB			NB			SB		
HCM Control Delay, s	4			0.2			25.5			12.3		
HCM LOS							D			B		

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	254	1354	-	-	1463	-	-	724
HCM Lane V/C Ratio	0.313	0.1	-	-	0.004	-	-	0.321
HCM Control Delay (s)	25.5	8	0	-	7.5	0	-	12.3
HCM Lane LOS	D	A	A	-	A	A	-	B
HCM 95th %tile Q(veh)	1.3	0.3	-	-	0	-	-	1.4

2028 No Build Weekday Evening Peak Hour
3: Old Plymouth Rd & Meetinghouse Ln/Scusset Beach Rd

Peak Month Volumes

Intersection												
Int Delay, s/veh	13.3											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	294	195	42	5	151	18	26	30	1	12	34	179
Future Vol, veh/h	294	195	42	5	151	18	26	30	1	12	34	179
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	92	92	92	84	84	84	82	82	82	88	88	88
Heavy Vehicles, %	0	0	0	0	0	0	0	0	0	0	0	0
Mvmt Flow	320	212	46	6	180	21	32	37	1	14	39	203

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	201	0	0	258	0	0	1199	1088	235	1097	1101	191
Stage 1	-	-	-	-	-	-	875	875	-	203	203	-
Stage 2	-	-	-	-	-	-	324	213	-	894	898	-
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	1383	-	-	1318	-	-	164	218	809	192	214	856
Stage 1	-	-	-	-	-	-	347	370	-	804	737	-
Stage 2	-	-	-	-	-	-	692	730	-	338	361	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1383	-	-	1318	-	-	80	158	809	125	155	856
Mov Cap-2 Maneuver	-	-	-	-	-	-	80	158	-	125	155	-
Stage 1	-	-	-	-	-	-	253	269	-	585	733	-
Stage 2	-	-	-	-	-	-	497	726	-	212	263	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	4.6	0.2	82.1	25
HCM LOS			F	D

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	110	1383	-	-	1318	-	-	429
HCM Lane V/C Ratio	0.632	0.231	-	-	0.005	-	-	0.596
HCM Control Delay (s)	82.1	8.4	0	-	7.7	0	-	25
HCM Lane LOS	F	A	A	-	A	A	-	D
HCM 95th %tile Q(veh)	3.2	0.9	-	-	0	-	-	3.8

2028 Build Weekday Morning Peak Hour
3: Old Plymouth Rd & Meetinghouse Ln/Scusset Beach Rd

Peak Month Volumes

Intersection												
Int Delay, s/veh	7.5											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	123	101	20	5	185	4	40	7	7	8	14	200
Future Vol, veh/h	123	101	20	5	185	4	40	7	7	8	14	200
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	90	90	90	85	85	85	68	68	68	95	95	95
Heavy Vehicles, %	1	5	0	0	2	0	5	0	50	0	0	2
Mvmt Flow	137	112	22	6	218	5	59	10	10	8	15	211

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	223	0	0	134	0	0	743	632	123	640	641	221
Stage 1	-	-	-	-	-	-	397	397	-	233	233	-
Stage 2	-	-	-	-	-	-	346	235	-	407	408	-
Critical Hdwy	4.11	-	-	4.1	-	-	7.15	6.5	6.7	7.1	6.5	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.15	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.15	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.209	-	-	2.2	-	-	3.545	4	3.75	3.5	4	3.318
Pot Cap-1 Maneuver	1352	-	-	1463	-	-	327	400	814	391	395	819
Stage 1	-	-	-	-	-	-	623	607	-	775	716	-
Stage 2	-	-	-	-	-	-	664	714	-	625	600	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	1352	-	-	1463	-	-	215	354	814	344	350	819
Mov Cap-2 Maneuver	-	-	-	-	-	-	215	354	-	344	350	-
Stage 1	-	-	-	-	-	-	554	540	-	690	712	-
Stage 2	-	-	-	-	-	-	481	710	-	539	534	-

Approach	EB			WB			NB			SB		
HCM Control Delay, s	4			0.2			25.7			12.4		
HCM LOS							D			B		

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	252	1352	-	-	1463	-	-	722
HCM Lane V/C Ratio	0.315	0.101	-	-	0.004	-	-	0.324
HCM Control Delay (s)	25.7	8	0	-	7.5	0	-	12.4
HCM Lane LOS	D	A	A	-	A	A	-	B
HCM 95th %tile Q(veh)	1.3	0.3	-	-	0	-	-	1.4

2028 Build Weekday Evening Peak Hour
3: Old Plymouth Rd & Meetinghouse Ln/Scusset Beach Rd

Peak Month Volumes

Intersection												
Int Delay, s/veh	13.4											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	295	195	42	5	152	18	26	30	1	12	34	180
Future Vol, veh/h	295	195	42	5	152	18	26	30	1	12	34	180
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	92	92	92	84	84	84	82	82	82	88	88	88
Heavy Vehicles, %	0	0	0	0	0	0	0	0	0	0	0	0
Mvmt Flow	321	212	46	6	181	21	32	37	1	14	39	205





Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	202	0	0	258	0	0	1203	1091	235	1100	1104	192
Stage 1	-	-	-	-	-	-	877	877	-	204	204	-
Stage 2	-	-	-	-	-	-	326	214	-	896	900	-
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	1382	-	-	1318	-	-	163	217	809	191	213	855
Stage 1	-	-	-	-	-	-	346	369	-	803	737	-
Stage 2	-	-	-	-	-	-	691	729	-	338	360	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	1382	-	-	1318	-	-	80	157	809	124	154	855
Mov Cap-2 Maneuver	-	-	-	-	-	-	80	157	-	124	154	-
Stage 1	-	-	-	-	-	-	252	268	-	584	733	-
Stage 2	-	-	-	-	-	-	495	725	-	212	262	-

Approach	EB			WB			NB			SB		
HCM Control Delay, s	4.7			0.2			82.1			25.3		
HCM LOS							F			D		

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	110	1382	-	-	1318	-	-	428
HCM Lane V/C Ratio	0.632	0.232	-	-	0.005	-	-	0.6
HCM Control Delay (s)	82.1	8.4	0	-	7.7	0	-	25.3
HCM Lane LOS	F	A	A	-	A	A	-	D
HCM 95th %tile Q(veh)	3.2	0.9	-	-	0	-	-	3.8





Meetinghouse Lane at Cape View Road at 54 Meetinghouse Lane Driveway

2021 Existing Weekday Morning Peak Hour
2: Driveway/Cape View Way & Meetinghouse Ln

Intersection												
Int Delay, s/veh	0.4											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	5	242	28	12	387	1	0	0	0	1	0	4
Future Vol, veh/h	5	242	28	12	387	1	0	0	0	1	0	4
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	91	91	91	25	25	25	50	50	50
Heavy Vehicles, %	0	3	6	57	6	0	0	0	0	0	0	0
Mvmt Flow	6	281	33	13	425	1	0	0	0	2	0	8
Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	426	0	0	314	0	0	766	762	298	762	778	426
Stage 1	-	-	-	-	-	-	310	310	-	452	452	-
Stage 2	-	-	-	-	-	-	456	452	-	310	326	-
Critical Hdwy	4.1	-	-	4.67	-	-	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	-	-	2.713	-	-	3.5	4	3.3	3.5	4	3.3
Pot Cap-1 Maneuver	1144	-	-	992	-	-	322	337	746	324	330	633
Stage 1	-	-	-	-	-	-	705	663	-	591	574	-
Stage 2	-	-	-	-	-	-	588	574	-	705	652	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1144	-	-	992	-	-	312	329	746	318	322	633
Mov Cap-2 Maneuver	-	-	-	-	-	-	312	329	-	318	322	-
Stage 1	-	-	-	-	-	-	701	659	-	587	564	-
Stage 2	-	-	-	-	-	-	571	564	-	701	648	-
Approach	EB			WB			NB			SB		
HCM Control Delay, s	0.1			0.3			0			12		
HCM LOS							A			B		
Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1				
Capacity (veh/h)	-	1144	-	-	992	-	-	528				
HCM Lane V/C Ratio	-	0.005	-	-	0.013	-	-	0.019				
HCM Control Delay (s)	0	8.2	0	-	8.7	0	-	12				
HCM Lane LOS	A	A	A	-	A	A	-	B				
HCM 95th %tile Q(veh)	-	0	-	-	0	-	-	0.1				

