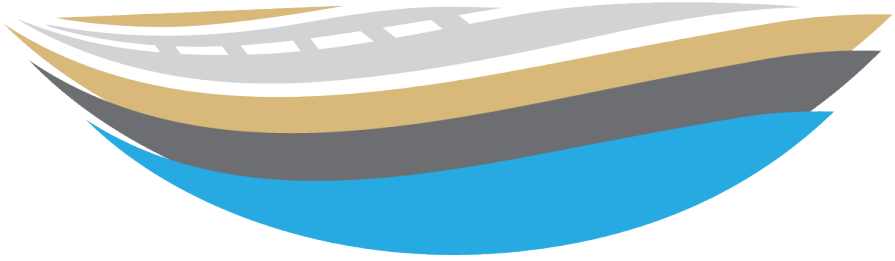
MARTHA'S VINEYARD

BEACH ROAD STUDY

VINEYARD HAVEN, TISBURY



Summary Report

June 2025

Acknowledgement

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1. Introduction

1.1 Study Goals

The goals of the Martha's Vineyard Beach Road Study were to:

- Evaluate roadway improvements at Five Corners and on Beach Road to increase safety and comfort for all road users, including pedestrians, bicyclists, trucks, and buses; building on a previous Road Safety Audit (2015).
- Develop and screen alternatives that could address current and potential future flooding under climate change, including sea level rise and more severe storms.
- Involve local stakeholders in decision-making about potential future changes and review of developed concepts.

To support these goals, feedback on the study, including alternatives, was collected through three working group meetings and two public meetings. Working Group meetings were held in July and October 2023 and in May 2025. Public meetings were held in December 2023 and June 2025.

1.2 Study Area

The study area is located on the north-central coast of Martha's Vineyard in Tisbury, Massachusetts. It includes the central business district of Vineyard Haven, bounded by the Steamship Authority year-round ferry terminal to the north, the marina to the south, the Beach Road bridge near Lagoon Pond to the east, and Main Street to the west. A map of the study area is provided in Figure 1. A detailed map of the Five Corners area is provided in Figure 2.

Figure 1 | Map of the Martha's Vineyard Beach Road Study Area

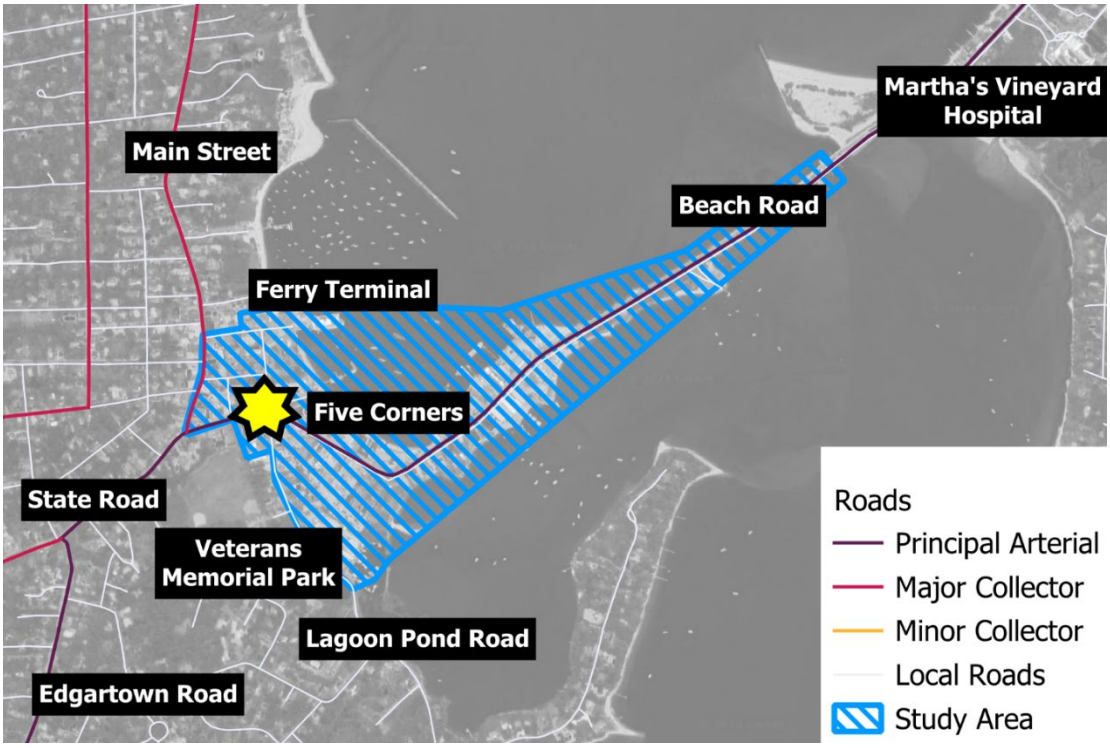
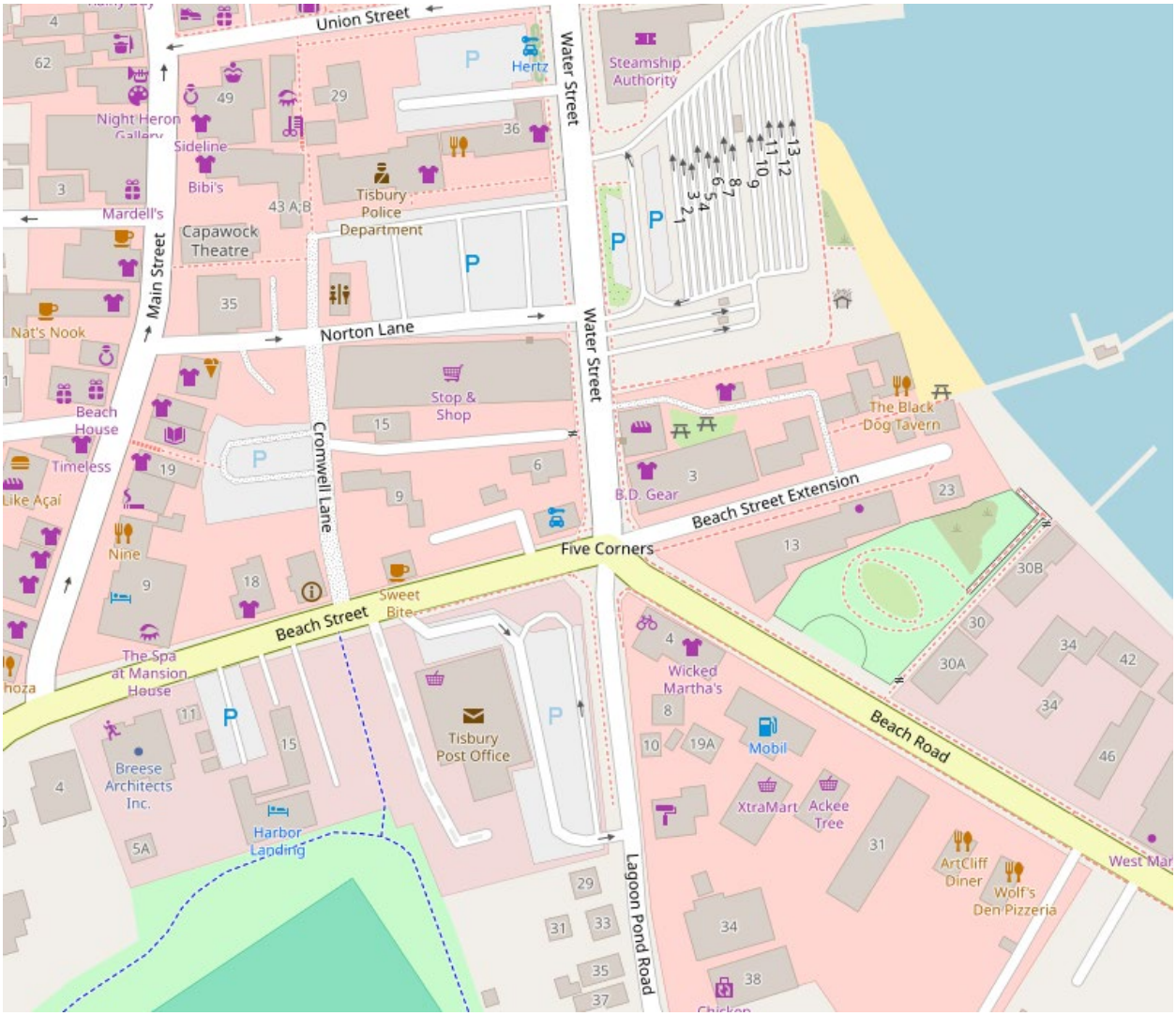


Figure 2 | Detail Map of the Five Corners Area



Source: Open Street Map

Beach Street, Beach Road, Water Street, and their intersection at Five Corners are among the most critical transportation infrastructure on Martha's Vineyard:

- **Beach Road provides access from the west to Martha's Vineyard Hospital,** located to the northeast, outside the study area. Traffic, including emergency vehicles, uses Beach Road to reach the hospital and Oak Bluffs from the west and southwest, including from Vineyard Haven and West Tisbury. A detour around Five Corners requires rounding Lagoon Pond through Oak Bluffs and adds significant travel time.
- **Water Street provides primary access to the Steamship Authority Ferry Terminal.** The Steamship Authority operates two ferry terminals – Vineyard Haven and Oak Bluffs – that provide the vast majority of passenger and goods movement to Martha's Vineyard (supplemented by air service and more specialized passenger ferries). The Vineyard Haven Ferry Terminal is the only one on the Vineyard that can accommodate truck traffic and

operates year-round. Water Street, connecting at Five Corners to Beach Street and Beach Road, is the sole entry and exit point for cargo that is not moved by air. Thus, the study area is critical to delivery of groceries, packages, supplies for businesses, medical supplies, and other goods to Martha's Vineyard. Much of this cargo is moved in large trucks, which are routed through study area roads and must pass through Five Corners.

The Vinyard Haven Ferry Terminal is the only year-round terminal and serves as the access point for residents and visitors traveling to and from the island.

