

# Climate Resilience Design Standards Tool Project Report

## Sesuit Harbor Improvements

Date Created: 9/2/2025 7:59:18 AM

Created By: grounseville

Date Report Generated: 9/5/2025 2:25:09 PM

Tool Version: Version 1.4

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## Project Summary

[Link to Project](#)

Estimated Capital Cost: \$8000000.00

End of Useful Life Year: 2076

Project within mapped Environmental Justice neighborhood: No

### Ecosystem Service

### Scores

#### Benefits

Project Score

High

#### Exposure

### Scores

Sea Level Rise/Storm

High

Surge

Exposure

Extreme Precipitation -

High

Stormwater Flooding

Exposure

Extreme Precipitation -

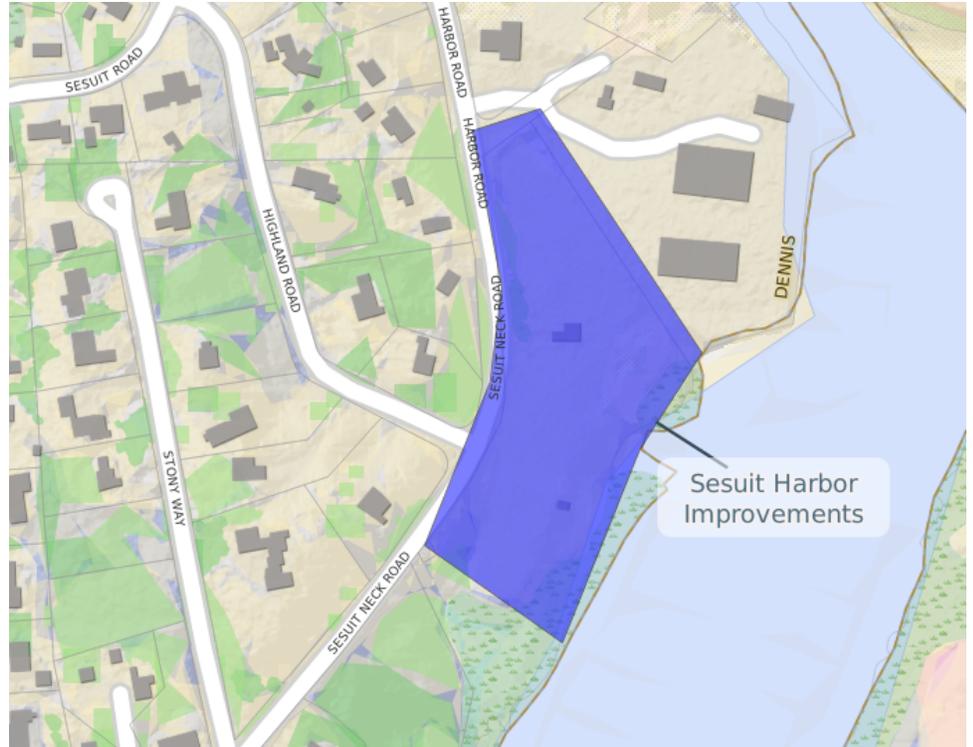
Not Exposed

Riverine Flooding

Extreme Heat

High

Exposure



## Asset Preliminary Climate Risk Rating

Number of Assets: 3

### Summary

#### Asset Risk

#### Sea Level Rise/Storm Surge

#### Extreme Precipitation - Stormwater Flooding

#### Extreme Precipitation - Riverine Flooding

#### Extreme Heat

Harbor Master Office & Public Restroom Facilities

High Risk

High Risk

Low Risk

High Risk

Harbor Master Garage

High Risk

High Risk

Low Risk

High Risk

Parking Lot

High Risk

High Risk

Low Risk

High Risk

## Climate Resilience Design Standards Summary

	Target Planning Horizon	Intermediate Planning Horizon	Percentile	Return Period	Tier
<b>Sea Level Rise/Storm Surge</b>					
Harbor Master Office & Public Restroom Facilities	2070	2050		200-yr (0.5%)	
Harbor Master Garage	2070	2050		100-yr (1%)	
Parking Lot	2070	2050		100-yr (1%)	
<b>Extreme Precipitation</b>					
Harbor Master Office & Public Restroom Facilities	2070			50-yr (2%)	Tier 3
Harbor Master Garage	2070			25-yr (4%)	Tier 3

Parking Lot	2070		25-yr (4%)	Tier 3
<b>Extreme Heat</b>				
Harbor Master Office & Public Restroom Facilities	2070	90th		Tier 3
Harbor Master Garage	2070	90th		Tier 3
Parking Lot	2070	90th		Tier 3

## Scoring Rationale - Project Exposure Score

The purpose of the Exposure Score output is to provide a preliminary assessment of whether the overall project site and subsequent assets are exposed to impacts of natural hazard events and/or future impacts of climate change. For each climate parameter, the Tool will calculate one of the following exposure ratings: Not Exposed, Low Exposure, Moderate Exposure, or High Exposure. The rationale behind the exposure rating is provided below.

### Sea Level Rise/Storm Surge

This project received a "High Exposure" because of the following:

- Located within the predicted mean high water shoreline by 2030
- Exposed to the 1% annual coastal flood event as early as 2030
- Historic coastal flooding at project site

### Extreme Precipitation - Stormwater Flooding

This project received a "High Exposure" because of the following:

- Maximum annual daily rainfall exceeds 10 inches within the overall project's useful life
- Existing impervious area of the project site is greater than 50%
- No historic flooding at project site
- No increase to impervious area

### Extreme Precipitation - Riverine Flooding

This project received a "Not Exposed" because of the following:

- No historic riverine flooding at project site
- The project is not within a mapped FEMA floodplain [outside of the Massachusetts Coast Flood Risk Model (MC-FRM)]
- Project is more than 500ft from a waterbody
- Project is not likely susceptible to riverine erosion

### Extreme Heat

This project received a "High Exposure" because of the following:

- Existing impervious area of the project site is greater than 50%
- 10 to 30 day increase in days over 90 deg. F within project's useful life
- Located within 100 ft of existing water body
- No increase to the impervious area of the project site
- No tree removal

## Scoring Rationale - Asset Preliminary Climate Risk Rating

A Preliminary Climate Risk Rating is determined for each infrastructure and building asset by considering the overall project Exposure Score and responses to Step 4 questions provided by the user in the Tool. Natural Resource assets do not receive a risk rating. The following factors are what influenced the risk ratings for each asset.