2021 Existing Weekday Evening Peak Hour
2: Driveway/Cape View Way & Meetinghouse Ln

Peak Month Volumes

Intersection												
Int Delay, s/veh	0.4											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	497	12	0	350	1	4	0	0	1	0	0
Future Vol, veh/h	0	497	12	0	350	1	4	0	0	1	0	0
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	89	89	89	90	90	90	25	25	25	25	25	25
Heavy Vehicles, %	0	0	71	0	0	0	0	0	0	0	0	0
Mvmt Flow	0	558	13	0	389	1	16	0	0	4	0	0
Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	390	0	0	571	0	0	955	955	565	955	961	390
Stage 1	-	-	-	-	-	-	565	565	-	390	390	-
Stage 2	-	-	-	-	-	-	390	390	-	565	571	-
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	1180	-	-	1012	-	-	240	260	528	240	258	663
Stage 1	-	-	-	-	-	-	513	511	-	638	611	-
Stage 2	-	-	-	-	-	-	638	611	-	513	508	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1180	-	-	1012	-	-	240	260	528	240	258	663
Mov Cap-2 Maneuver	-	-	-	-	-	-	240	260	-	240	258	-
Stage 1	-	-	-	-	-	-	513	511	-	638	611	-
Stage 2	-	-	-	-	-	-	638	611	-	513	508	-
Approach	EB			WB			NB			SB		
HCM Control Delay, s	0			0			21.1			20.3		
HCM LOS							C			C		
Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1				
Capacity (veh/h)	240	1180	-	-	1012	-	-	240				
HCM Lane V/C Ratio	0.067	-	-	-	-	-	-	0.017				
HCM Control Delay (s)	21.1	0	-	-	0	-	-	20.3				
HCM Lane LOS	C	A	-	-	A	-	-	C				
HCM 95th %tile Q(veh)	0.2	0	-	-	0	-	-	0.1				

2021 Existing Weekday Morning Peak Hour
2: Driveway/Cape View Way & Meetinghouse Ln

Peak Month Volumes

Intersection												
Int Delay, s/veh	0.3											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	5	259	28	12	415	1	0	0	0	1	0	4
Future Vol, veh/h	5	259	28	12	415	1	0	0	0	1	0	4
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	91	91	91	25	25	25	50	50	50
Heavy Vehicles, %	0	3	6	57	6	0	0	0	0	0	0	0
Mvmt Flow	6	301	33	13	456	1	0	0	0	2	0	8

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	457	0	0	334	0	0	817	813	318	813	829	457
Stage 1	-	-	-	-	-	-	330	330	-	483	483	-
Stage 2	-	-	-	-	-	-	487	483	-	330	346	-
Critical Hdwy	4.1	-	-	4.67	-	-	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	-	-	2.713	-	-	3.5	4	3.3	3.5	4	3.3
Pot Cap-1 Maneuver	1114	-	-	973	-	-	298	315	727	299	308	608
Stage 1	-	-	-	-	-	-	687	649	-	569	556	-
Stage 2	-	-	-	-	-	-	566	556	-	687	639	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	1114	-	-	973	-	-	288	307	727	293	300	608
Mov Cap-2 Maneuver	-	-	-	-	-	-	288	307	-	293	300	-
Stage 1	-	-	-	-	-	-	682	644	-	565	546	-
Stage 2	-	-	-	-	-	-	548	546	-	682	635	-

Approach	EB			WB			NB			SB		
HCM Control Delay, s	0.1			0.2			0			12.3		
HCM LOS							A			B		

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	-	1114	-	-	973	-	-	500
HCM Lane V/C Ratio	-	0.005	-	-	0.014	-	-	0.02
HCM Control Delay (s)	0	8.2	0	-	8.8	0	-	12.3
HCM Lane LOS	A	A	A	-	A	A	-	B
HCM 95th %tile Q(veh)	-	0	-	-	0	-	-	0.1

2028 No Build Weekday Evening Peak Hour
2: Driveway/Cape View Way & Meetinghouse Ln

Peak Month Volumes

Intersection												
Int Delay, s/veh	0.4											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	0	532	12	0	375	1	4	0	0	1	0	0
Future Vol, veh/h	0	532	12	0	375	1	4	0	0	1	0	0
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	89	89	89	90	90	90	25	25	25	25	25	25
Heavy Vehicles, %	0	0	71	0	0	0	0	0	0	0	0	0
Mvmt Flow	0	598	13	0	417	1	16	0	0	4	0	0

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	418	0	0	611	0	0	1023	1023	605	1023	1029	418
Stage 1	-	-	-	-	-	-	605	605	-	418	418	-
Stage 2	-	-	-	-	-	-	418	418	-	605	611	-
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	1152	-	-	978	-	-	216	238	501	216	236	639
Stage 1	-	-	-	-	-	-	488	491	-	616	594	-
Stage 2	-	-	-	-	-	-	616	594	-	488	487	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	1152	-	-	978	-	-	216	238	501	216	236	639
Mov Cap-2 Maneuver	-	-	-	-	-	-	216	238	-	216	236	-
Stage 1	-	-	-	-	-	-	488	491	-	616	594	-
Stage 2	-	-	-	-	-	-	616	594	-	488	487	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0	23	22
HCM LOS			C	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	216	1152	-	-	978	-	-	216
HCM Lane V/C Ratio	0.074	-	-	-	-	-	-	0.019
HCM Control Delay (s)	23	0	-	-	0	-	-	22
HCM Lane LOS	C	A	-	-	A	-	-	C
HCM 95th %tile Q(veh)	0.2	0	-	-	0	-	-	0.1

2028 Build Weekday Morning Peak Hour
2: Driveway/Cape View Way & Meetinghouse Ln

Peak Month Volumes

Intersection												
Int Delay, s/veh	0.8											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	9	259	28	12	415	3	0	0	0	3	0	15
Future Vol, veh/h	9	259	28	12	415	3	0	0	0	3	0	15
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	91	91	91	25	25	25	50	50	50
Heavy Vehicles, %	0	3	6	57	6	0	0	0	0	0	0	0
Mvmt Flow	10	301	33	13	456	3	0	0	0	6	0	30

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	459	0	0	334	0	0	837	823	318	822	838	458
Stage 1	-	-	-	-	-	-	338	338	-	484	484	-
Stage 2	-	-	-	-	-	-	499	485	-	338	354	-
Critical Hdwy	4.1	-	-	4.67	-	-	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	-	-	2.713	-	-	3.5	4	3.3	3.5	4	3.3
Pot Cap-1 Maneuver	1113	-	-	973	-	-	288	311	727	295	305	607
Stage 1	-	-	-	-	-	-	681	644	-	568	555	-
Stage 2	-	-	-	-	-	-	557	555	-	681	634	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	1113	-	-	973	-	-	268	302	727	289	296	607
Mov Cap-2 Maneuver	-	-	-	-	-	-	268	302	-	289	296	-
Stage 1	-	-	-	-	-	-	674	637	-	562	545	-
Stage 2	-	-	-	-	-	-	520	545	-	674	627	-