- **Beach Street and Beach Road form a major thoroughfare on the island,** as the most direct route between West Tisbury, Vineyard Haven, and Oak Bluffs. This routes critical traffic through the study area, including bicycles, emergency vehicles, electrical line repair trucks during and after large storms, and buses from the Martha's Vineyard Transit Authority (VTA), which has one of its principal hubs at the ferry terminal and plans to build a charging base for battery-electric buses there, which will likely traverse Five Corners.
- **The study area includes prominent destinations, including the Black Dog Tavern,** the main United States Postal Service (USPS) location and mail distribution center on Martha's Vineyard, the east side of the Main Street commercial strip, and a maintenance dock for Vineyard Wind, a major offshore wind farm off the coast of Martha's Vineyard.

1.3 Summary of Chapters

This technical memorandum serves as the final report of the Martha's Vineyard Beach Road Study. It is divided into two parts:

- **Chapter 2: Existing Conditions** reviews the study area infrastructure in terms of vulnerability, safety, and roadway geometry and operations. This includes the identification of deficiencies that could be resolved through infrastructure changes.
- **Chapter 3: Alternatives Development and Analysis** presents conceptual design alternatives that address the deficiencies identified in Chapter 2.
- **Chapter 4: Summary and Next Steps** summarizes the work of the study, results of alternatives analysis, and presents next steps for stakeholders following this study.

2. Existing Conditions

This section outlines the existing conditions of the infrastructure in the study area across three themes: vulnerability, safety, and roadway geometry and operations.

2.1 Flood Vulnerability

The study area is highly vulnerable to flooding in the current year (2024)[1]. Its low elevation and position at the head of a shallow, funnel-shaped harbor contributes to storm surge during Northeasters (nor-easters), tropical cyclones, and other heavy rainfall storms. In addition, Five Corners' position as the low point of the surrounding area and the routing of drainage under it to an outfall at the foot of Beach Road Extension causes flooding from rainwater when the outfall pipe is blocked by debris or incoming tides.

2.1.1 Study Area Elevation

The study area has relatively low elevation, as shown in Figure 3. The elevation of Five Corners is about 2.5 feet above NAVD88 sea level. Stretches of Beach Road, Lagoon Pond Road, Beach Street, and Water Street have 2 to 4 feet elevation, with some segments having elevations less than two feet.

The elevation profile of the study area has two major implications for vulnerability. First, the overall low elevation of the land makes it vulnerable to sea level rise and increasing storm surge intensity. Second, the low point at Five Corners makes it both a pooling point for rainwater flowing on the surface and also impedes the effectiveness of the stormwater drainage system that runs through it. Each of these issues is discussed in the sections that follow.

[1] The baseline year for flood vulnerability reviewed during this study was 2024.

Figure 3 | Study Area Elevation relative to NAVD88 Mean Sea Level

Note: North American Vertical Datum of 1988 (NAVD88) is a national standard reference system used for measuring elevation and water depth. It sets a standard "zero" point that serves as a baseline for elevation above or below sea level in North America, which provides a consistent way to measure elevations across the country.

2.1.2 Rainfall Flooding and Drainage

As shown in Figure 3, the topography of the study area includes a steep descent from Main Street to the harbor. Roads such as Beach Street and Union Street that follow the slope allow substantial stormwater runoff toward the shoreline, and to Five Corners, the lowest point in the area. The Town of Tisbury's drainage system follows these roads as well, as shown in Figure 4. The study area is served by four discharge locations (outfalls) and three distinct stormwater drainage systems:

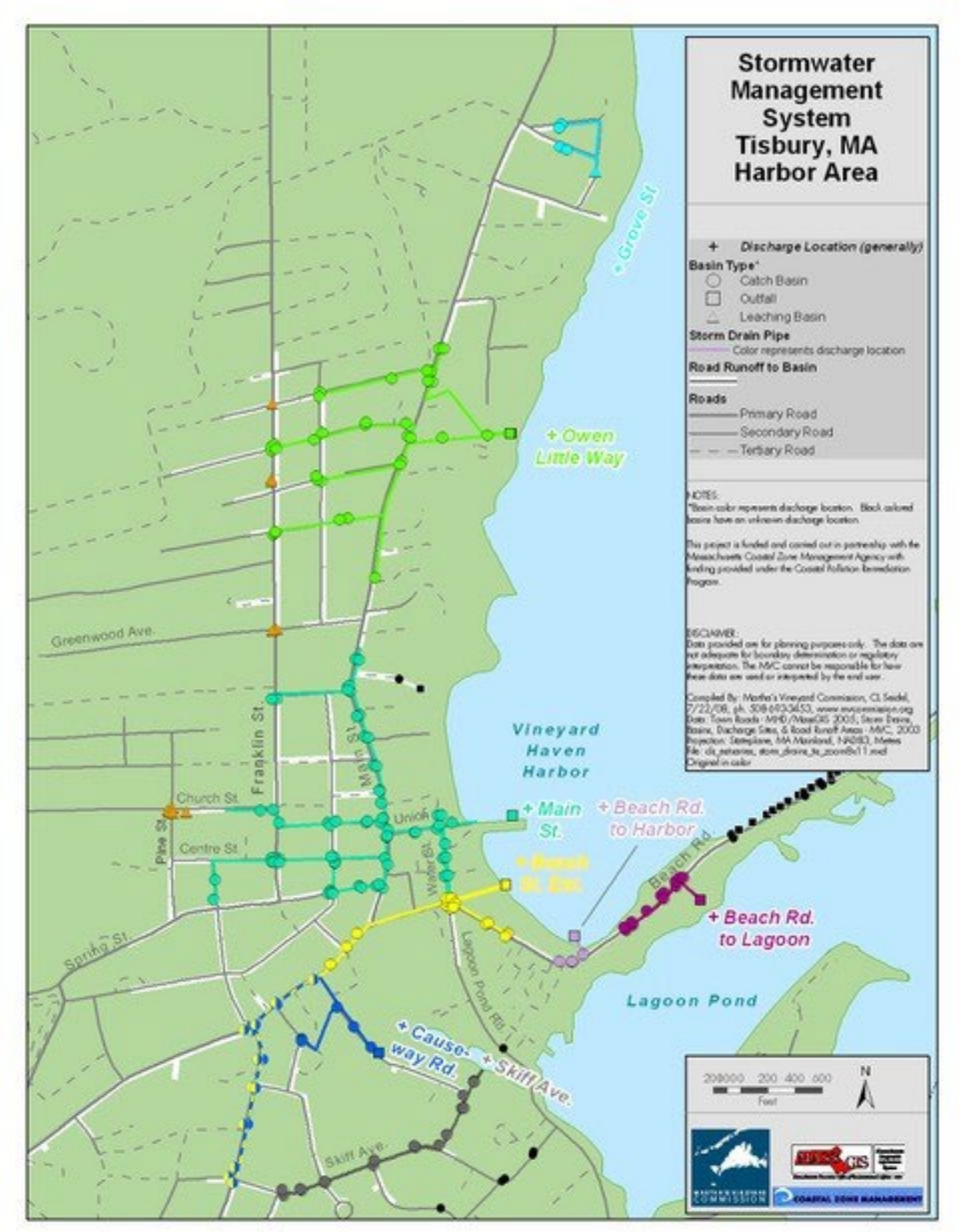
- The largest stormwater management network collects from storm drains in the higher-elevation areas of Vineyard Haven behind Main Street and as far away as Edgartown-Vineyard Haven Road. The northern section of this network is designed to discharge at the Main Street Outfall, while the southern section of the network is designed to discharge at the Beach Street Extension Outfall.
- A small network collects from three storm drains on Beach Road and discharges at the Beach Road Harbor Outfall.
- A slightly larger network collects from Beach Road along the causeway and discharges at the Beach Road Lagoon Outfall.

As noted by the Town of Tisbury Alternatives Analysis for Vineyard Haven (2023) report (discussed in the Related Efforts section), flooding in the study area is made worse by persistent sedimentation of the Beach Street Extension Outfall. The Beach Street Extension outfall has been noted by additional stakeholders as a significant challenge for drainage in the area. During significant storm events, this outfall pipe often backs up due to ground residue and debris, affecting the overall efficacy of drainage at Five Corners and contributing to flooding at the intersection area. Notably, the tide control valve on the outfall sits below mean sea level under future climate scenarios (discussed under 2.1.3), which will likely impede efficient drainage in the future. MassDOT has identified this outfall location as a critical element for drainage and stormwater discharge in the study area.

Also contributing to drainage challenges is the design of the current drainage system. The pipe under Beach Street Extension has a 3% grade away from the outfall toward Five Corners. The drainage system at Five Corners sits lower than the outfall, with the slope and draining patterns toward the center of the intersection. The low elevation of the outfall on the beach not only contributes to sedimentation but induces backflow during storm surge events. Effectively, the existing drainage system under Beach Street Extension and Five Corners functions more as storage than facilitating stormwater discharge during storm events.

MassDOT has introduced project 609459 to address drainage within the limits of state highway to reduce current flooding at the Five Corners intersection and Beach Street Extension, which is pending further discussion with local stakeholders.

Figure 4 | Stormwater Management System Map for Vineyard Haven



2.1.3 Coastal Flooding and Sea Level Rise

The Massachusetts Coast Flood Risk Model (MC-FRM) model was used to analyze the flood risk for this area in the year 2030. MC-FRM is a means of displaying coastal flood vulnerability in the Commonwealth. It provides a representation of current and future flood risk. The MC-FRM is a dynamic probabilistic model that provides estimation of flood risk by incorporating the effect of sea level rise, wind, waves, wave-setup, storm surge, wave run-up and overtopping, etc. It is a more detailed representation of flood risk than "bathtub" models – which assume the ocean stays perfectly flat. This model was run through a vulnerability screening and design standards tool developed by the ResilientMass Action Team (RMAT).

RMAT initiated development of a Climate Resilience Design Standards Tool (the RMAT Tool) to allow state agencies and other interested parties to screen areas and projects for flood risk and then suggest flood model scenarios to use for project development. The RMAT tool provides a preliminary climate change exposure and risk rating, recommended climate resilience design standards for projects with physical assets, and guidance with best practices to support implementation. Massachusetts state agencies have been directed to use this tool for project screening and capital planning.