### Asset - Harbor Master Office & Public Restroom Facilities

Primary asset criticality factors influencing risk ratings for this asset:

- Asset may be inaccessible/inoperable during natural hazard event, but must be accessible/operable within one day after natural hazard event
- Greater than 10,000 people would be directly affected by the loss/inoperability of the asset
- Inoperability of the asset would result in moderate or severe injuries or moderate or severe impacts to chronic illnesses

- Inoperability may moderately impact other facilities, assets, or buildings, but is not expected to affect their ability to operate
- Spills and/or releases of hazardous materials would be relatively easy to clean up

**Asset - Harbor Master Garage**

Primary asset criticality factors influencing risk ratings for this asset:

- Asset may inaccessible/inoperable for more than a day but less than a week after natural hazard event
- Loss/inoperability of the asset would have impacts limited to local area and/or municipality
- Some alternative programs and/or services are available to support the community
- Inoperability is likely to significantly impact other facilities, assets, or buildings and will likely affect their ability to operate
- Spills and/or releases of hazardous materials would be relatively easy to clean up

**Asset - Parking Lot**

Primary asset criticality factors influencing risk ratings for this asset:

- Asset may inaccessible/inoperable for more than a day but less than a week after natural hazard event
- Greater than 10,000 people would be directly affected by the loss/inoperability of the asset
- Inoperability of the asset would be expected to result in minor impacts to people's health, including minor injuries or minor impacts to chronic illnesses
- Inoperability is likely to significantly impact other facilities, assets, or buildings and will likely affect their ability to operate
- Spills and/or releases of hazardous materials would be relatively easy to clean up

## Project Climate Resilience Design Standards Output

Climate Resilience Design Standards and Guidance are recommended for each asset and climate parameter. The Design Standards for each climate parameter include the following: recommended planning horizon (target and/or intermediate), recommended return period (Sea Level Rise/Storm Surge and Precipitation) or percentile (Heat), and a list of applicable design criteria that are likely to be affected by climate change. Some design criteria have numerical values associated with the recommended return period and planning horizon, while others have tiered methodologies with step-by-step instructions on how to estimate design values given the other recommended design standards.

Asset: Harbor Master Office & Public Restroom Facilities

Building/Facility

### Sea Level Rise/Storm Surge

High Risk

Target Planning Horizon: 2070

Intermediate Planning Horizon: 2050

Return Period: 200-yr (0.5%)

**LIMITATIONS:** The recommended Climate Resilience Design Standards for the Sea Level Rise / Storm Surge Design Criteria are based on the user drawn polygon and relationships as defined in the Supporting Documents. The projected values provided through the Tool are based on the Massachusetts Coast Flood Risk Model (MC-FRM) outputs as of 9/13/2021, which included GIS-based data for three planning horizons (2030, 2050, 2070) and six return periods (0.1%, 0.2%, 0.5%, 1%, 2%, 5%). These values are projections based on assumptions as defined in the model and the LiDAR used at the time. For additional information on the MC-FRM, review the additional resources provided on the Start Here page.

The projected values, Standards, and Guidance provided within this Tool may be used to inform plans and designs, but they do not provide guarantees for future conditions or resilience. The projected values are not to be considered final or appropriate for construction documents without supporting engineering analyses. The guidance provided within this Tool is intended to be general and users are encouraged to do their own due diligence.

### Applicable Design Criteria

#### Projected Tidal Datums: APPLICABLE

Planning Horizon	MHHW	MHW	MTL	MLW	MLLW
	(ft-NAVD88)				
2050	7.8	7.4	2.5	-2.5	-2.7
2070	9.7	9.3	4.3	-0.8	-1.0

This project is located in an area with uncertainty for future tidal datums. These uncertain zones are either dynamic in terms of geomorphology or are restricted by manmade features (i.e., culverts, tide gates, etc.) that should be evaluated in more detail at the site-scale.

#### Projected Water Surface Elevation: APPLICABLE

Asset Name	Recommended Planning Horizon	Recommended Return Period	Max	Min	Area Weighted Average
			(ft - NAVD88)		
Harbor Master Office & Public Restroom Facilities	2050	0.5% (200-Year)	13.6	13.6	13.6
	2070		15.4	15.4	15.4

#### Projected Wave Action Water Elevation: APPLICABLE

Asset Name	Recommended Planning Horizon	Recommended Return Period	Max	Min	Area Weighted Average
			(ft - NAVD88)		
Harbor Master Office & Public Restroom Facilities	2050	0.5% (200-Year)	16.2	13.6	15.1
	2070		18.4	15.4	17.2

#### Projected Wave Heights: APPLICABLE

Asset Name	Recommended Planning Horizon	Recommended Return Period	Max	Min	Area Weighted Average
			(Feet)		
Harbor Master Office & Public Restroom Facilities	2050	0.5% (200-Year)	4.0	0.0	2.1
	2070		4.5	0.0	2.6

#### Projected Duration of Flooding: APPLICABLE

[Methodology to Estimate Projected Values](#)

**Projected Design Flood Velocity:** APPLICABLE

[Methodology to Estimate Projected Values](#)

**Projected Scour & Erosion:** NOT APPLICABLE

**Extreme Precipitation**

High Risk

Target Planning Horizon: 2070  
Return Period: 50-yr (2%)

**LIMITATIONS:** The recommended Standards for Total Precipitation Depth & Peak Intensity are determined by the user drawn polygon and relationships as defined in the Supporting Documents. The projected Total Precipitation Depth values provided through the Tool are based on the climate projections developed by Cornell University as part of EEA's Massachusetts Climate and Hydrologic Risk Project, GIS-based data as of 10/15/21. For additional information on the methodology of these precipitation outputs, see Supporting Documents.