Approach	EB			WB			NB			SB		
HCM Control Delay, s	0.3			0.2			0			12.5		
HCM LOS							A			B		

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	-	1113	-	-	973	-	-	513
HCM Lane V/C Ratio	-	0.009	-	-	0.014	-	-	0.07
HCM Control Delay (s)	0	8.3	0	-	8.8	0	-	12.5
HCM Lane LOS	A	A	A	-	A	A	-	B
HCM 95th %tile Q(veh)	-	0	-	-	0	-	-	0.2

2028 Build Weekday Evening Peak Hour
2: Driveway/Cape View Way & Meetinghouse Ln

Peak Month Volumes

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	12	532	12	0	375	3	4	0	0	2	0	8
Future Vol, veh/h	12	532	12	0	375	3	4	0	0	2	0	8
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	89	89	89	90	90	90	25	25	25	25	25	25
Heavy Vehicles, %	0	0	71	0	0	0	0	0	0	0	0	0
Mvmt Flow	13	598	13	0	417	3	16	0	0	8	0	32

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	420	0	0	611	0	0	1066	1051	605	1050	1056	419
Stage 1	-	-	-	-	-	-	631	631	-	419	419	-
Stage 2	-	-	-	-	-	-	435	420	-	631	637	-
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	1150	-	-	978	-	-	202	229	501	207	227	638
Stage 1	-	-	-	-	-	-	472	477	-	616	593	-
Stage 2	-	-	-	-	-	-	604	593	-	472	475	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	1150	-	-	978	-	-	189	225	501	204	223	638
Mov Cap-2 Maneuver	-	-	-	-	-	-	189	225	-	204	223	-
Stage 1	-	-	-	-	-	-	464	469	-	606	593	-
Stage 2	-	-	-	-	-	-	574	593	-	464	467	-




Approach	EB	WB	NB	SB
HCM Control Delay, s	0.2	0	25.8	13.8
HCM LOS			D	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	189	1150	-	-	978	-	-	448
HCM Lane V/C Ratio	0.085	0.012	-	-	-	-	-	0.089
HCM Control Delay (s)	25.8	8.2	0	-	0	-	-	13.8
HCM Lane LOS	D	A	A	-	A	-	-	B
HCM 95th %tile Q(veh)	0.3	0	-	-	0	-	-	0.3

Cape View Road at the west Project Site Driveway




2028 Build Weekday Morning Peak Hour
4: Cape View Way & Driveway

Peak Month Volumes

Intersection						
Int Delay, s/veh	1.2					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	4	0	5	7	0	13
Future Vol, veh/h	4	0	5	7	0	13
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	4	0	5	8	0	14
Major/Minor	Minor1	Major1	Major2			
Conflicting Flow All	23	9	0	0	13	0
Stage 1	9	-	-	-	-	-
Stage 2	14	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	993	1073	-	-	1606	-
Stage 1	1014	-	-	-	-	-
Stage 2	1009	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	993	1073	-	-	1606	-
Mov Cap-2 Maneuver	993	-	-	-	-	-
Stage 1	1014	-	-	-	-	-
Stage 2	1009	-	-	-	-	-
Approach	WB	NB		SB		
HCM Control Delay, s	8.6	0		0		
HCM LOS	A					
Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT		
Capacity (veh/h)	-	-	993	1606	-	
HCM Lane V/C Ratio	-	-	0.004	-	-	
HCM Control Delay (s)	-	-	8.6	0	-	
HCM Lane LOS	-	-	A	A	-	
HCM 95th %tile Q(veh)	-	-	0	0	-	

2028 Build Weekday Evening Peak Hour
4: Cape View Way & Driveway

Peak Month Volumes

Intersection						
Int Delay, s/veh	0.3					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	1	0	14	1	0	9
Future Vol, veh/h	1	0	14	1	0	9
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	1	0	15	1	0	10

Major/Minor	Minor1	Major1	Major2
Conflicting Flow All	26	16	0
Stage 1	16	-	-
Stage 2	10	-	-
Critical Hdwy	6.42	6.22	-
Critical Hdwy Stg 1	5.42	-	-
Critical Hdwy Stg 2	5.42	-	-
Follow-up Hdwy	3.518	3.318	-
Pot Cap-1 Maneuver	989	1063	-
Stage 1	1007	-	-
Stage 2	1013	-	-
Platoon blocked, %		-	-
Mov Cap-1 Maneuver	989	1063	-
Mov Cap-2 Maneuver	989	-	-
Stage 1	1007	-	-
Stage 2	1013	-	-

Approach	WB	NB	SB
HCM Control Delay, s	8.6	0	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT
Capacity (veh/h)	-	-	989	1602
HCM Lane V/C Ratio	-	-	0.001	-
HCM Control Delay (s)	-	-	8.6	0
HCM Lane LOS	-	-	A	A
HCM 95th %tile Q(veh)	-	-	0	0

CONSTRUCTION MANAGEMENT PLAN

**CONSTRUCTION MANAGEMENT PLAN
MULTIFAMILY RESIDENTIAL DEVELOPMENT
CAPE VIEW WAY
BOURNE, MASSACHUSETTS**

The Project proponent will implement a Construction Management Plan (CMP) in coordination with Town of Bourne in order to facilitate the safe and efficient access to the Project site during construction activities. Summarized below are several measures which will be undertaken during the construction phase of the Project.

- Prior to construction activities, a Temporary Traffic Control Plan (TTCP) will be submitted to the Department of Public Works (DPW) and the Police Department for review and approval. The TTCP will depict the location of the construction entrance, traffic and sediment control measures, traffic control devices and the location of any construction activities that will occur with the public right-of-way.
- A pre-construction meeting will be held with the DPW and the Police Department prior to the initiation of construction activities.
- The contact information for the general contractor or construction superintendent will be provided to the DPW and the Police Department.
- Hours of construction will be as defined by the Zoning By Laws of the Town or as established in the Comprehensive Permit Decision.
- Police details will be used when construction activities will occur that may disrupt travel along Meetinghouse Lane.
- Truck routes will be established that will avoid travel through residential areas and will be included in all construction contracts.
- Employees will be encouraged to car/vanpool in order to reduce construction-related traffic.
- Secure on-site storage will be provided for tools and equipment in an effort to minimize construction-related vehicle trips to the site.
- Full or partial street closures will be avoided to the extent possible. Should a partial street closure be necessary in order to off-load construction materials and/or complete construction-related activities, the closure will be limited to off-peak periods as defined by the DPW and the Police Department so as to minimize the impact of vehicular and pedestrian flow.
- Construction worker parking will be expressly prohibited along Meetinghouse Lane and the paved portion of Cape View Way. Construction contracts for the project will include notification of this prohibition.

July 27, 2021

Matthew Sawicki, Superintendent
North Sagamore Water District
14 Squanto Road
Sagamore Beach, MA 02562

RE: Flow Test for Cape View Drive 40B Development

Dear Mr. Sawicki:

The North Sagamore Water District (District) retained Resilient Civil Engineering, P.C. (ResilientCE) to conduct a flow test along Meetinghouse Lane near the proposed location of the Cape View Drive development.

Two hydrants were used to complete this test, one to monitor system pressure and the other to measure flow. The flowing hydrant was located at the hydrant between the Post Office and Ace Hardware along Meetinghouse Lane. The residual hydrant was located at the Fire Station at 51 Meetinghouse Lane. The attached Fire Flow Test sheet provides the pressures and flow measured during the test. A map identifying the hydrant locations is also provided.