MC-FRM is one input to the RMAT tool. Based on screening questions, the RMAT tool provides recommendations for what flood model future year ("target planning horizon" and "return period") to use for design. The RMAT tool also provides a high-level Climate Exposure Score, such as vulnerability to sea level rise and extreme precipitation. In the case of the Tisbury study, the risk rating for sea level rise/storm surge and extreme precipitation is "high", the most extreme vulnerability rating for the tool.

Under the 2030 MC-FRM scenario, sea level is projected to rise by an average of 1.2 feet (Mean Tide Level) with the average height of daily highest tides can reach 2.4 feet (Mean Higher High Water) above the current sea level, which is almost at the same elevation as Five Corners and higher than some portions of Beach Road (Table 1). While this does not inundate Five Corners completely, the increased water elevation will make it more difficult for the drainage system to work properly and further increase the chances of backflow and inland flooding. The study team also evaluated future scenarios for 2050 and 2070. By 2050 the study area is projected to experience between 1 and 4 feet of water during regular tidal events, indicating Five Corners could be flooded on a near-daily basis.

Table 1 | Projected Tidal Datums for the Study Area in 2030 (feet above NAVD88 sea level)

Elevation	MMHW	MHW	MTL	MLW	MLLW
2.5	2.4	2.1	1.2	0.4	0.3

Notes: MHHW = Mean Higher High Water; MHW = Mean High Water; MTL = Mean Tide Level; MLW = Mean Low Water; MLLW = Mean Lower Low Water

Water Surface Elevation is the projected elevation for a specific future flood event, considering storm surge, tides, and wave setup. Wave setup, as included in water surface elevation, is defined by FEMA as "an increase in the total stillwater [without waves] elevation against a barrier

(dunes, bluffs, or structures) caused by breaking waves."[2] In a 20-year storm event scenario (5% annual average probability), the elevation of water surface at Five Corners is about 7.7 feet, which is over 5.2 feet higher than the current roadway (Table 2). The projected water surface elevation increases to 9.3 feet in a 100-year flood event, potentially causing over 6 feet of inundation at Five Corners.

Wave Action Water Elevation represents the flood elevation that incorporates the projected Water Surface Elevation and Wave Heights associated with the planning horizon timeline. The maximum wave elevation at Five Corners is projected to be approximately 8.8 feet, which is 6.3 feet higher than the current roadway.

[2] https://www.fema.gov/sites/default/files/2020-02/Coastal_Wave_Setup_Guidance_Nov_2015.pdf

Table 2 | Projected Water Surface and Wave Elevation for Five Corners in 2030

Return Period	Water Surface Elevation (feet)	Maximum Wave Elevation (feet)
5% (20-year event)	7.7	8.8
2% (50-year event)	8.6	9.7
1% (100-year event)	9.3	10.4
0.5% (200-year event)	10	11.5
0.2% (500-year event)	10.9	12.4
0.1% (1000-year event)	11.6	13.1

Reflecting this analysis, Figures 5 and 6 illustrate the extent of flooding in Vineyard Haven through sea level rise, tides, and storm events at various conditions through 2030. Figure 5 illustrates the geographic extent of these impacts, while Figure 6 illustrates the height of the water against the height of infrastructure and reference points.

Figure 5 | Extent of Flooding in Vineyard Haven under Several Future Conditions

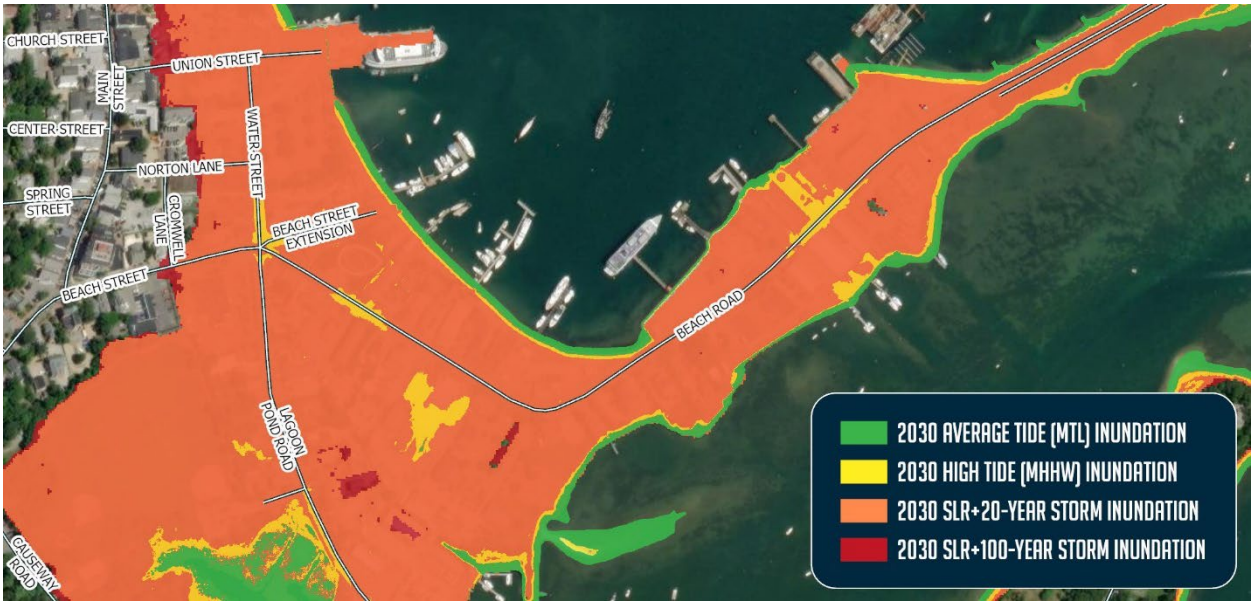
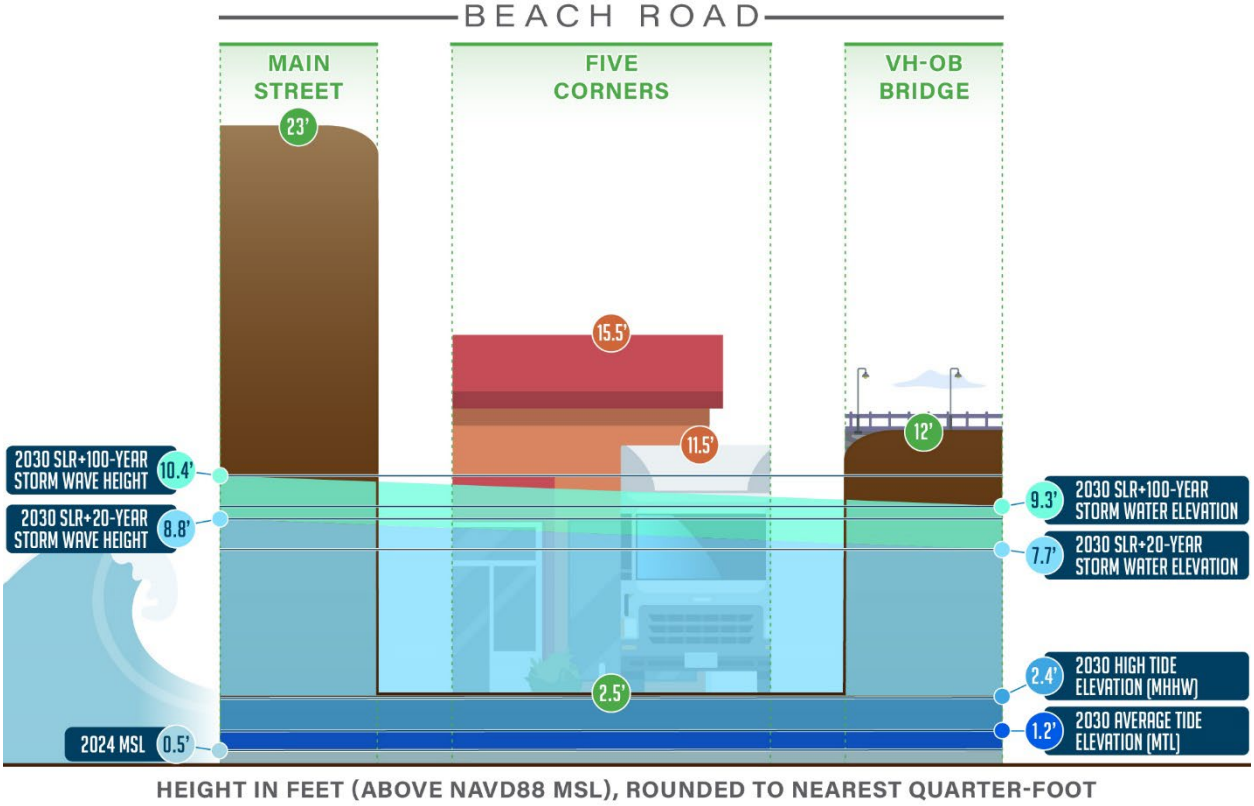


Figure 6 | Vertical Extent of Flooding in Vineyard Haven under Several Future Conditions



2.1.4 Related Efforts

Several prior studies informed the development of conceptual design alternatives. These studies and their results can be considered in future planning for flood mitigation in the Five Corners area.

- **The Tisbury Drainage Master Plan** identified and mapped the location of drainage system structures in Tisbury, reported on the structure condition assessment and maintenance needs, and identified major catchment areas for follow-up work. From this analysis and prioritization process, 15 drainage areas were chosen for improvement, and ranked Five Corners priority location number one.
- **The Dukes County Multi-Jurisdiction Hazard Mitigation Plan** was created by local emergency managers and stakeholders, with coordination from the Martha's Vineyard Commission and funding support from the Massachusetts Municipal Vulnerability Preparedness program. The vulnerability of specific locations is determined by the likelihood and intensity of these hazards.

  The study provides a Tisbury-specific mitigation matrix which provides information on the vulnerability of assets and properties in Tisbury to climate change impacts, including storm

flooding and sea level rise. The report anticipates significant impacts to Vineyard Haven, indicating the need for flood adaptation improvements for the Five Corners.