While Total Precipitation Depth & Peak Intensity for 24-hour Design Storms are useful to inform planning and design, it is recommended to also consider additional longer- and shorter-duration precipitation events and intensities in accordance with best practices. Longer-duration, lower-intensity storms allow time for infiltration and reduce the load on infrastructure over the duration of the storm. Shorter-duration, higher-intensity storms often have higher runoff volumes because the water does not have enough time to infiltrate infrastructure systems (e.g., catch basins) and may overflow or back up during such storms, resulting in flooding. In the Northeast, short-duration high intensity rain events are becoming more frequent, and there is often little early warning for these events, making it difficult to plan operationally. While the Tool does not provide recommended design standards for these scenarios, users should still consider both short- and long-duration precipitation events and how they may impact the asset.

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**Applicable Design Criteria**

**Tiered Methodology:** Tier 3

**Projected Total Precipitation Depth & Peak Intensity for 24-hr Design Storms:** APPLICABLE

Asset Name	Recommended Planning Horizon	Recommended Return Period (Design Storm)	Projected 24-hr Total Precipitation Depth (inches)	Step-by-Step Methodology for Peak Intensity
Harbor Master Office & Public Restroom Facilities	2070	50-Year (2%)	8.4	<a href="#">Downloadable Methodology PDF</a>

**Projected Riverine Peak Discharge & Peak Flood Elevation:** NOT APPLICABLE

**Extreme Heat**

High Risk

Target Planning Horizon: 2070  
Percentile: 90th Percentile

**LIMITATIONS:** The recommended standards are determined by the user-drawn polygon and relationships as defined in the supporting Section Documents. The guidance provided within this Tool may be used to inform plans and designs, but does not provide guarantees for resilience. The guidance provided within this Tool is intended to be general and users are encouraged to do their own due diligence. One avenue to seek more information would be to access the comprehensive temperature and precipitation projections including additional return periods, time horizons, and seasons at the [Climate Projections Dashboard](#).

**Applicable Design Criteria**

**Projected Annual/Summer/Winter Average Temperatures:** APPLICABLE

Asset Name	Recommended Planning Horizon	Recommended Percentile	Projected Annual Average Temperature [°F]	Projected Summer Average Temperature [°F]	Projected Winter Average Temperature [°F]
Harbor Master Office & Public Restroom Facilities	2070	90th	60.65	78.47	42.71

**LIMITATIONS:** The recommended Standards for Projected Average Annual/Summer/Winter Temperature are determined by the user-drawn polygon and relationships as defined in the supporting Section Documents. The guidance provided within this Tool may be used to inform plans and designs, but is not comprehensive and does not provide guarantees for resilience. The guidance provided within this Tool is intended to be general and users are encouraged to do their own due diligence. One avenue to seek more information would be to access the comprehensive temperature and precipitation projections including additional return periods, time horizons, and seasons at the [Climate Projections Dashboard](#).

**Projected Growing Degree Days:** NOT APPLICABLE

**Projected Days Per Year With Max Temp > 95°F, >90°F, <32°F:** APPLICABLE

Asset Name	Recommended Planning Horizon	Recommended Percentile	Projected Days with Max Temp >95°F (days)	Projected Days with Max Temp >90°F (days)	Projected Days with Max Temp <32°F (days)
Harbor Master Office & Public Restroom Facilities	2070	90th	9	35	42

**LIMITATIONS:** The recommended Standards for Projected Days per Year with Max Temp >95°F, >90°F, <32°F are determined by the user-drawn polygon and relationships as defined in the supporting Section Documents. The guidance provided within this Tool may be used to inform plans and designs, but is not comprehensive and does not provide guarantees for resilience. The guidance provided within this Tool is intended to be general and users are encouraged to do their own due diligence. One avenue to seek more information would be to access the comprehensive temperature and precipitation projections including additional return periods, time horizons, and seasons at the [Climate Projections Dashboard](#).

**Projected Number of Heat Waves Per Year & Average Heat Wave Duration:** APPLICABLE

Asset Name	Recommended Planning Horizon	Recommended Percentile	Projected Number of Heat Waves Per Year (events)	Projected Average Heat Wave Duration (days)
Harbor Master Office & Public Restroom Facilities	2070	90th	0	4

**LIMITATIONS:** The recommended Standards for Projected Number of Heat Waves Per Year and Average Heat Wave Duration are determined by the user-drawn polygon and relationships as defined in the supporting Section Documents. The guidance provided within this Tool may be used to inform plans and designs, but is not comprehensive and does not provide guarantees for resilience. The guidance provided within this Tool is intended to be general and users are encouraged to do their own due diligence. One avenue to seek more information would be to access the comprehensive temperature and precipitation projections including additional return periods, time horizons, and seasons at the [Climate Projections Dashboard](#).

**Projected Cooling Degree Days & Heating Degree Days (base = 65°F):** APPLICABLE

Asset Name	Recommended Planning Horizon	Recommended Percentile	Projected Cooling Degree Days (base = 65°) (degree days)	Projected Heating Degree Days (base = 65°) (degree days)
Harbor Master Office & Public Restroom Facilities	2070	90th	1749	3338

**LIMITATIONS:** The recommended Standards for Projected Cooling Degree Days and Heating Degree Days are determined by the user-drawn polygon and relationships as defined in the supporting Section Documents. The guidance provided within this Tool may be used to inform plans and designs, but is not comprehensive and does not provide guarantees for resilience. The guidance provided within this Tool is intended to be general and users are encouraged to do their own due diligence. One avenue to seek more information would be to access the comprehensive temperature and precipitation projections including additional return periods, time horizons, and seasons at the [Climate Projections Dashboard](#).