The flow was similar to the flow test conducted by Horsley Witten Group, Inc. on September 5, 2019. However, the residual pressure during the recent test was about 9 psi greater than the prior test. The improved residual pressure is a direct result of the District identifying and opening a valve that had unknowingly been closed during the prior flow test. This valve is located along the 8-inch diameter water main at the intersection of Meetinghouse Lane and Route 3A. The closed valve was discovered and opened on February 17, 2021. It is not known how long the valve was closed. Based on the results of this flow test, the valve was closed during the prior flow test.

Note that the results of the flow tests validate the hydraulic model simulations that were run with the 8-inch diameter water main that crosses Route 3A both open and closed to compare impacts with and without a water main break at this location.

When using the results of this flow test, please keep in mind the need to maintain pressures at the high points of the water system along the Scenic Highway. It is customary to extrapolate the available flow at the flow test location at residual pressure of 20 psi. However, decreasing the system pressure to 20 psi at the flowing hydrant location will decrease the pressures along the Scenic Highway far below 20 psi and the

minimum pressure requirement for water distribution systems has been established in the Massachusetts Department of Environmental Protection (MassDEP) "Guidelines and Policies for Public Water Systems", as 20 psi for emergency conditions. This minimum pressure requirement is established to protect public health.

Please contact me with any questions at 508-726-2458 or kberger@resilientce.com.

Sincerely,
Resilient Civil Engineering, P.C.

A handwritten signature in blue ink, appearing to read "Kristen M. Berger".

Kristen M. Berger, P.E.
President

encl.

FIRE FLOW TEST

WATER SYSTEM: North Sagamore Water District

TEST PERFORMED BY: Resilient Civil Engineering, PC

DATE: 7/22/2021

START OF TEST: 9:18 AM 9:28 AM

END OF TEST: 9:22 AM 9:35 AM

TEST DURATION: 4 minutes 7 minutes

WATER STORAGE TANK LEVEL

AT START OF TEST: Bournedale 28.46', Clark 92.32', Norris 41.01'

AT END OF TEST: Bournedale 27.89', Clark 90.10', Norris 41.14'

STATUS OF PUMPS: Off

HYDRANT LOCATIONS

FLOWING HYDRANT: Between Post Office and Ace Hardware Meetinghouse Lane

RESIDUAL HYDRANT: Fire Station at 51 Meetinghouse Lane

HYDRANT COEFFICIENT: 0.9

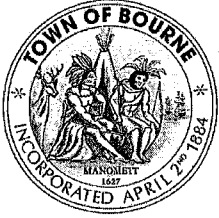
	TEST #1	TEST#2
FLOWING HYDRANT		
Flow Opening (Inches)	2.375	2.5
No. of Butts Flowing	1	1
Static Pressure (psi)	48	48
Pitot Reading (psi)	40	30
Flow, Q_f (gpm)	956	960
RESIDUAL HYDRANT		
Static Pressure, H_s (psi)	56	56
Residual Pressure, H_r (psi)	49	49

COMMENTS:

Test completed twice using different flow nozzles/pitots to verify results.

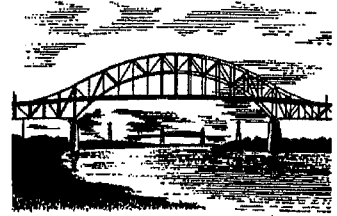
FLOW TEST HYDRANT LOCATIONS





TOWN OF BOURNE CONSERVATION COMMISSION

24 Perry Avenue
Buzzards Bay, MA 02532



April 7, 2021

Re: Conservation Department comments on Cape View Way Project
0, 6, 8, 10, 11, & 12 Cape View Way & 0 Homestead Rd. Ext.,
Sagamore Beach, MA 02562

Dear Cassie Hammond and members of the Zoning Board of Appeals:

This letter is to provide comment from the Conservation Department and the Bourne Conservation Commission on the Cape View Way Project.

- 1) The Conservation Commission approved the project under the State wetland act and did not have any additional comments for the ZBA under the bylaw.
- 2) The Conservation Departments concerns are related to the stormwater controls on the site. Typically the Commission would work together with the planning board to ensure that the project meets the MA stormwater standards and the construction & post construction stormwater standards of the subdivision regulations. It would be my recommendation that the Board have the stormwater report peer reviewed by a professional engineer.

Please contact me if you require additional information.

Respectfully,

Samuel Haines
Bourne Conservation Agent

RECEIVED
2021 APR - 7 AM 10:04
TOWN CLERK BOURNE

TOWN OF BOURNE POLICE DEPARTMENT



PAUL J. SHASTANY
INTERIM DIRECTOR OF POLICE SERVICES

35 Armory Road, Buzzards Bay, Massachusetts, 02532
Phone: (508) 759-4420 EXT 8001
Address All Communications to Chief of Police
Fax: (508) 759-0603

Tuesday, April 4, 2021

Cassie Hammond
Zoning Board of Appeals
24 Perry Ave
Buzzards Bay, MA 02532

Cassie,

The police department is in receipt of your information regarding the proposed 40B project, Cape View Way. After reviewing the information provided, the department has no comments relevant to the proposed project.

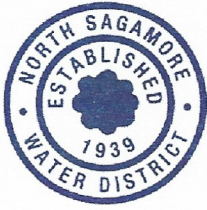
Sincerely,

Lieutenant Brandon M. Esip

RECEIVED

2021 APR -7 AM 10:03

TOWN CLERK BOURNE



NORTH SAGAMORE WATER DISTRICT

14 SQUANTO ROAD, P.O. BOX 133
SAGAMORE BEACH, MA 02562

www.northsagamorewaterdistrict.com

Tel. 508-888-1085
Fax 508-888-8951

Date: March 30, 2021
To: North Sagamore Water District Board of Water Commissioners
From: Matt Sawicki, Superintendent
RE: Cape View Way Application for Water for a Subdivision

Commissioners,

Enclosed you will find the North Sagamore Water District's staff review of the proposed 40B development on Cape View Way in Sagamore Beach. Included is also the letter from Kristen Berger, PE of ResilientCE in regards to the water model simulations for the Cape View Drive 40B development dated March 9, 2021.

Sincerely,

A handwritten signature in dark ink, appearing to read "Matt Sawicki", written in a cursive style.

Matt Sawicki

North Sagamore Water District Requirements of Subdivision

Project: **Cape View Way (40B)**
Preservation of Affordable Housing, Inc.
Meena Jacob, Senior Project Manager
(617) 449-0895 mjacob@poah.org

Date Completed Application Submitted: March 5, 2021

Requirements Prior to installation / Approval

North Sagamore Water District Board of Water Commissioners favorable vote

Mitigation per hydraulic analysis: Developer must agree to design and replace the existing 8" AC water main with a new 12" PVC water main on Williston Rd from the Hoxie School to Scusset Beach Road, on Scusset Beach Road from Williston Road to Old Plymouth Road and on Meetinghouse Lane from Old Plymouth Road to Cape View Way.