- **The Martha's Vineyard Hospital Resilience Plan** aimed to understand how EMS operations will be impacted by road network flooding and sea level rise in 2030, 2050, and 2070. To minimize property damage and ensure EMS access to the hospital, the analysis recommended a two-phase reconstruction and raising of Eastville Avenue and County Road. The first phase recommends raising the area to 7.9 feet to accommodate for the 2030 flood elevations while the second phase recommends raising the area to ten feet for the 2040-2045 year horizon. A phased approach was noted to be more costly than a single phase and the study recommends a one-phase approach, if possible.
- **Town of Tisbury Alternatives Analysis for Vineyard Haven** is a 2023 report prepared for the Town of Tisbury outlining potential flood adaptation strategies and their impacts. This project developed alternatives to address flooding in Tisbury, including at Five Corners, where the intersection and intersecting roads could be elevated to five feet above NAVD88 to meet the contemporary recommended design flood elevation, or a dune barrier (coastal berm) could be implemented.

While not directly located in the study area, Veterans Memorial Park is an important consideration for this study. It sits within the Lagoon Pond watershed and contains recreation fields, a vegetated wetland, and an extension of the Mud Creek salt marsh. Stormwater runoff from the surrounding areas regularly accumulates in the park. In 2022, stormwater control measures (SCM) were identified for the park. A total of 12 SCM sites were identified which cumulatively provide a significant potential for runoff management in the area. The identified SCM could benefit abutting areas, including Five Corners, by reducing the amount of storm water overflow, which could also be directed to the park for stormwater storage.

2.2 Safety

2.2.1 Crash History

Between 2018 and 2022 there were 82 crashes in the study area, as shown in Table 3. One crash resulted in a fatal injury (a head-on collision on a darkened Beach Road in the causeway section), and one was a serious injury involving a pedestrian (a left-turning vehicle from Lagoon Pond Road impacting a pedestrian crossing Beach Street in the crosswalk). A total of 60 crashes (73%) were property damage only.

Table 3 | Crashes by Severity in Study Area, 2018-2022

Severity of Crash	Count	Percentage
Fatal Injury	1	1%
Non-Fatal Injury	19	23%
Property Damage Only	60	73%
Not Reported	2	2%
Total (percentage does not sum perfectly due to rounding)	82	100%

Source: MassDOT Crash Database

The rate of crashes in the study area has decreased over time – 21 crashes were reported in 2018 and 13 were reported in 2022 at the time of this report.[3] MassDOT reported several factors that contributed to crashes, such as distraction, inattention; failure to yield the right-of-way; failure to keep in the proper lane; following too closely; disregarding traffic signs, signals, and road markings; over-steering; visual obstructions to view; reckless driving; and physical impairment.

From the reported crashes in the study area, four crash clusters were identified in the downtown Vineyard Haven area, as shown in Figure 7 and Figure 8.

- **Cluster 1: North Bound on Lagoon Pond Road** | This cluster includes a severe injury to a pedestrian who was hit in the crosswalk and another incident in which an overspeed vehicle lost control and crashed into a building on the northwest corner of the intersection. On-site assessment of the roadway indicated that Lagoon Pond Road northbound toward Five Corners is straight, wide, flat, and lacks curbing on the east (right) side. It should also be noted that this approach is the only one at Five Corners with substandard sightlines toward Beach Road over a motorist's right shoulder.
- **Cluster 2: Water Street north bound at the Ferry Terminal turnoff |** Crashes in this cluster are primarily categorized as sideswipes while passing in the northbound direction. It also has one pedestrian or cyclist crash, also in the northbound direction.
- **Cluster 3: Intersection of Beach Street and Cromwell Lane |** Several characteristics of this location could contribute to the crash cluster: the location is on a steep slope, turning

[3] At the time of existing conditions review, 2022 MassDOT crash data was still being finalized.

movements to and from Cromwell Lane may be unexpected, as it is a mid-block alleyway, and this location may often be the start of a queue from Five Corners.

Figure 7 | Five Corners Crash Diagram

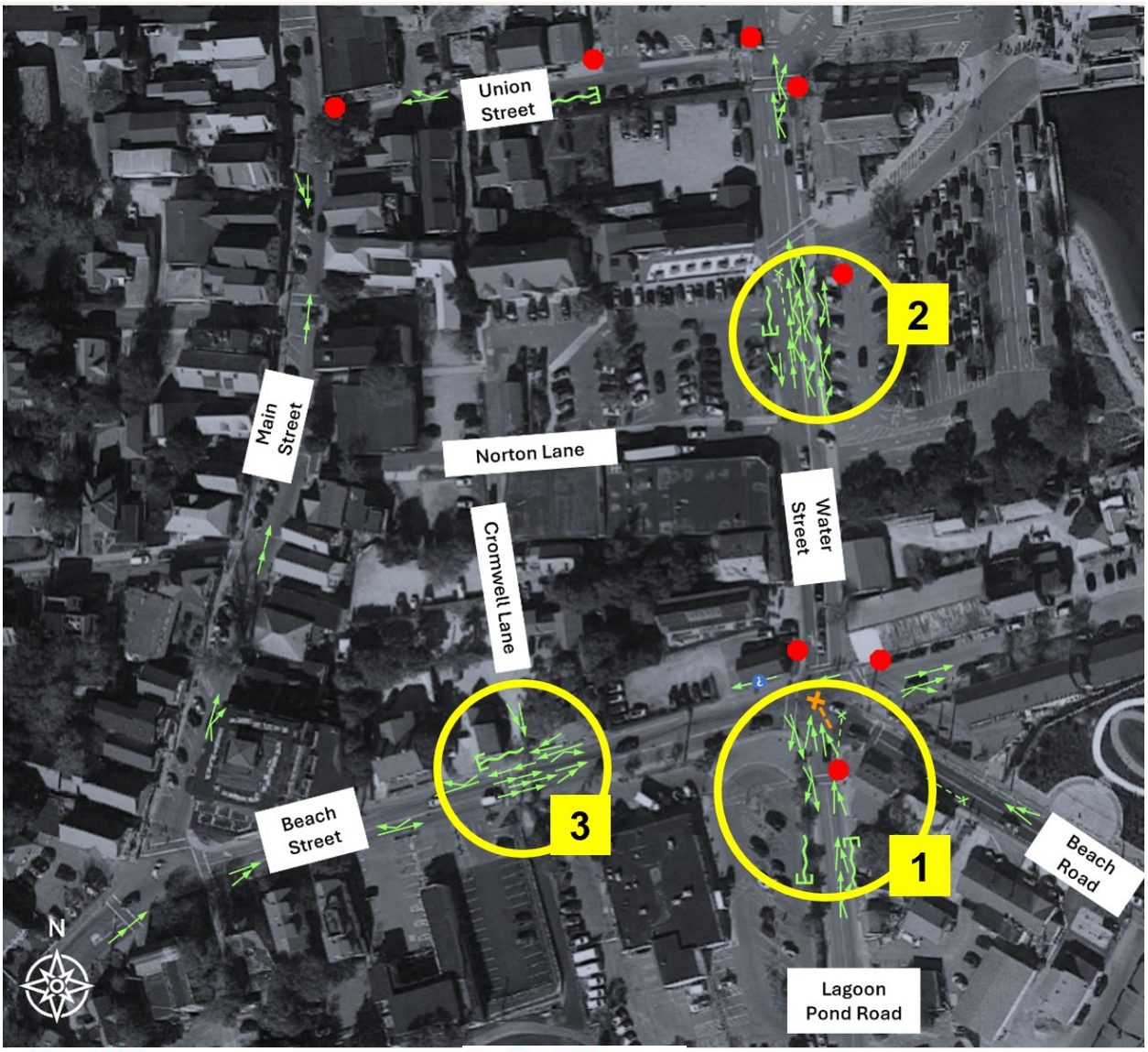


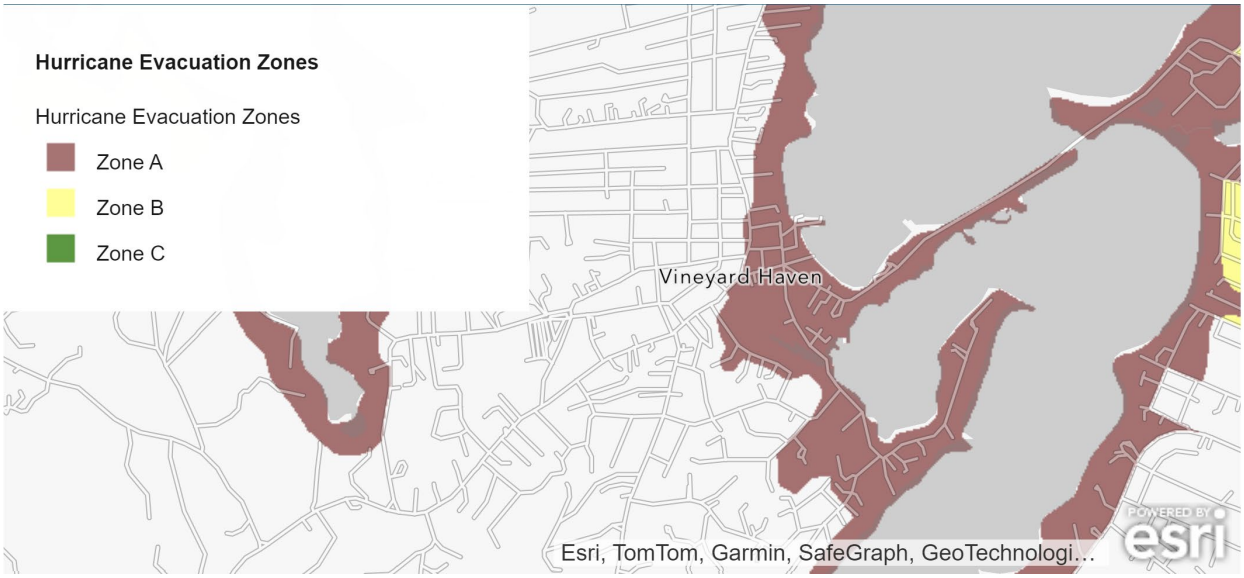
Figure 8 | Southwest Area Crash Diagram

- **Cluster 4: Beach Road east of the curve |** Crashes at this location are primarily rear-end collisions in both directions. It is possible that for motorists traveling toward Five Corners, a queue may exist on the far side of the curve that is not anticipated or visible. It is less clear what may influence a crash cluster for travel in the eastbound direction, though there are curb cuts at the curve, which could create conflicting entering or turning movements there.