**Projected Heat Index:** APPLICABLE

[Methodology to Estimate Projected Values](#) : Tier 3

Asset: Harbor Master Garage

Building/Facility

**Sea Level Rise/Storm Surge**

High Risk

Target Planning Horizon: 2070

Intermediate Planning Horizon: 2050

Return Period: 100-yr (1%)

**LIMITATIONS:** The recommended Climate Resilience Design Standards for the Sea Level Rise / Storm Surge Design Criteria are based on the user drawn polygon and relationships as defined in the Supporting Documents. The projected values provided through the Tool are based on the Massachusetts Coast Flood Risk Model (MC-FRM) outputs as of 9/13/2021, which included GIS-based data for three planning horizons (2030, 2050, 2070) and six return periods (0.1%, 0.2%, 0.5%, 1%, 2%, 5%). These values are projections based on assumptions as defined in the model and the LiDAR used at the time. For additional information on the MC-FRM, review the additional resources provided on the Start Here page.

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**Applicable Design Criteria**

**Projected Tidal Datums:** APPLICABLE

Planning Horizon	MHHW	MHW	MTL	MLW	MLLW
	(ft-NAVD88)				
2050	7.8	7.4	2.5	-2.5	-2.7
2070	9.7	9.3	4.3	-0.8	-1.0

**This project is located in an area with uncertainty for future tidal datums. These uncertain zones are either dynamic in terms of geomorphology or are restricted by manmade features (i.e., culverts, tide gates, etc.) that should be evaluated in more detail at the site-scale.**

**Projected Water Surface Elevation:** APPLICABLE

Asset Name	Recommended Planning Horizon	Recommended Return Period	Max	Min	Area Weighted Average
			(ft - NAVD88)		
Harbor Master Garage	2050	1% (100-Year)	13.1	13.0	13.1
	2070		15.1	14.8	14.9

**Projected Wave Action Water Elevation:** APPLICABLE

Asset Name	Recommended Planning Horizon	Recommended Return Period	Max	Min	Area Weighted Average
			(ft - NAVD88)		
Harbor Master Garage	2050	1% (100-Year)	15.4	13.1	14.5
	2070		17.9	15.0	16.6

**Projected Wave Heights:** APPLICABLE

Asset Name	Recommended Planning Horizon	Recommended Return Period	Max	Min	Area Weighted Average
			(Feet)		
Harbor Master Garage	2050	1% (100-Year)	3.5	0.0	1.9
	2070		4.0	0.0	2.4

**Projected Duration of Flooding:** APPLICABLE

[Methodology to Estimate Projected Values](#)

**Projected Design Flood Velocity:** APPLICABLE

[Methodology to Estimate Projected Values](#)

**Projected Scour & Erosion:** NOT APPLICABLE

**Extreme Precipitation**

High Risk

Target Planning Horizon: 2070

Return Period: 25-yr (4%)

**LIMITATIONS:** The recommended Standards for Total Precipitation Depth & Peak Intensity are determined by the user drawn polygon and relationships as defined in the Supporting Documents. The projected Total Precipitation Depth values provided through the Tool are based on the climate projections developed by Cornell University as part of EEA's Massachusetts Climate and Hydrologic Risk Project, GIS-based data as of 10/15/21. For additional information on the methodology of these precipitation outputs, see Supporting Documents.

While Total Precipitation Depth & Peak Intensity for 24-hour Design Storms are useful to inform planning and design, it is recommended to also consider additional longer- and shorter-duration precipitation events and intensities in accordance with best

practices. Longer-duration, lower-intensity storms allow time for infiltration and reduce the load on infrastructure over the duration of the storm. Shorter-duration, higher-intensity storms often have higher runoff volumes because the water does not have enough time to infiltrate infrastructure systems (e.g., catch basins) and may overflow or back up during such storms, resulting in flooding. In the Northeast, short-duration high intensity rain events are becoming more frequent, and there is often little early warning for these events, making it difficult to plan operationally. While the Tool does not provide recommended design standards for these scenarios, users should still consider both short- and long-duration precipitation events and how they may impact the asset.

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**Applicable Design Criteria**

**Tiered Methodology:** Tier 3

**Projected Total Precipitation Depth & Peak Intensity for 24-hr Design Storms:** APPLICABLE

Asset Name	Recommended Planning Horizon	Recommended Return Period (Design Storm)	Projected 24-hr Total Precipitation Depth (inches)	Step-by-Step Methodology for Peak Intensity
Harbor Master Garage	2070	25-Year (4%)	7.5	<a href="#">Downloadable Methodology PDF</a>

**Projected Riverine Peak Discharge & Peak Flood Elevation:** NOT APPLICABLE

**Extreme Heat**

High Risk

Target Planning Horizon: 2070  
 Percentile: 90th Percentile

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**Applicable Design Criteria**

**Projected Annual/Summer/Winter Average Temperatures:** APPLICABLE

Asset Name	Recommended Planning Horizon	Recommended Percentile	Projected Annual Average Temperature [°F]	Projected Summer Average Temperature [°F]	Projected Winter Average Temperature [°F]
Harbor Master Garage	2070	90th	60.65	78.47	42.71

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**Projected Growing Degree Days:** NOT APPLICABLE

**Projected Days Per Year With Max Temp > 95°F, >90°F, <32°F:** APPLICABLE

Asset Name	Recommended Planning Horizon	Recommended Percentile	Projected Days with Max Temp >95°F (days)	Projected Days with Max Temp >90°F (days)	Projected Days with Max Temp <32°F (days)
Harbor Master Garage	2070	90th	9	35	42

**LIMITATIONS:** The recommended Standards for Projected Days per Year with Max Temp >95°F, >90°F, <32°F are determined by the user-drawn polygon and relationships as defined in the supporting Section Documents. The guidance provided within this

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**Projected Number of Heat Waves Per Year & Average Heat Wave Duration: APPLICABLE**

Asset Name	Recommended Planning Horizon	Recommended Percentile	Projected Number of Heat Waves Per Year (events)	Projected Average Heat Wave Duration (days)
Harbor Master Garage	2070	90th	0	4

**LIMITATIONS:** The recommended Standards for Projected Number of Heat Waves Per Year and Average Heat Wave Duration are determined by the user-drawn polygon and relationships as defined in the supporting Section Documents. The guidance provided within this Tool may be used to inform plans and designs, but is not comprehensive and does not provide guarantees for resilience. The guidance provided within this Tool is intended to be general and users are encouraged to do their own due diligence. One avenue to seek more information would be to access the comprehensive temperature and precipitation projections including additional return periods, time horizons, and seasons at the [Climate Projections Dashboard](#).