Satisfy plan review comments (March 26, 2021) and resubmit proposed water main design

NSWD water will not be permitted for irrigation

A copy of the recorded deed and plan for the easement shall be submitted to the water district

Performance Bond, 10% of water system expense for 2 years

Fees:

System Development Fee	\$ 10,000.00
Engineering Reimbursement	\$ 3,592.50
Legal Reimbursement	<i>TBD</i>
Connection fee for Building (1 1/2 Meter)	\$ 11,500.00
Fire Service Connection Fee	\$ 300.00
<i>Payments as of March 26, 2021</i>	<i>\$ 1,000.00</i>
Total Fees Due as of March 26, 2021	\$ 24,392.50

Requirements Prior to Acceptance / Water Turned On

As-built drawings submitted per regulations

Inspector paid in full

Backflow Prevention Device Design Data Sheets for building submitted and approved

Service Installation Fee to be finalized once the domestic service size is determined by the project engineer. (See plan review)

North Sagamore Water District

Subdivision Plan Review

Project: Cape View Way – Preservation of Affordable Housing

Engineer: Horsley Witten Group, Inc., Joseph Henderson, PE

Plan Date: March 5, 2021

Reviewed by: Matt Sawicki

Review Date: March 26, 2021

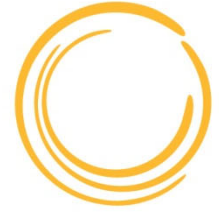
Description: Proposed 40B subdivision connecting to water mains on Meetinghouse Lane and looping to Homestead Road. Project includes one building containing 51 units and 90 bedrooms. It will be supplied by an 8" water main with one domestic and one fire service. A utility easement is needed to tie the water system into Homestead Road.

Sheet	Modification
C11, C12	Engineer shall clarify if the developer intends to use the existing 8" PVC water main or if the water main will be replaced. Proposed 8" DI water mains may be constructed of PVC.
C11, C12	Utility plan shall show all street names.
C11, C12	A hydrant shall be added between the proposed hydrant and TSG on Meetinghouse Lane. Hydrants should be located no less than 500' apart. Proposed hydrant is approximately 650' from the TSG. Engineer shall confirm hydrant locations with the Bourne Fire Department prior to construction.
C11	Plan shall show the size of the proposed domestic and fire service lines. Plan shall also show location of shut off valves for these lines. The Wonzy/Barbar and Associates, Inc. Domestic Water Service Calculation calls for a 3" minimum water service. 3" is not a standard size pipe in the NSWDC water system and shall not be used.
C11	Plan states "insulate water line within 10' of wall and chambers". Does this pipe require insulation due to depth or just a sleeve for separation from the wastewater system?
C11	Light post located 10' from match line shall be minimum 3' from proposed water main.
C11	An 8" main line gate shall be installed between the domestic/fire service lines and the Homestead Road tie in to isolate the cross county main and still supply the building with water.
C12	The existing TSG on Meetinghouse Lane shall be located on the plan. If a new water main is being installed, the plan shall specify if the existing TSG will be utilized. If a new TSG will be installed,

	plan shall call for the existing TSG to be plugged. Plan shall show existing water main size and type on Meetinghouse Lane (8" AC).
C11, C12	Water Line Easement shall be 20' wide with water main located in center. The easement as drawn is only 15' with the water main off center.
C12	Once ownership of the water main is established, a copy of the recorded deed and plan for the easement shall be submitted to the water district.
C12	Homestead Road Tie in – Connection should be a cut in connection. A main line valve and a hydrant must be installed on Homestead Road northwest of the gate supplying Cape View Way. Valve and hydrant configuration shall be shown on the plan. Plan shall show existing water main size and type on Homestead Road (8" PVC).
C11, C12	Chlorination taps are not shown on the plan and may be located during construction with District approval.
Inspection	All work done and materials used are to be inspected by the District representative whose decision to accept or reject either work or materials shall be in accordance with district regulations. The developer shall be responsible for the cost of the inspector.
As-built Drawings	Developer must also supply 4 copies of accurate as-built Mylar drawings as well as an electronic copy before acceptance of the system.



3225 MAIN STREET • P.O. BOX 226
BARNSTABLE, MASSACHUSETTS 02630



CAPE COD
COMMISSION

(508) 362-3828 • Fax (508) 362-3136 • www.capecodcommission.org

Via Electronic Mail

March 26, 2021

To: Bourne Zoning Board of Appeals
Coreen Moore, Town Planner

Re: Cape Cod Commission Staff Comments
*Cape View Way Comprehensive Permit Application, Bourne
Applicants: Preservation of Affordable Housing, Inc. (POAH) and
Housing Assistance Corporation (HAC)*

cc: Stephen Mealy, Bourne Representative, Cape Cod Commission
Harold Mitchell, Chair, Cape Cod Commission
Elizabeth Taylor, Chair, Cape Cod Commission Committee on Planning and Regulation

Pursuant to Section 13(j) of the Cape Cod Commission Act, the Cape Cod Commission (herein, “Commission” or “CCC”) is considered a “Local Board” for purposes of MGL Ch. 40B, ss. 20-23. Accordingly, the Commission provides, through its staff and in its capacity as a Local Board, the following review comments to the ZBA on the above-referenced matter.

The project proposes the construction of 51 new housing units in one building on a +/- 2.9-acre site currently owned by the Bourne Housing Authority. The proposed location is walkable to area businesses including restaurants, a hardware store, and a post office. It is also within walking distance of the regional transportation hub at the Sagamore Bridge. The project’s proximity to these amenities make the location appropriate for the development of housing.

AFFORDABLE HOUSING

The Cape Cod Commission Act and Cape Cod Regional Policy Plan look to preserve the social diversity of the region by promoting the development of affordable housing for low- and moderate- income families. Bourne has made significant headway in the construction of

affordable housing on the Cape, with almost 600 units listed on the State's Subsidized Housing Inventory. Still only 6.9% of Bourne's existing year-round housing stock is restricted as affordable, and a significant need remains.

There continues to be a shortage of housing throughout our region, with a particularly acute need for affordable housing to retain working families. The Commission's 2017 Regional Housing Market Analysis found that as of 2015 the Upper Cape sub-region needs over 1,500 additional rental units affordable to those earning up to 80% of Area Median Income. More than 4,400 rental units are needed for this group Cape-wide.

This gap leads to a significant housing cost burden on working year-round households, most acutely on those earning at 100% of Area Median Income and below. Gaps such as these also hinder the formation of new households and can force individuals and families into substandard or unsafe housing conditions.

This project is a significant step to lessen the gap through the provision of safe year-round housing that is deed-restricted as affordable.

COMMUNITY DESIGN AND CULTURAL HERITAGE

The proposed building is a L-shaped structure with approximately 100- to 200-foot long facades and a modest amount of facade variation in the form of shallow projections and changes in building materials. There are 2-foot projections or recesses in the facade roughly every 15 to 25 feet, and the projections have forward-facing gable roofs that provide some variation in the roof form. The building will be partially screened by existing commercial buildings on Meetinghouse Lane but will likely still be visible due to its height and scale relative to existing development. Commission staff suggests the applicant explore possible ways to lower the height of the projecting gables to reduce the overall apparent height of the building and to increase the depth of some of the projections to further break up the apparent mass of the building.

Screening for the building and the proposed parking lots would be enhanced by additional landscape plantings along the south side of the entrance road, particularly in the area between the existing post office and hardware buildings, as well as along the northeastern side of the building. Adjacent parcels contain vegetation that will provide some screening, but it is preferable to have some screening provided on the subject property.

There are no known historic structures or resources in the project vicinity. Still, Commission staff recommends the applicant file a Project Notification Form (PNF) with the Massachusetts Historical Commission to determine whether there are known archaeological resources on or near the property, especially given its proximity to wetlands and to the Canal area.

TRANSPORTATION

The site is in close proximity to nearby area businesses, regional and inter-city transit service, and the regional multi-modal path network along the Cape Cod Canal. These amenities will provide future residents the opportunity for healthy alternative modes of transportation. Commission staff recommends the applicant consider providing bicycle storage and posting CCRTA bus schedules. These measures could assist with reducing motor vehicle trips to and from the site.