2.2.2 Emergency Services

The study area is critical to public safety and disaster preparation, response, and recovery for both Vineyard Haven and all of Martha's Vineyard. As shown in Figure 9, it is in Hurricane Evacuation Zone "A",[4] indicating that this area is likely to flood first during a storm surge or hurricane. During storm events and other emergencies Five Corners provides access to emergency service providers such as Martha's Vineyard Hospital, the Tisbury School (which serves as the Tisbury Emergency Management Agency's Operations Center for response and recovery coordination), the regional emergency shelter located at the Oak Bluffs Elementary School, local and State Police headquarters, Fire Department, and the ferry terminal. It is also situated on the principal island emergency evacuation route. During storm events, power line maintenance vehicles have been observed traveling through this area while working to restore power.

Figure 9 | Hurricane Evacuation Zones in Vineyard Haven



Source: Massachusetts Emergency Management Agency

The Martha's Vineyard Hospital is located just outside of the study area to the east and relies on Five Corners for access from the west. Maintaining access to the hospital is essential during disaster events. Between 2023 and 2024, Martha's Vineyard Hospital, MassDOT, Massachusetts Office of Coastal Zone Management, the Martha's Vineyard Commission, and the community of Oak Bluffs collaborated on a Hospital Resilience Project. The purpose of this project was to

[4] https://www.mass.gov/info-details/hurricane-evacuation-zones

address emergency medical service (EMS) needs and understand how EMS operations could be impacted by flooding in 2030, 2050, and 2070. The Hospital Resilience Project identified Five Corners and Beach Road as priority areas for flood mitigation projects in order to maintain future EMS access to Martha's Vineyard Hospital.

2.3 Roadway Geometry and Operations

2.3.1 Intersection Configuration and Vehicle Operations

Five Corners is a five-legged intersection, consisting of Water Street from the north, Beach Street from the west, Lagoon Pond Road from the south, Beach Road to the southwest, and Beach Street extension to the east. The intersection is located on the east side of downtown Vineyard Haven and approximately 500 feet south of the Steamship Authority Vineyard Haven Terminal. Five Corners is stop-controlled on Water Street, Lagoon Pond Road, and Beach Street Extension.

Figure 10 | Beach Road Crosswalk

Beach Road, Beach Street, Lagoon Pond Road, and Beach Street Extension all have a single all-purpose lane approaching the intersection, without dedicated turning lanes. Beach Street Extension is a short (<350 ft) dead end road that has limited parking for area businesses. Water Street is a three-lane road consisting of two southbound lanes approaching the intersection: a right/through-lane and a left-turn lane. Except for Beach Street Extension, on-street parking is not permitted within the vicinity of the study intersection.

Buses and trucks utilize Beach Street and Beach Road to access Water Street and the ferry terminal. However, the lanes at this intersection are not wide enough, thus causing insufficient turning radii for these large vehicles which leads them to encroach onto the sidewalks to complete turns. This encroachment negatively impacts perceived and real pedestrian safety and complicates traffic operations.

2.3.2 Pedestrian Infrastructure

Sidewalks are present along all approaches to the intersection. Apart from Beach Street Extension, which only has a sidewalk on the southbound side of the street, sidewalks are provided on both sides of the road. Sidewalks are generally not up to Americans with Disabilities

Act (ADA) or Public Right-of-Way Accessibility Guidelines (PROWAG) standard as they are narrow, often with a smaller effective width due to utility poles, fire hydrants, signposts, etc. Current standards require 48 inches of clear space, which is not consistent within the study area.

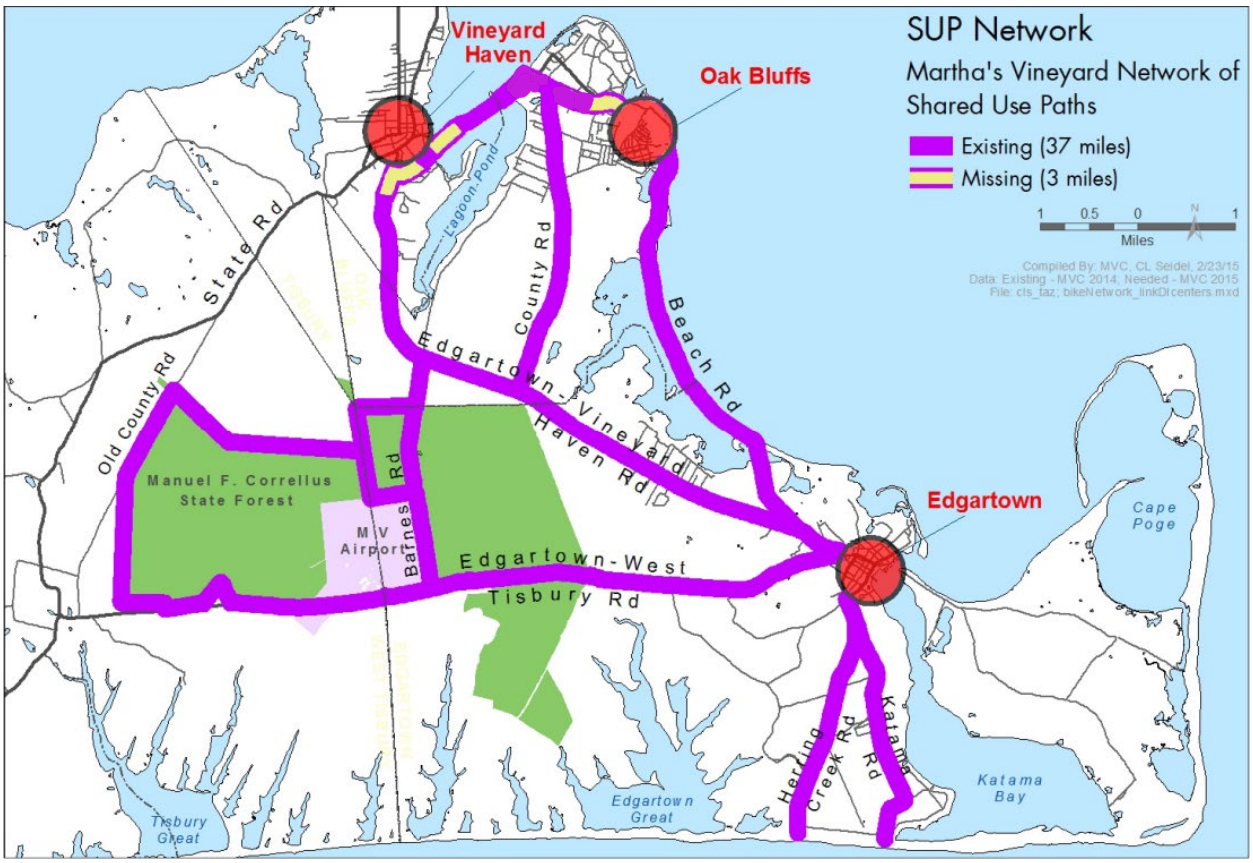
Crosswalks are also provided across each leg of the intersection. The crosswalks at Lagoon Pond Road and Beach Road are offset behind the stop bar, which presents a safety concern as pedestrians must cross behind queued vehicles. Curb ramps are present at each of the crosswalks, but only the ramps on Beach Road have tactile warning panels. Curb ramps appear to range from poor-to-fair condition, with all except the Beach Road ramps appearing not compliant with current ADA/PROWAG standards.

2.3.4 Bicycle Infrastructure

Beach Road is outfitted with bicycle lanes on either side of the street beginning at Five Corners and leading to a shared-use path approximately ½ mile east. All of the other streets within the study area function as shared spaces for vehicles and bicyclists. Signage is posted along these streets and moving into the intersection from Beach Road to communicate shared lanes. Observations at this intersection show that some bicyclists use the sidewalks to navigate through the intersection instead of the road, which could be caused by the lack of high-comfort bicycle facilities in the area.

Figure 11 illustrates the gap in the shared-use path network through the study area, beginning on the causeway section of Beach Road and continuing up Beach Street and State Road to the shared-use path on Edgartown-Vineyard Haven Road. Of the 40 planned miles of shared use paths on Martha's Vineyard, approximately half of the remaining three miles to be developed are in the study area.

Figure 11 | Shared Use Path Network in Martha's Vineyard



3. Alternatives Development and Analysis

Conceptual alternatives were developed for roadway improvements to the Five Corners intersection at Beach Road to improve safety and operations, which are outlined in the following section. Flood mitigation alternatives were then developed for the horizon year of 2030 to address current and near-term flooding, which could potentially be advanced alongside or separate from the roadway alternatives.

3.1 Development of Roadway Alternatives

Initial conceptual design alternatives were developed to address transportation safety and operations at the Five Corners intersection (3.1.1), which led into the development of medium- and long-term alternatives combined with flood mitigation measures (3.1.2). The initial conceptual design alternatives include high-level cost estimates. The below Conceptual Design Alternatives outline and display potential roadway improvements.

3.1.1 Short-Term Alternatives

Short-term alternatives consist of improvements at two locations: Five Corners and the intersection of Main Street, State Road, and Beach Street.

- The improvements at Five Corners present potential short-term changes. The elements of the design alternative include:
  - Re-aligning crosswalks to be closer to perpendicular with the street
  - Repainting all crosswalks to improve visibility
  - Installing signs indicating crosswalks. These signs could include rectangular rapid flashing beacons (RRFBs).
  - Repainting stop lines on the approaches with stop signs (Lagoon Pond Road, Water Street, and Beach Street Extension
  - Painting new yield lines ("shark's teeth") on the approaches without stop signs (Beach Road and Beach Street
  - Painting a curving dotted yellow line that curves from the centerline of Beach Street to the Centerline of Beach Road, to communicate the path of through traffic clearly to approaching drivers
  - Rebuilding the curbing and sidewalk at all corners of the intersection, including ramps and tactile strips at all crosswalks
- The improvements at the intersection of Main Street, State Road, and Beach Street do not vary between the design alternatives. They include:
  - Re-aligning crosswalks to be closer to perpendicular with the street
  - Repainting all crosswalks to improve visibility
  - Painting new yield lines ("shark's teeth") on the Beach Street approaches

- Rebuilding the sidewalk at the northeast and northwest corners of the intersection
- Expanding the sidewalk on the south side of Beach Street (this is shown in Figure 10 in red, as surrounding sidewalk is made of brick)
- Including ramps and tactile strips at all crosswalks

Overhead illustrations of this alternative are shown in Figure 12 and Figure 13. All construction could be within existing right-of-way, and property impacts from construction would be minor.