**Projected Cooling Degree Days & Heating Degree Days (base = 65°F): APPLICABLE**

Asset Name	Recommended Planning Horizon	Recommended Percentile	Projected Cooling Degree Days (base = 65°) (degree days)	Projected Heating Degree Days (base = 65°) (degree days)
Harbor Master Garage	2070	90th	1749	3338

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**Projected Heat Index: APPLICABLE**

[Methodology to Estimate Projected Values](#) : Tier 3

Asset: Parking Lot

Building/Facility

**Sea Level Rise/Storm Surge**

High Risk

Target Planning Horizon: 2070  
 Intermediate Planning Horizon: 2050  
 Return Period: 100-yr (1%)

**LIMITATIONS:** The recommended Climate Resilience Design Standards for the Sea Level Rise / Storm Surge Design Criteria are based on the user drawn polygon and relationships as defined in the Supporting Documents. The projected values provided through the Tool are based on the Massachusetts Coast Flood Risk Model (MC-FRM) outputs as of 9/13/2021, which included GIS-based data for three planning horizons (2030, 2050, 2070) and six return periods (0.1%, 0.2%, 0.5%, 1%, 2%, 5%). These values are projections based on assumptions as defined in the model and the LiDAR used at the time. For additional information on the MC-FRM, review the additional resources provided on the Start Here page.

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**Applicable Design Criteria**

**Projected Tidal Datums: APPLICABLE**

Planning Horizon	MHHW	MHW	MTL	MLW	MLLW
	(ft-NAVD88)				
2050	7.8	7.4	2.5	-2.5	-2.7

Planning Horizon	MHHW	MHW	MTL	MLW	MLLW
	(ft-NAVD88)				
2070	9.7	9.3	4.3	-0.8	-1.0

This project is located in an area with uncertainty for future tidal datums. These uncertain zones are either dynamic in terms of geomorphology or are restricted by manmade features (i.e., culverts, tide gates, etc.) that should be evaluated in more detail at the site-scale.

**Projected Water Surface Elevation:** APPLICABLE

Asset Name	Recommended Planning Horizon	Recommended Return Period	Max	Min	Area Weighted Average
			(ft - NAVD88)		
Parking Lot	2050	1% (100-Year)	13.1	13.0	13.1
	2070		15.1	14.8	14.9

**Projected Wave Action Water Elevation:** APPLICABLE

Asset Name	Recommended Planning Horizon	Recommended Return Period	Max	Min	Area Weighted Average
			(ft - NAVD88)		
Parking Lot	2050	1% (100-Year)	15.4	13.1	14.5
	2070		17.9	15.0	16.6

**Projected Wave Heights:** APPLICABLE

Asset Name	Recommended Planning Horizon	Recommended Return Period	Max	Min	Area Weighted Average
			(Feet)		
Parking Lot	2050	1% (100-Year)	3.5	0.0	1.9
	2070		4.0	0.0	2.4

**Projected Duration of Flooding:** APPLICABLE

[Methodology to Estimate Projected Values](#)

**Projected Design Flood Velocity:** APPLICABLE

[Methodology to Estimate Projected Values](#)

**Projected Scour & Erosion:** NOT APPLICABLE

**Extreme Precipitation**

High Risk

Target Planning Horizon: 2070

Return Period: 25-yr (4%)

**LIMITATIONS:** The recommended Standards for Total Precipitation Depth & Peak Intensity are determined by the user drawn polygon and relationships as defined in the Supporting Documents. The projected Total Precipitation Depth values provided through the Tool are based on the climate projections developed by Cornell University as part of EEA's Massachusetts Climate and Hydrologic Risk Project, GIS-based data as of 10/15/21. For additional information on the methodology of these precipitation outputs, see Supporting Documents.

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**Applicable Design Criteria**

**Tiered Methodology:** Tier 3

**Projected Total Precipitation Depth & Peak Intensity for 24-hr Design Storms:** APPLICABLE

Asset Name	Recommended Planning Horizon	Recommended Return Period (Design Storm)	Projected 24-hr Total Precipitation Depth (Inches)	Step-by-Step Methodology for Peak Intensity
Parking Lot	2070	25-Year (4%)	7.5	<a href="#">Downloadable Methodology PDE</a>

**Projected Riverine Peak Discharge & Peak Flood Elevation:** NOT APPLICABLE

**Extreme Heat**

High Risk

Target Planning Horizon: 2070  
 Percentile: 90th Percentile

**LIMITATIONS:** The recommended standards are determined by the user-drawn polygon and relationships as defined in the supporting Section Documents. The guidance provided within this Tool may be used to inform plans and designs, but does not provide guarantees for resilience. The guidance provided within this Tool is intended to be general and users are encouraged to do their own due diligence. One avenue to seek more information would be to access the comprehensive temperature and precipitation projections including additional return periods, time horizons, and seasons at the [Climate Projections Dashboard](#).

**Applicable Design Criteria**

**Projected Annual/Summer/Winter Average Temperatures:** APPLICABLE

Asset Name	Recommended Planning Horizon	Recommended Percentile	Projected Annual Average Temperature [°F]	Projected Summer Average Temperature [°F]	Projected Winter Average Temperature [°F]
Parking Lot	2070	90th	60.65	78.47	42.71

**LIMITATIONS:** The recommended Standards for Projected Average Annual/Summer/Winter Temperature are determined by the user-drawn polygon and relationships as defined in the supporting Section Documents. The guidance provided within this Tool may be used to inform plans and designs, but is not comprehensive and does not provide guarantees for resilience. The guidance provided within this Tool is intended to be general and users are encouraged to do their own due diligence. One avenue to seek more information would be to access the comprehensive temperature and precipitation projections including additional return periods, time horizons, and seasons at the [Climate Projections Dashboard](#).