WATER RESOURCES

The proposed project is in an area of direct groundwater discharge to the Cape Cod Canal, which is not impaired for nitrogen, and the site is outside of all Commission-mapped water resource protection areas. The applicant should investigate whether there are any private wells or other drinking water supplies downgradient of the site that should be considered.

The project proposes 90 bedrooms in 51 housing units. The project will be served by municipal water from the North Sagamore Water District, and wastewater will be managed on-site by a private septic system utilizing an Innovative/Alternative leach field to allow for a smaller footprint that maximizes the existing vegetated buffer to the adjacent residential property. The anticipated site nitrogen loading concentration from this development is approximately 20 mg/L, which is unlikely to negatively impact the aquifer and any downgradient waterbodies despite being above the 5 mg/L standard set out in the Commission's Water resources Technical Bulletin.

Project stormwater will be managed through site design and a variety of green stormwater infrastructure elements designed to control, infiltrate, and treat runoff from the site. The system was designed consistent with Massachusetts' stormwater standards, including the provision of 1-inch water quality treatment.

NATURAL RESOURCES

The project has been designed to respect both site's natural topography and the surrounding uses and development. The development footprint is clustered toward the flattest portion of the site, and the project proposes the use of a biodiverse mix of resilient native plants that support pollinators and birds, and should not require significant use of water, fertilizers, or pesticides.

The project proposes development within the 100' buffer to the isolated wetland in the westerly portion of the site, although development is largely kept out of the 50' buffer. This wetland is not mapped by MassDEP and it is unclear whether it is a 'jurisdictional' wetland; the project engineers concluded that it appears to be the result of runoff from existing development to the north of the site. Though not of high ecological value, it likely still provides some beneficial functions such as stormwater recharge and filtration, sedimentation and erosion control, and plant and wildlife habitat. Commission staff would encourage the applicant to explore ways as feasible to limit the project's location within the wetland buffer.

Commission staff also encourages the applicant to consider best practices such as scheduling clearing and grading outside of the peak bird breeding season (late May to early August), reusing on-site the Prime Farmland Soils mapped in the easterly portion of the site, and reusing downed trees onsite to create wildlife habitat or chipped and used for landscaping as practicable.

APPENDIX B

Lighting Specifications



K723 FALCONRIDGE JR. - LED

A 3/4 scaled version of the K823, the K723 Falconridge Jr. is a sleek, shrouded fixture designed to be used on its own in a street or area lighting system, or in combination with its matching K800 luminaire. This allows both roadway and pedestrian concerns to be individually met without any compromise.



**King
Luminaire**

PRODUCT SPECIFICATIONS

LED ENGINE

Light engine shall include an array of 30 solid state Cree X-Series high power LEDs (light emitting diodes). The emitters shall be mounted to a metal core circuit board using SMT technology. The LEDs and circuit boards shall then be mounted to a high performance heat sink which is vented to the outside ambient air to provide dynamic airflow for cooling the system.

OPTICS

External light control shall consist of high precision refractive lenses mounted above the LED emitter arrays in such a way to achieve optimum uplight control. The lenses shall also control horizontal light distribution so that Type II, III, IV or V IESNA distribution patterns are achieved.

LENS

The K723 Falconridge Jr. pendant is available with or without a lens. Lens options include; sag glass lens; shallow glass lens; rippled acrylic shallow lens; or rippled acrylic deep dish lens. The glass lens shall be made of #9000 clear borosilicate glass (fully annealed). It shall maintain a minimum thickness of 0.16". The acrylic lens shall be moulded of rippled acrylic Acrylite Plus Acrylic Polymer, or equivalent, having a minimum thickness of 0.15". The lens is secured by means of a cast A319 aluminum holding ring that is sealed to provide an IP66 Ingress rating. Additionally, a continuous circular gasket rated for 270°F must hold the lens into place within the cast ring assembly and assist in sealing the fixture.

CAST HOUSING

The luminaire shall consist of a heavy Grade A319 cast aluminum housing that acts as the enclosure for the engine and is of adequate thickness to give structural rigidity. The engine must be affixed to the inside of the housing with stainless steel screws.

PLUMBIZER

The K723 Falconridge Jr. comes with multiple mounting op-

tions including the KPL10, KPL11, KPL20, KPL21, KPL30, KPL31 and KPL40. Please contact King Luminaire for more details and specifications.

DRIVER

The LED universal dimmable driver will be class 2 and capable of 120 - 277V or 347 - 480V input voltage, greater than 0.9 power factor, less than 20% total harmonic distortion. The case temperature of the driver can range from -40°C up to 70°C. Each LED system comes with a standard surge protection designed to withstand up to 20kV/10kA of transient line surge as per IEEE C62.41.2 C High. An in-line ferrite choke is utilized to provide protection against EFT's. The driver assembly will be mounted on a fabricated aluminum bracket to allow complete tool-less maintenance. Dimming capable using 1-10vdc (10% to 100%), 10v PWM, or resistance.

PHOTOMETRICS

Fixtures are tested to IESNA LM79 specifications. These reports are available upon request.

CHROMATICITY

High output LEDs come standard at 3000K & 4000K (+/- 300K) with a minimum nominal 70 CRI. Additional CCT emitters are available upon request.

LUMEN MAINTENANCE

Reported (TM21) and Calculated (L70) reports are available upon request with a minimum calculated value of 100,000 hrs.

WIRING

All internal wiring and connections shall be completed so that it will be necessary only to attach the incoming supply connectors to Mate-N-Lok connectors or to a terminal block. Mate-N-Lok shall be certified for 600V operation. Internal wire connectors shall be crimp connector only and rated at 1000V and 150°C. All wiring to be CSA certified and/or UL listed, type SFF-2, SEWF-2, or SEW-2 No. 14 gauge, 150°C, 600V, and color coded for the required voltage.

THERMALS

Fixtures tested to DOE sanctioned standards to determine the maximum in-situ solder-point or junction-point temperatures of the LED emitters. This report is available upon request.

FINISH

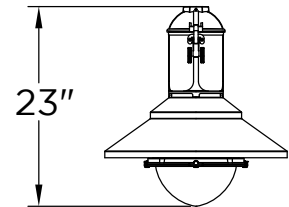
Housing is finished with a 13 step KingCoat™ SuperDurable polyester TGIC powder coat. Standard colors include strobe white, brown metal, marina blue, gate gray, Chicago bronze, standard gold, standard black, federal green and rain forest. Please see our website for a complete list of colors. RAL and custom color matches are available.

MISCELLANEOUS

All exterior hardware and fasteners, wholly or partly exposed, shall be stainless steel alloy. All internal fasteners are stainless steel or zinc coated steel. All remaining internal hardware is stainless steel, aluminum alloy, or zinc coated steel.

WARRANTY

The K723 Falconridge Jr. LED luminaire comes with a 7 year limited warranty.



CERTIFICATION:

CSA US Listed
Suitable for wet locations
ISO 9001
IP66
ARRA Compliant
LM79 / LM80 Compliant

DRIVER INFO:

>0.9 Power Factor
<20% Total Harmonic Distortion
120 - 277V & 347 - 480V
-40°C Min. Case Temperature
70°C Max. Case Temperature
Surge Protection: ANSI C136.2
extreme level 20kV/10kA
Dimming Capable: 1-10vdc

EPA:

Flat:	0.52 sq. ft.
Sag Lens:	0.63 sq. ft.
Shallow Lens:	0.71 sq. ft.
Deep Dish Lens:	0.74 sq. ft.