A high-level cost estimate of this alternative is approximately $523,000 in 2024 dollars, including improvements at both Five Corners and the Beach Street intersection with Main Street.

3.1.2 Medium-term Alternative

Compared to short-term alternatives, the medium-term alternative involves a moderate level of intervention at Five Corners with the same improvements being made at the intersection of Main Street, State Road, and Beach Street. It is assumed this alternative would be implemented in the medium-term, due to the more substantial reconstruction compared to short-term alternatives.

- The improvements at Five Corners include the same improvements to Lagoon Pond Road and to the south sides of Beach Street and Beach Road. Improvements to the north side of the Five Corners intersection would include:
  - Narrowing Water Street to two travel lanes from the present three, eliminating the current dedicated turning lanes. This would permit a shared-use path to be added to the west side of Water Street wider than the current sidewalk. Shifting trucks turning left from Water Street to Beach Street one lane-width to the east would prevent some of the overrunning of the curb and sidewalk that currently takes place.
- The improvements at Main Street include the same improvements Alternative 1 with the potential addition of a shared use path on the south side of Main Street, connecting to Five Corners.

Raising Beach Street Extension to the current curb height with pavers to create a shared street, sometimes referred to as a "woonerf." A sloped sidewalk and curb would allow local traffic to access Beach Street Extension. This improvement would allow Five Corners to be perceived to the majority of users as a four-way, stop-controlled intersection, would further emphasize the visual through movement from Beach Street to Beach Road, and would provide a more pleasant pedestrian experience accessing the beach and businesses on Beach Street Extension. Raising Beach Street Extension also creates the opportunity for flood mitigation measures, which are discussed in 3.2.

Overhead illustrations of this alternative are shown in Figure 12 and Figure 14. All improvements could be within existing right-of-way except for the southwestern corner of Five Corners, where property acquisition from USPS may be required. In addition, temporary construction impacts to properties along Beach Street Extension could be significant, as the road is proposed to be raised (in accordance with the above description of flood mitigation alternatives) and reconstructed completely as a woonerf at the current curb line.

A high-level cost estimate of this alternative is $2.3 million in 2024 dollars.

Figure 12 | Short-Term Alternative at Main Street, State Road, and Beach Street

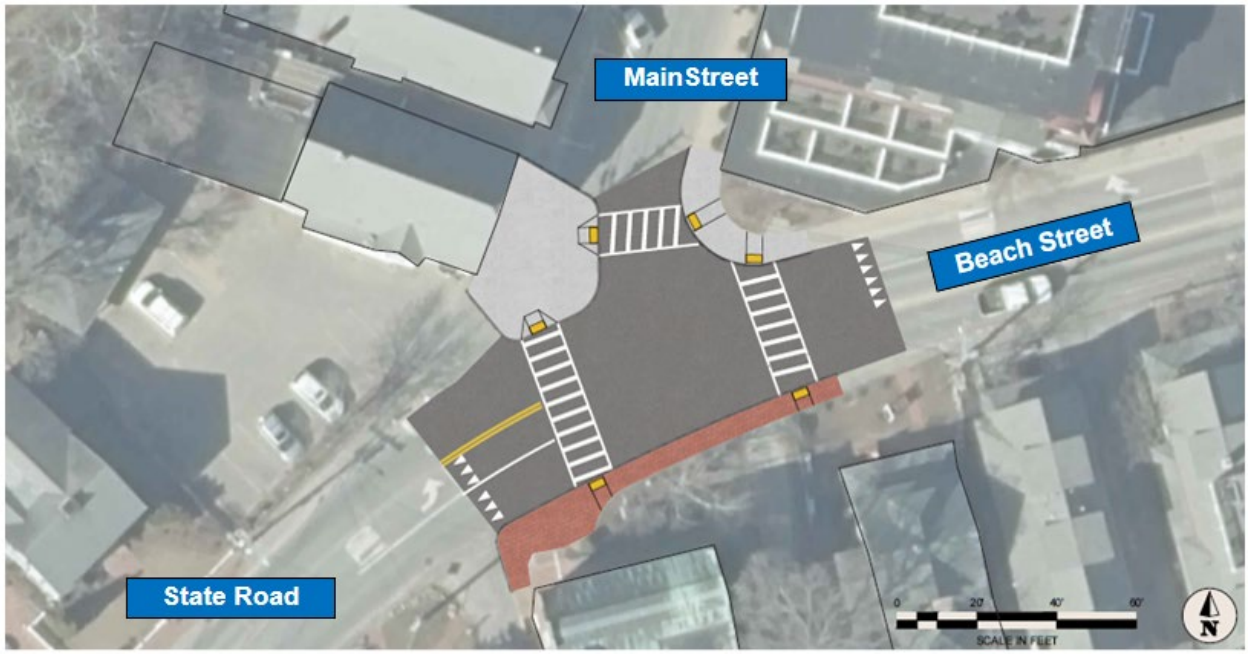


Figure 13 | Short-Term Alternative at Five Corners

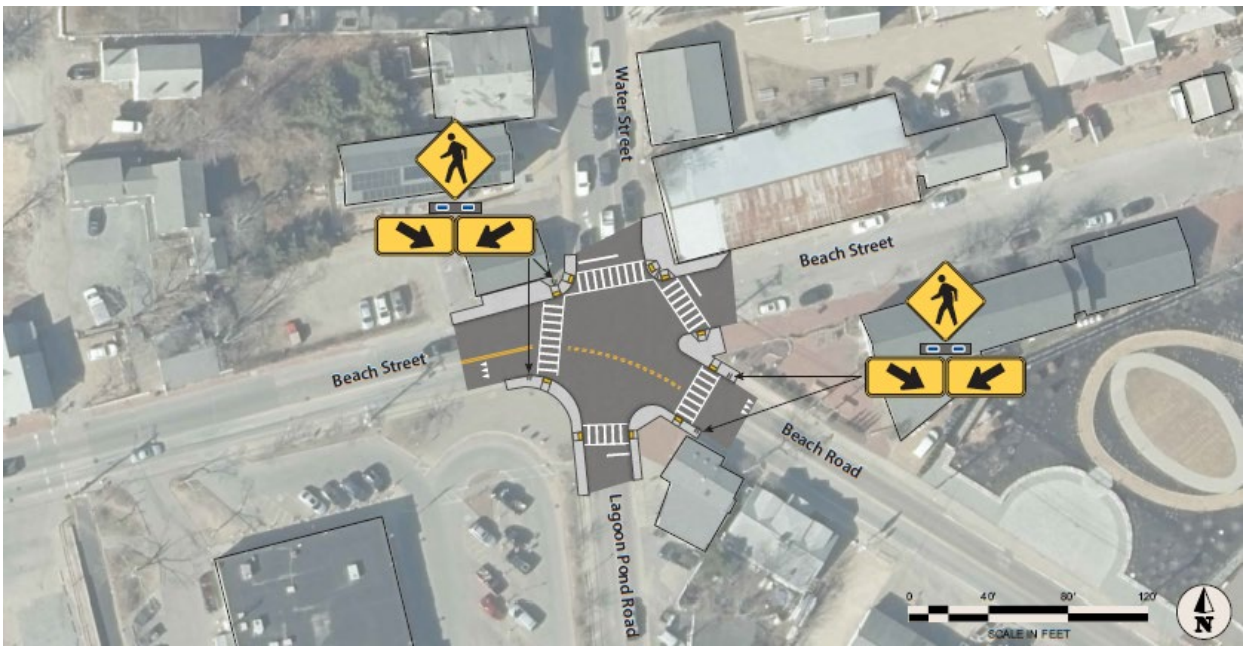
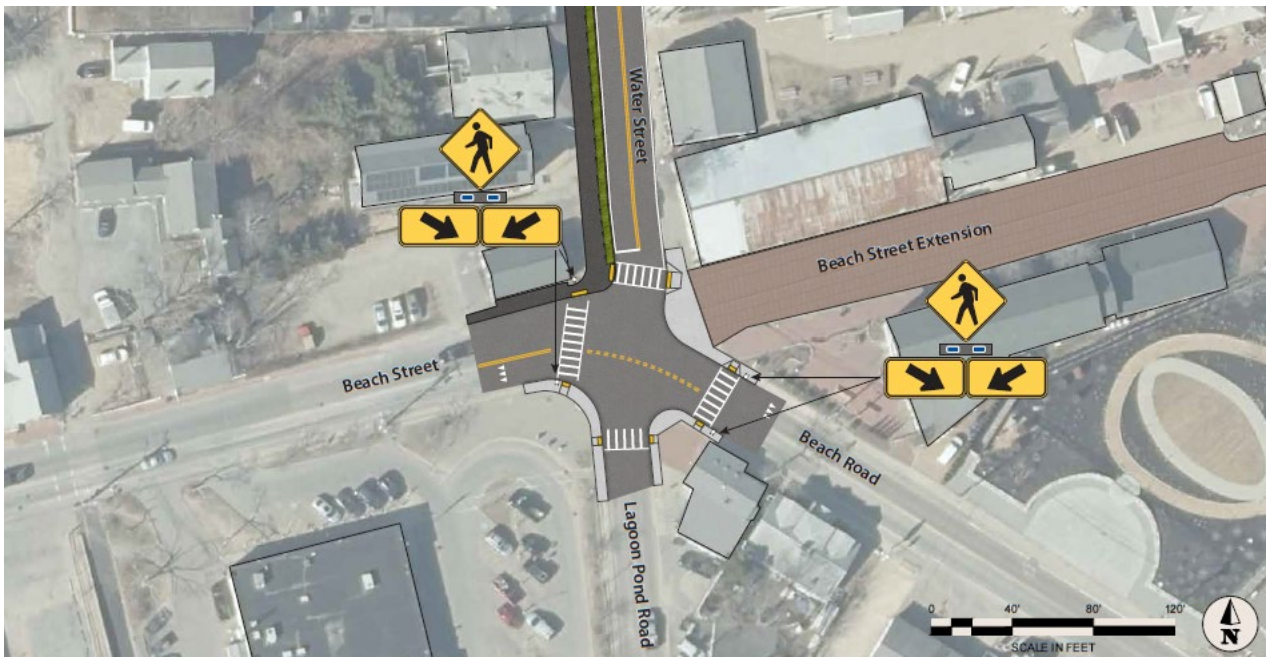


Figure 14 | Medium-Term Alternative at Five Corners



3.2 Development of Long-Term and Flood Mitigation Alternatives

Three potential alternatives were developed to address flooding at Five Corners, which have been paired with long-term roadway alternatives, including potential intersection formalizations. These paired concepts were then placed in the following categories based on the anticipated impacts and complexity of implementation. Cost estimates were not produced for these alternatives due to the variable elevations of infrastructure that could be carried out and the property impacts that would need to be evaluated in future project development stages.