**Projected Growing Degree Days:** NOT APPLICABLE

**Projected Days Per Year With Max Temp > 95°F, >90°F, <32°F:** APPLICABLE

Asset Name	Recommended Planning Horizon	Recommended Percentile	Projected Days with Max Temp >95°F (days)	Projected Days with Max Temp >90°F (days)	Projected Days with Max Temp <32°F (days)
Parking Lot	2070	90th	9	35	42

**LIMITATIONS:** The recommended Standards for Projected Days per Year with Max Temp >95°F, >90°F, <32°F are determined by the user-drawn polygon and relationships as defined in the supporting Section Documents. The guidance provided within this Tool may be used to inform plans and designs, but is not comprehensive and does not provide guarantees for resilience. The guidance provided within this Tool is intended to be general and users are encouraged to do their own due diligence. One avenue to seek more information would be to access the comprehensive temperature and precipitation projections including additional return periods, time horizons, and seasons at the [Climate Projections Dashboard](#).

**Projected Number of Heat Waves Per Year & Average Heat Wave Duration:** APPLICABLE

Asset Name	Recommended Planning Horizon	Recommended Percentile	Projected Number of Heat Waves Per Year (events)	Projected Average Heat Wave Duration (days)
Parking Lot	2070	90th	0	4

**LIMITATIONS:** The recommended Standards for Projected Number of Heat Waves Per Year and Average Heat Wave Duration are determined by the user-drawn polygon and relationships as defined in the supporting Section Documents. The guidance provided within this Tool may be used to inform plans and designs, but is not comprehensive and does not provide guarantees for resilience. The guidance provided within this Tool is intended to be general and users are encouraged to do their own due diligence. One avenue to seek more information would be to access the comprehensive temperature and precipitation projections including additional return periods, time horizons, and seasons at the [Climate Projections Dashboard](#).

**Projected Cooling Degree Days & Heating Degree Days (base = 65°F): APPLICABLE**

Asset Name	Recommended Planning Horizon	Recommended Percentile	Projected Cooling Degree Days (base = 65°) (degree days)	Projected Heating Degree Days (base = 65°) (degree days)
Parking Lot	2070	90th	1749	3338

**LIMITATIONS:** The recommended Standards for Projected Cooling Degree Days and Heating Degree Days are determined by the user-drawn polygon and relationships as defined in the supporting Section Documents. The guidance provided within this Tool may be used to inform plans and designs, but is not comprehensive and does not provide guarantees for resilience. The guidance provided within this Tool is intended to be general and users are encouraged to do their own due diligence. One avenue to seek more information would be to access the comprehensive temperature and precipitation projections including additional return periods, time horizons, and seasons at the [Climate Projections Dashboard](#).

**Projected Heat Index: APPLICABLE**

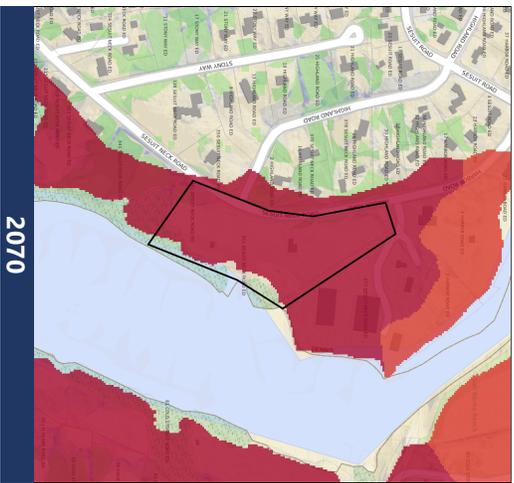
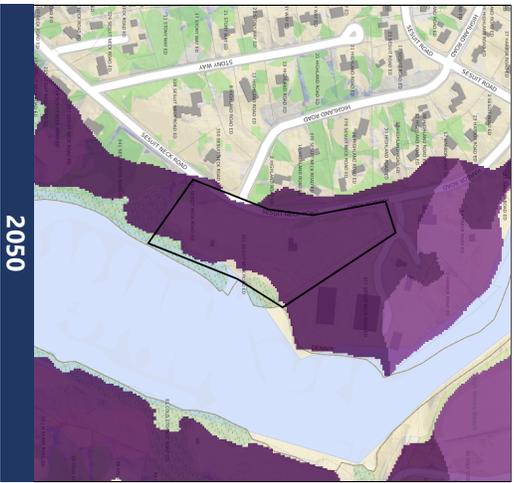
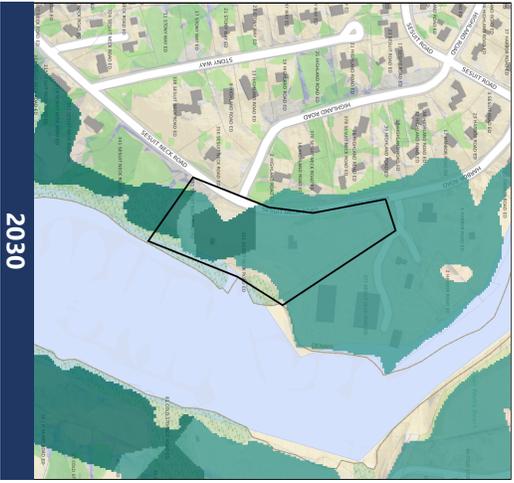
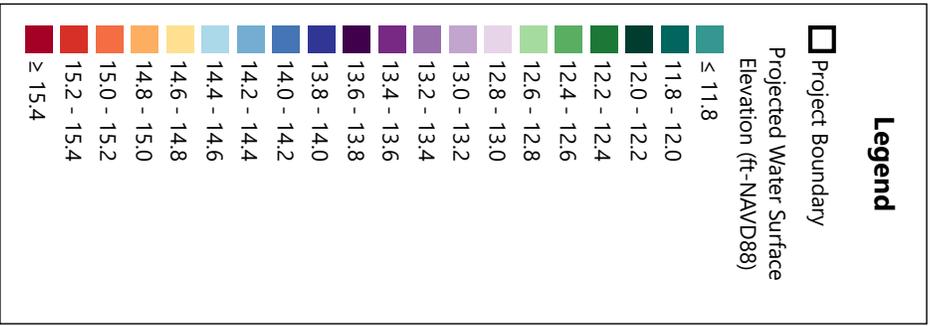
[Methodology to Estimate Projected Values](#) : Tier 3