FIXTURE WEIGHT:

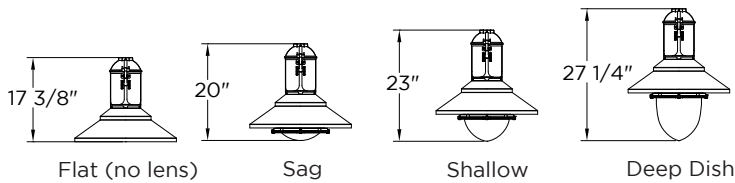
Flat:	21 lbs
Sag Lens:	24 lbs
Shallow Lens:	25 lbs
Deep Dish Lens:	25 lbs



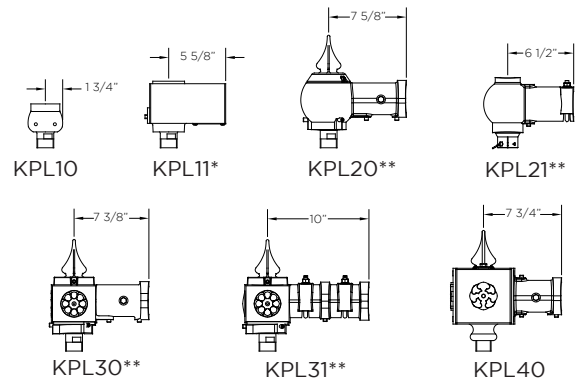
FIXTURE OPTIONS

K723 FALCONRIDGE JR. - LED

Lens Options



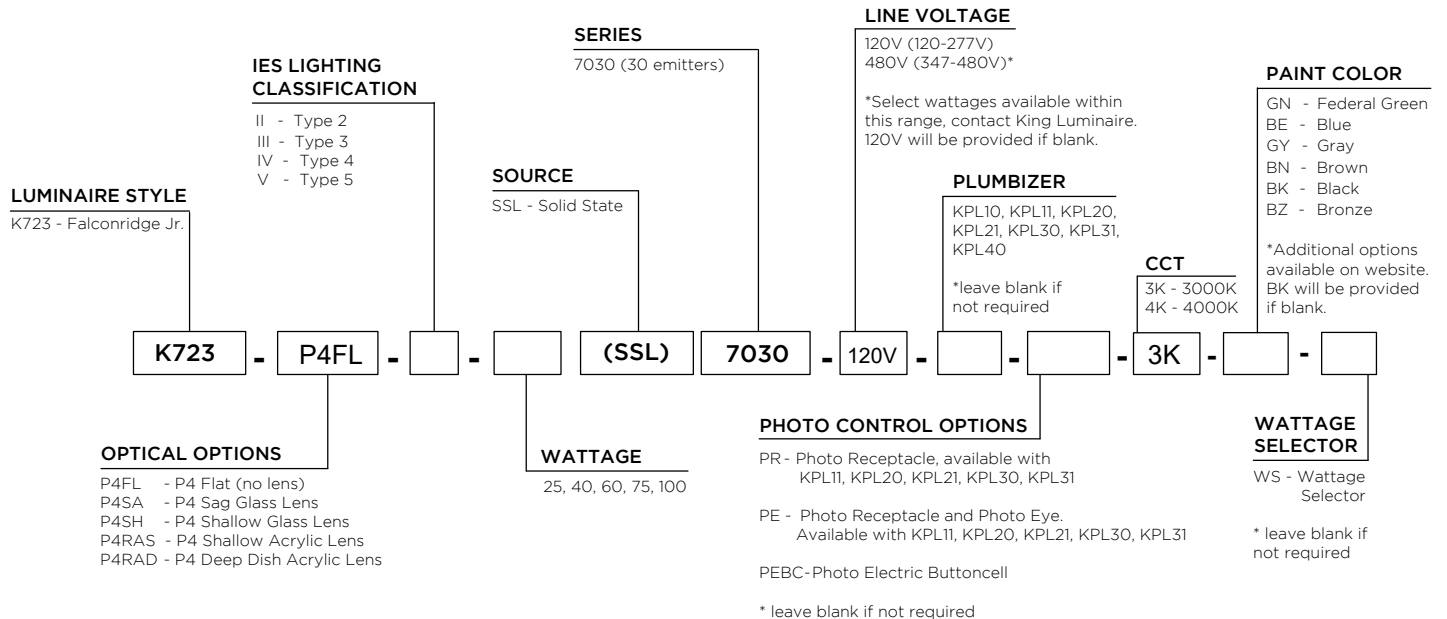
Plumbizer/Mounting Options



*Available with PR7

**Available with PR7 or final

HOW TO ORDER



HOUSE SIDE SHIELDS

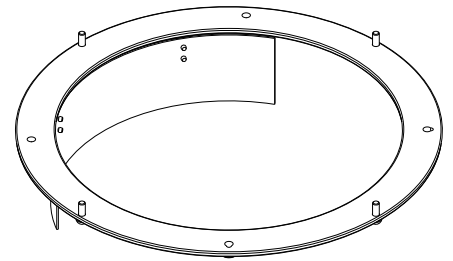
Pendant P4 Optical Engine



House Side Shields designed for our P4 optical system are available for all pendant lens options.

HSS4 - P4 with Flat, Sag or Shallow Lens

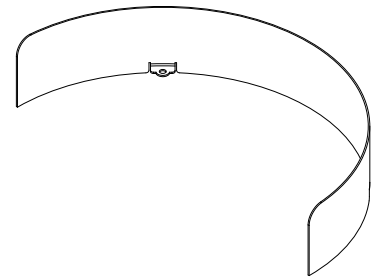
- Available for production of new luminaires
- Suitable for field installation into existing luminaires
- Available for P4 engine with no lens, sag or shallow lens
- 2", 4" and 6" shield height options
- Shield coverage of 120° and 180°



Ring with shield easily installed outside of the flat array engine with four screws.

HSS5 - P4 with Deep Dish Lens

- Available for production of new luminaires
- Suitable for field installation into existing luminaires
- Available for P4 engine with acrylic or glass deep dish lens
- 3" and 6" shield height options
- Shield coverage of 120° and 180°



Shield easily installed outside of the flat array engine with two screws.

HOUSE SIDE SHIELDS

Pendant P4 Optical Engine



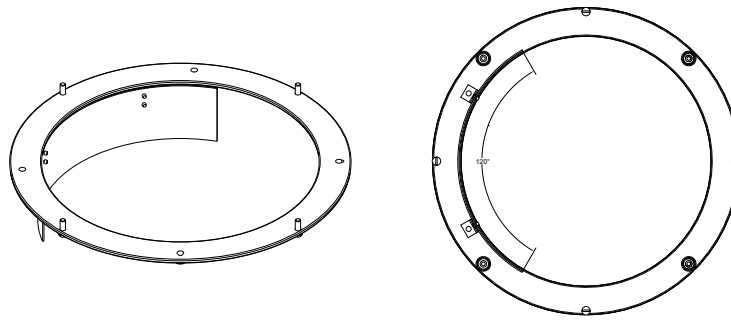
INSTALLATION INSTRUCTIONS

WARNING: Read these instructions carefully before attempting to install or maintain this product. Work must be done by qualified personnel. Improper installation or maintenance may result in personal injury or death or significant property damage.

WARNING: Be certain that all electrical power is disconnected from the fixture before installing or maintaining the fixture. Failure to do so may result in personal injury or death.