3.2.1 Beach Street Extension Shared Street and Stormwater Retention Tank

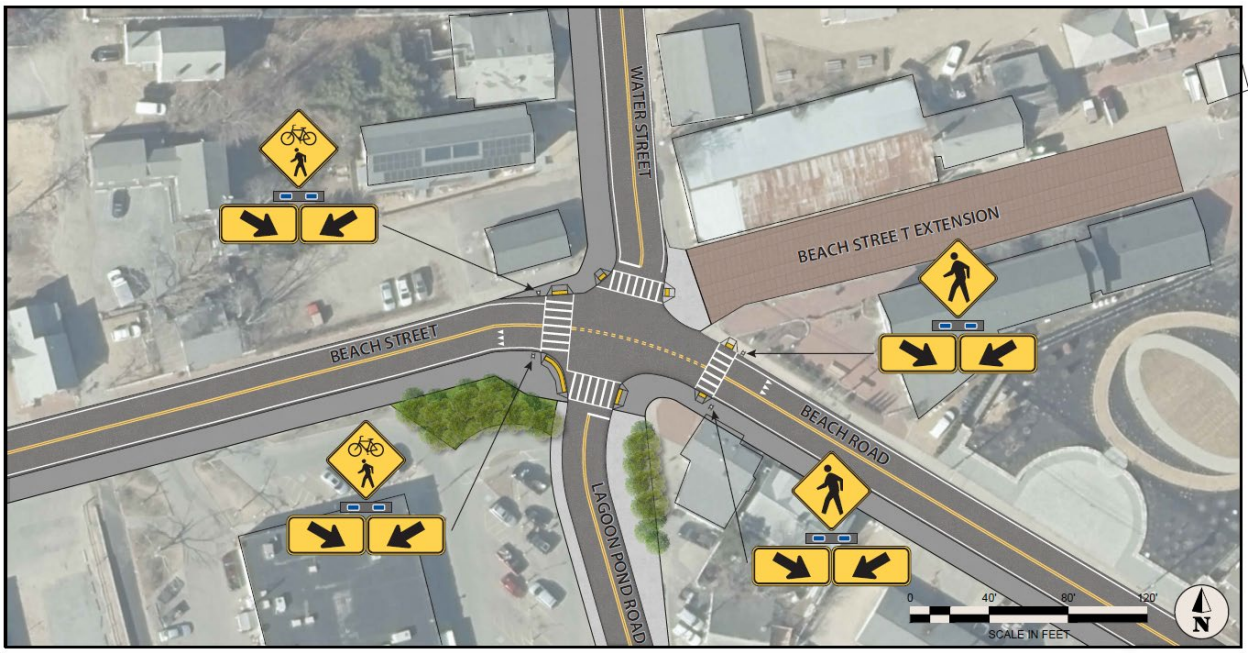
This alternative could be carried out as part of the medium-term alternative and would revise the geometry of the Five Corners intersection by raising Beach Street Extension to the level of the curb, creating a shared street space oriented toward pedestrian use, sometimes referred to as a "woonerf." Beach Road Extension would remain accessible from Five Corners via sloped pavement but would appear less like a leg of the intersection. Water Street would be reduced to one lane in each direction, allowing for a bi-directional shared-use path along the western side. Additional elements of short-term improvements could be included.

This alternative also considered the possibility of placing a retention tank for stormwater underneath the Beach Road Extension woonerf that could collect and store stormwater, which would be pumped out to the Harbor after severe weather events (necessitating a pump station, the location of which would need to be determined). This improvement could also address the existing reverse slope of the stormwater system below Beach Street Extension, which causes drainage issues.

3.2.2 Raised Five Corners Intersection

This long-term alternative would reconfigure Five Corners as a new stop-controlled intersection with a clear through-priority line between Beach Street and Beach Road and between Lagoon Pond Road and Water Street, with Beach Street de-emphasized as a raised woonerf. This alternative could include a bi-directional shared-use path on the south side of Beach Street and Beach Road and a sidewalk on the west side of Lagoon Pond Road. These improvements are rendered at a conceptual level in Figure 15.

Figure 15 | Long-Term Five Corners Formalized Intersection



From a resilience component, this alternative proposes reconstructing the intersection and raising the elevation of the infrastructure by five feet above the current level of Five Corners (7.5 feet above NAVD88), allowing the drainage system to be sloped toward the harbor shoreline outfall rather than toward Five Corners. This elevation change is not captured in the conceptual rendering. Stormwater retention capacity could be expanded under the raised infrastructure as part of this project, which would serve to accommodate excess water during storm events and then be pumped out to the Harbor once flooding levels recede.

A high-level cost estimate of this alternative is $3.1 in 2024 dollars, which does not include costs associated with raising infrastructure, the level of which would be determined as part of the project development process. The costs encompass roadway changes to the Five Corners intersection, as well as the Beach Street Extension shared street.

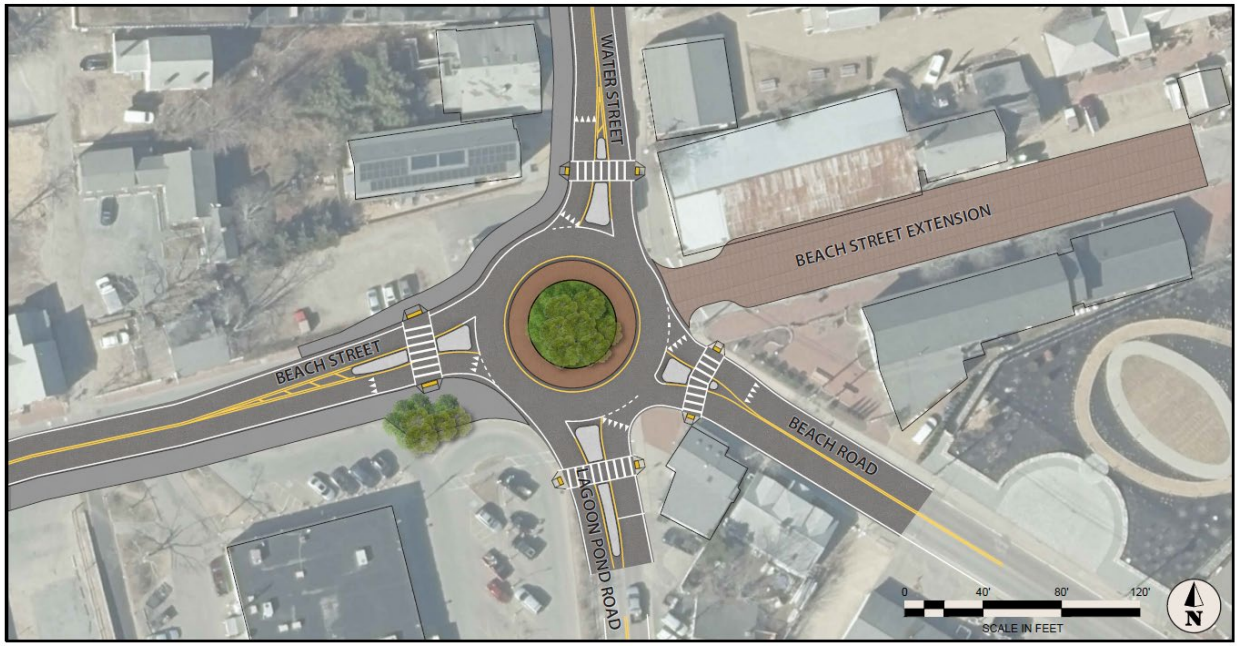
3.2.3 Roundabout

This long-term alternative is similar to the Raised Five Corners Intersection alternative but would reconfigure Five Corners as a roundabout centered on the northwest side of the current intersection, rather than as a signalized treatment. The roundabout would have five entrance points, with the Beach Street Extension access being sloped to the level of the raised woonerf to

de-emphasize it. The roundabout could be raised above the existing intersection level to a point at or above MMHW in 2030 (2.4 feet), which would need to be evaluated during subsequent potential project development phases. A conceptual rendering of a potential roundabout is provided in Figure 16 for illustrative purposes. The actual layout and footprint of a roundabout would be determined in project development following this study, were this concept to move forward.

A high-level cost estimate of this alternative is $3.8 million in 2024 dollars, which does not include costs associated with raising infrastructure.

Figure 16 | Long-Term Roundabout



3.3 Potential Impacts of Alternatives

The alternatives developed were screened for high-level potential impacts, which are described below.

3.3.1 Roadway Alternatives

Short-term improvements are near-term infrastructure improvements and quick-build investments that could be anticipated to improve safety and operations at the Five Corners intersection as shown in Conceptual Design Alternative 1. It would bring the intersection up to current MassDOT standards, including for ADA access, but would not significantly change the way the intersection currently operates with no formal traffic control or clear priority lines. Additionally, it would likely be insufficient to address existing intersection turning challenges for large vehicles. As it does not incorporate drainage or flood improvements, this alternative would likely have no changes to existing flood vulnerability. Due to all improvements proposed being within the existing right-of-way, this alternative is not anticipated to result in impacts to neighboring properties.

Medium-term improvements could have more impacts than the short-term improvements, as outlined in Conceptual Design Alternative 2. Similar to the short-term alternative, it is anticipated to be contained within public right-of-way. However, temporary construction impacts to properties along Beach Street Extension could be significant if the road were raised and reconstructed as a woonerf at the existing curb line. This would require grade and elevation changes to the road profile. Vehicle travel patterns at Water Street could be adjusted or driver behavior may shift due to the change in lane configuration and addition of the shared-use path; this could be further evaluated as part of any project development.