## Sea Level Rise/Storm Surge Project Maps

The following three maps illustrate the Projected Water Surface Elevation for the 2030, 2050, and 2070 planning horizons corresponding to the lowest return period (largest design storm) recommended across the assets identified for this project in the Tool. For projects that only have Natural Resource assets, the maps will show the Projected Water Surface Elevations corresponding to the 5% (20-year) return period. Refer to the Climate Resilience Design Standards Output - Sea Level Rise/Storm Surge Section for additional values associated with other assets. The maps include the project area as drawn by the user with a 0.1 mile minimum buffer, but do not reflect the location of specific assets on the site.

**LIMITATIONS:** The recommended Climate Resilience Design Standards for the Sea Level Rise / Storm Surge Design Criteria are based on the user drawn polygon and relationships as defined in the Supporting Documents. The projected values and maps provided through the Tool are based on the Massachusetts Coast Flood Risk Model (MC-FRM) outputs as of 9/13/2021, which included GIS-based data for three planning horizons (2030, 2050, 2070) and six return periods (0.1%, 0.2%, 0.5%, 1%, 2%, 5%). These values are projections based on assumptions as defined in the model and the LiDAR used at the time. For additional information on the MC-FRM, review the additional resources provided on the Start Here page.

The projected values, maps, Standards, and Guidance provided within this Tool may be used to inform plans and designs, but they do not provide guarantees for future conditions or resilience. The projected values are not to be considered final or appropriate for construction documents without supporting engineering analyses. The guidance provided within this Tool is intended to be general and users are encouraged to do their own due diligence.



**Climate Resilience Design Standards Tool:  
Sea Level Rise/Storm Surge Design Criteria  
Projected Water Surface Elevation Map: 0.5% (200-yr)**

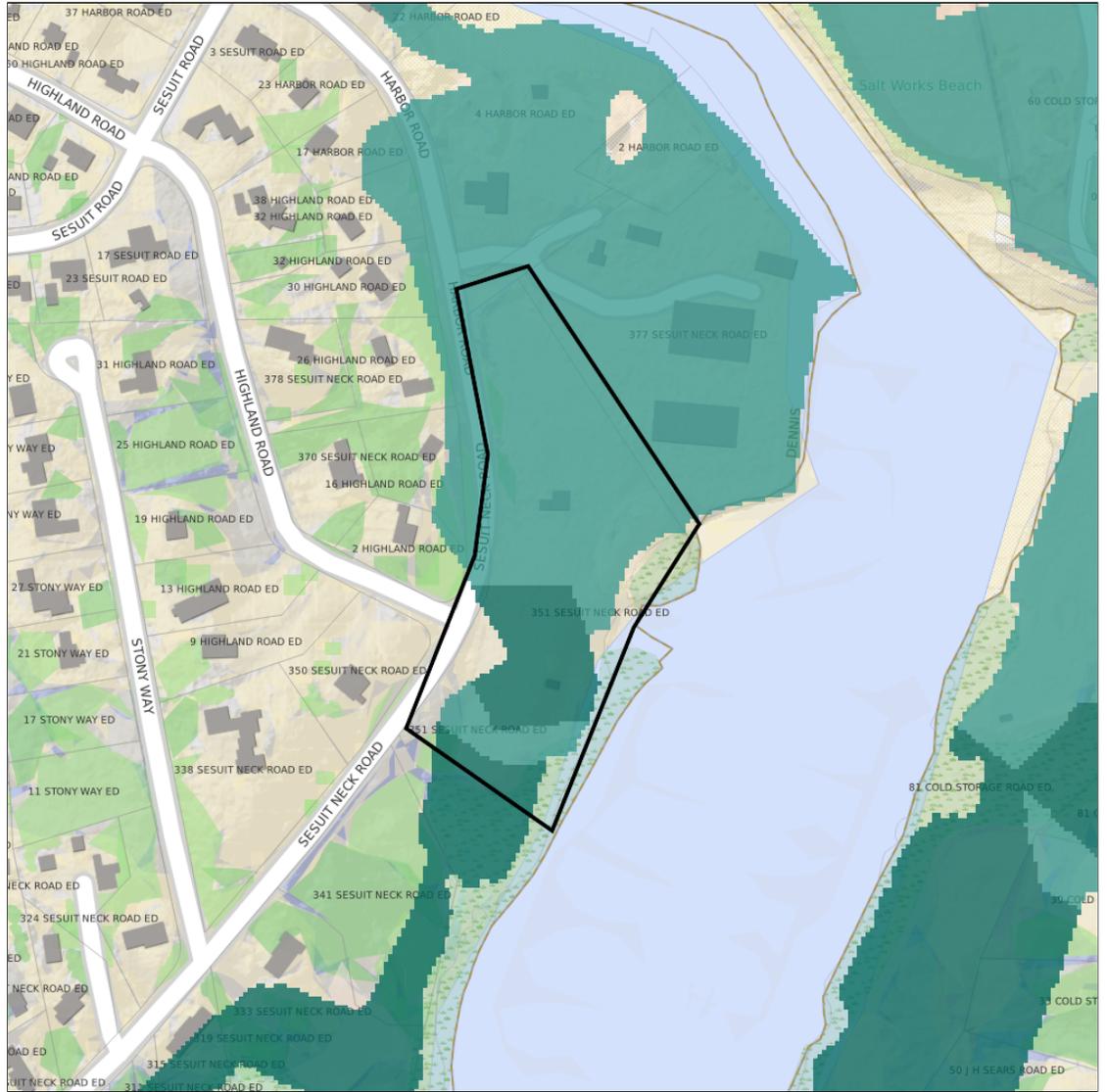
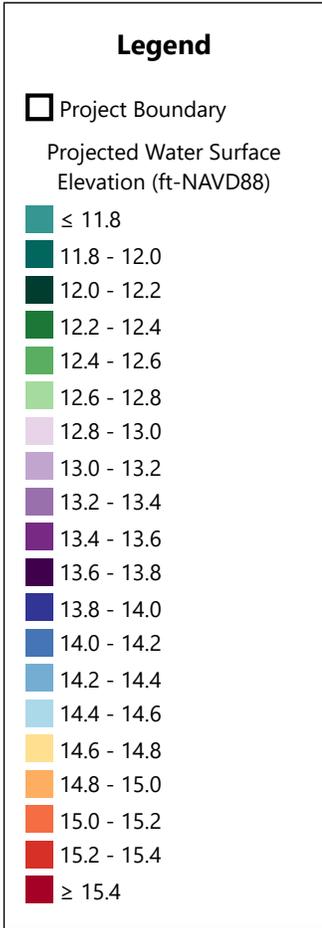
Project Name: Sesuit Harbor Improvements  
Location (Town): Dennis