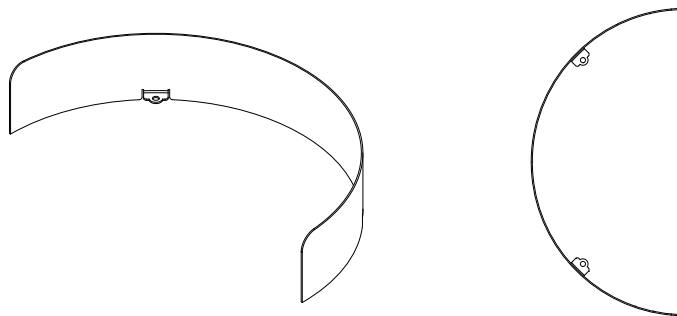
HSS4:

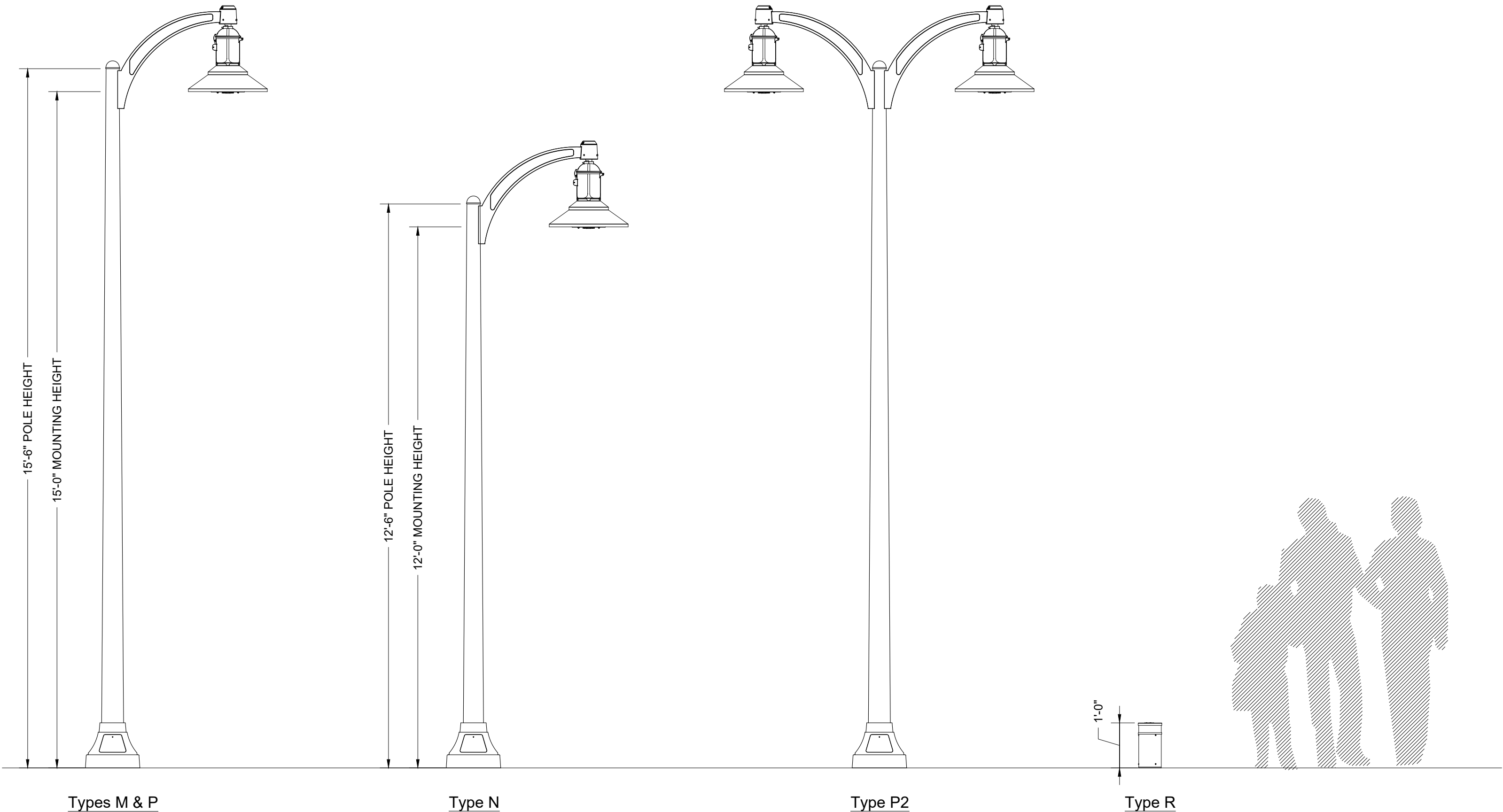
1. Disconnect the electrical supply to the intended luminaire location.
2. To install the HSS:
 - a) For flat (no lens) fixtures, place the ring so that the shield is positioned to block light in the desired location and secure the ring using the four supplied screws.
 - b) With sag and shallow lens fixtures, while supporting the lens, remove the existing lens holder ring and replace it with the new ring containing the shield. Place the ring so that the shield is positioned to block light in the desired location and secure the ring using the existing screws.
3. Re-connect the electrical power supply and check for proper operation.



HSS5:

1. Disconnect the electrical supply to the intended luminaire location.
2. To install the HSS:
 - a) Remove the existing two screws from the lens holder ring and then place the shield so that it is positioned to block light in the desired location. Secure the shield to the lens holder ring using the existing screws.
3. Re-connect the electrical power supply and check for proper operation.

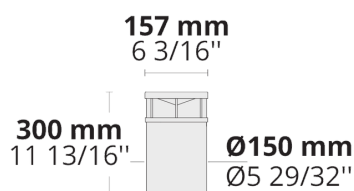




TROLI S

LB7032.693-US

IK05 IP65



[SYM-3L]

Symmetric, 360°,
Special effect: 3
lines

Configurations

Light distribution	[SYM-3L] 360° x 165°
Nominal LED lumens flux	1140 - 1225 lm
Nominal LED power	8 W (700 mA)
Rated luminaire lumens flux	489 - 537 lm
Rated luminaire power	10 W
Color temperature	3000 K CRI 80, 4000 K CRI 70
BUG rating	B1-U0-G1
Lifetime L90	>72, 600 hours
Lifetime L80	>72, 600 hours

Options

Control	On/Off
Input voltage	120-277V 50/60Hz
Insulation class	Class I
Product colors	

Extras








Finishing options	Double coating
--------------------------	----------------

Technical information

Housing	Corrosion resistant aluminum housing
Finishing	Electrostatic powder coating
Fasteners	Stainless steel (grade 304)
Lens / Reflector	High reflectance aluminium coating
Glass / Diffusor	Tempered safety glass
Impact protection	IK05
Ingress protection	IP65
Weight	5.5 lb
LED module	Multi-chip high power LEDs on metal-core PCB
Driver	Internal LED driver
Driver surge protection	4/2 kV
Power factor	> 0.90
Through wiring	Single cable entry
Cable	19 11/16" of flexible cable

Project name				Type		Quantity	
Date		Note					

LB7032.693-US-____-____-____-____-____-____-____-____-____

Light distribution	Drive current (LED power)	Color temperature	Control	Input voltage
SYM-3L Symmetric, 360°, Special effect: 3 lines - 360° x 165°	700 8 W (700 mA)	830 3000 K CRI 80 740 4000 K CRI 70	ONOFF On/Off	UNI 120-277V 50/60Hz
Insulation class	Product colors	Extras		
C1 Class I	HM1  Black (Textured) HM2  Dark gray (Textured) HM3  Anthracite gray (Textured) HM4  Light gray (Textured) HM5  White (Textured) HM6  Bronze (Textured) CC  Custom Colour (Please specify RAL code)	Finishing options		
		DC Double coating		