Long-term roadway alternatives are discussed in the following section, as these concepts could be combined with flood mitigation measures to address flood vulnerability.

3.3.2 Flood Mitigation Alternatives and Integrated Strategies

Flood mitigation alternatives are long-term alternatives with an extended outlook that could be potentially significant changes to Five Corners with the aim of addressing current and future flooding. As discussed in the existing conditions section, future high tides, sea level rise, and storm inundation levels are anticipated to cover a significant footprint of Vineyard Haven, encompassing the Five Corners intersection. The proposed long-term alternatives could have construction impacts beyond the immediate roadway footprint.

If a stormwater retention tank were included under a raised Beach Street Extension, it could help mitigate current flooding at Five Corners. However, due to the anticipated future-year 2030 flood projections, this retention tank may be insufficient to completely protect the area from future inundation.

For the Raised Five Corners Intersection and Raised Roundabout alternatives, impacts to neighboring properties are anticipated from three sources. First, disruption during construction could produce temporary access and noise impacts to nearby streets and properties; construction noise could be a concern during the construction period and access to major connecting streets, such as the Beach Road Causeway toward Martha's Vineyard Hospital, and access to the ferry terminal could be affected.

Second, the realignment of the intersection would potentially require acquiring a portion of the USPS property right-of-way.

Third, raising Five Corners and the proximate roadways by five feet would result in impacts to neighboring properties. As part of a previous effort in 2023, the Town of Tisbury produced mapping (Figure 17) to illustrate impacted areas for side slopes if the infrastructure were raised to five feet above NAVD88. It is likely that elevating the road by five feet relative to NAVD88 in the suggested area would require significant reconfiguration of Vineyard Haven around Five Corners. At this potential raised elevation, the slope contours overlap with the footprint of extant buildings on the northeast corner of Five Corners (the current Black Dog Tavern), the footprints of buildings on the southern side of Five Corners, and along the south side of Beach Road.

The impacts of raising Five Corners five feet above existing land elevation were considered, which is approximately seven and one-half feet above NAVD88. The assumption was that this

elevation change would have more significant impacts than visualized in Figure 17 from the Alternatives Analysis for Vineyard Haven Report, which proposed a five-foot elevation above NAVD88. The elevation height of a potentially reconfigured and raised Five Corners would be evaluated and determined during any future potential project development, in coordination with local stakeholders.

Figure 17 | Approximate Footprint Required to Elevate Infrastructure to Five Feet above NAVD88

Source: Town of Tisbury Alternatives Analysis for Vineyard Haven

If a roundabout were to be advanced, such a project could require additional right-of-way on the west side of Five Corners. Construction and elevation impacts would be similar to the four-way intersection. As envisioned, the roundabout would require property acquisition on the southeast (USPS) and northwest corners of the intersection, including a full property on the northwest side. A raised roundabout would likely require consideration of additional right-of-way, depending on the elevation level.

To briefly note, there are additional potential flood mitigation measures for the Five Corners-Vineyard Haven area that have been presented and evaluated outside of this planning study: notably, coastal berms, stormwater control measures in Veterans Park, a pump station, raising additional roadways, and drainage system alterations. These measures could potentially, in tandem or separately, address flood vulnerability to varying extents, although they require coordination and consensus with multiple stakeholders, not limited to MassDOT.

3.4 Flood Mitigation Alternatives - Key Findings

The elevation change proposed in the above long-term alternatives would result in significant impacts on neighboring properties. Elevating Five Corners, Beach Road, Lagoon Pond Road, Water Street, and other adjacent streets to either elevation (five feet above existing elevation or above NAVD88) would require a more comprehensive evaluation of impacts to the existing infrastructure and properties, along with continued discussion on its benefits and costs.

3.4.1 Project Development Timeline

The length of time that would be required to initiate and carry out the project development process, including design, permitting, funding, and construction, could extend beyond the 2030 horizon year. This has the potential to make the flood mitigation options presented in this report obsolete following the year 2030. Due to the projected severity of flooding beyond this horizon year, stakeholders should discuss the benefits and challenges of implementing alternatives designed for the 2030 horizon year, or more potentially significant alternatives outside the scope of this planning study.

3.4.2 Current vs. Future Year Flooding

It should be noted that while the long-term alternatives may have the potential to address current drainage and 2030 flood projections, they may not be sufficient to address coastal flooding from sea level rise and storm surge in the 2050 and 2070 horizon years. Modeling reviewed in this study suggests that in addition to Five Corners, other low-lying areas of Vineyard Haven could be inundated by water during regular tidal events. In the near-term, proposed drainage work advanced with coordination and consensus could mitigate extant inundation issues but will likely be insufficient to address future climate projections outlined in Chapter 2.1.

4. Summary and Recommendations

Five Corners is a critical intersection in Tisbury and is also a major road connection to both emergency services at Martha's Vineyard Hospital in Oak Bluffs and the Vineyard Haven Steamship Authority Ferry Terminal, which provides year-round ferry service to the mainland. The intersection has been identified as a crash risk site with the need to address road safety and operations, provide improved multimodal accommodations, and address flood vulnerability. Passage through Five Corners is vital both for emergency services on the island and for mainland transportation via the Ferry Terminal one block away.

Five Corners floods on a regular basis and climate modeling projects it to occur more frequently and severely. Several projects to address existing road deficiencies and drainage issues in the area have implemented, although concerns remain about continued and future flood vulnerability. Beach Road and the Beach Road Extension stormwater outfall pipe are under MassDOT jurisdiction, with properties in the area owned by private entities and other roads under the jurisdiction of the Town of Tisbury. Projects in this area require coordination with multiple stakeholders.

4.1 Roadway Improvements

Conceptual alternatives were developed to address existing transportation operational and safety challenges at the Five Corners Beach Roach Intersection. These are improvements that could be advanced in project development, separate from flood mitigation measures, to improve transportation conditions in the area.

All conceptual alternatives propose improvements to crosswalks – re-alignment, visibility, and rebuilt corners with improved accessibility. Conceptual Design Alternative 1 outlines potential improvements that could improve intersection safety. Conceptual Design Alternative 2 includes additional pedestrian safety improvements that could be made by narrowing Water Street, adding a shared use path that could be used by bicyclists, and tightening the intersection footprint to simplify vehicle travel. Beach Street Extension could also be turned into a shared street, visually simplifying Five Corners into a four-way intersection, while still providing access to local traffic. Long-term roadway alternatives considered creating formalized traffic patterns at Five Corners and potentially elevating the intersection. During project development, dimensions and footprint would be determined and evaluated so as not to impede any large vehicles moving through the area, such as delivery trucks and VTA buses. Intersection control and final multimodal improvements would also be evaluated in these future stages.

4.2 Flood Mitigation Measures

The study area is significantly vulnerable to current, and future flooding under climate change. Flood models reviewed as part of this study indicate that by 2030 the highest tides will reach nearly the elevation of Five Corners and storms will exceed that elevation. As the current stormwater drainage system is sloped toward the Five Corners intersection, substantial rebuilding of that system would be required to address existing and 2030 backflow. Work on this scale, including surface or subsurface detention areas, would likely require a significant investment beyond existing proposed work, such as alterations to the Beach Street Extension outfall pipe to address current flooding.

Parallel efforts by the Town of Tisbury, Town of Oak Bluffs, Martha's Vineyard Commission, and Martha's Vineyard Hospital have recommended raising roads to maintain infrastructure and asset access in the medium- to long-term. Additional potential flood mitigation measures that have been discussed, presented, and evaluated outside of this planning study include coastal berms, stormwater control measures in Veterans Park, a pump station, raising additional roadways, and drainage system alterations. These measures could potentially, in tandem or

separately, address flood vulnerability to varying extents, although they require coordination and consensus with multiple stakeholders, not limited to MassDOT.

The study developed several alternatives that could potentially address current and near-term flooding at Five Corners, with a horizon year of 2030. However, this would require significant elevation changes to the existing Five Corners intersection footprint and configuration and would necessitate additional realignment of the existing stormwater drainage system. Additionally, these changes would likely be insufficient to mitigate the impacts of flooding beyond the 2030 horizon year.

Impacts on neighboring properties of raising the intersection and approach roadways to the height required to mitigate future flooding would likely be significant. Potential long-term project development would require coordination and consensus with stakeholders on the benefits and challenges of implementing substantial changes at this intersection to address flooding, including any that fall outside MassDOT's jurisdiction, limited to state roads and portions of the drainage system.

4.3 Recommendations

This planning study was initiated to address resiliency, road safety, and operations at the Five Corners intersection with Beach Road, and to support drainage work proposed in the study area. During the public involvement process and engagement with stakeholders, addressing flood vulnerability emerged as a key priority. This study reviewed future year climate models for the horizon years 2030, 2050, and 2070 alongside developing alternatives for roadway improvements.

MassDOT could advance projects within its jurisdiction, such as improvements to the drainage system and outfall pipe at Beach Street Extension, and implementation of a raised intersection or roundabout at Five Corners. Based on the study process and stakeholder feedback, moving forward with the existing MassDOT drainage project number 609459 was identified as a means to address current flooding issues at the Five Corners intersection in the near-term. For project development purposes, this could be combined with intersection reconfiguration.

Future-year flood mitigation could potentially be addressed as part of a future roadway construction project, such as the long-term alternatives reconfiguring Five Corners as a formal intersection or a roundabout. At a minimum, any project involving reconstruction of the Five Corners intersection should include drainage enhancements. Any project that moves forward could also include raised infrastructure, the level of which would be determined during project development.

Given the various jurisdictions that extend beyond MassDOT's infrastructure, additional flood mitigation strategies must be determined and advanced by other stakeholders. Future stakeholder coordination is anticipated to include, but is not limited to, the Town of Tisbury, the Town of Oak Bluffs, the Martha's Vineyard Commission, the Steamship Authority, and other relevant stakeholders (such as Martha's Vineyard Hospital) and businesses. With the severity of current and future projected flooding and the criticality of the Five Corners intersection, MassDOT recommends regional and local partners collaborate to identify and advance a project or projects that address inundation concerns, bearing in mind the need for timely coordination.