Created by: grounseville  
Date Created: 9/2/2025  
Tool Version: 1.4

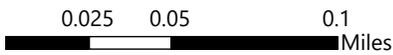


Asset Name	Planning Horizon		Return Period	Max/Min Area Weighted Average (ft-NAVD88)								
	2030	2050		2070	2030	2050	2070					
Harbor Master Office & Public Restroom Facilities	2030	2050	2070	0.5% (200-yr)	0.5% (200-yr)	0.5% (200-yr)	11.9 11.8	13.6 13.6	15.4 15.4	11.8	13.6	15.4



**Climate Resilience Design Standards Tool:  
Sea Level Rise/Storm Surge Design Criteria  
Projected Water Surface Elevation Map: 2030, 0.5% (200-yr)**

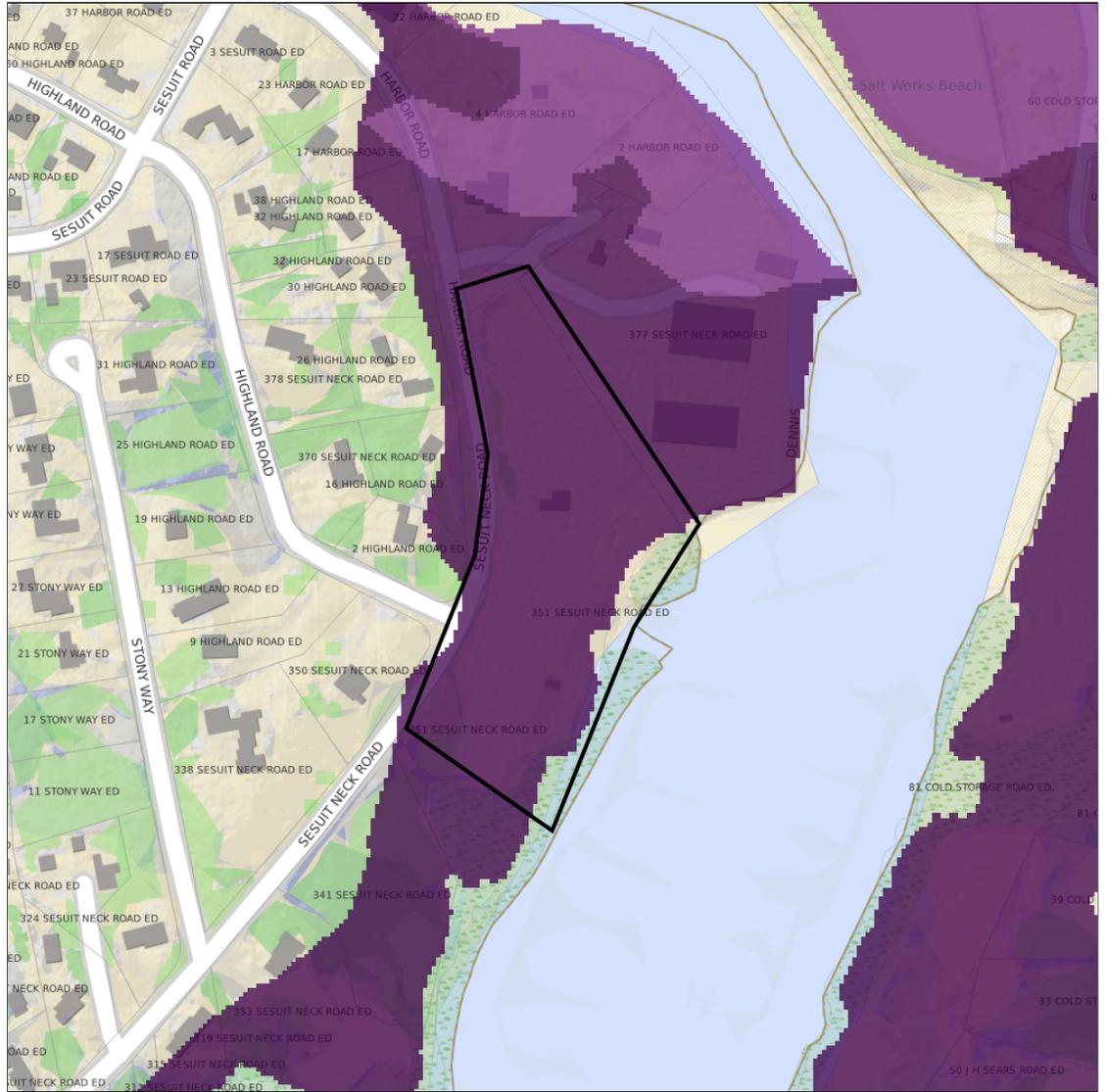
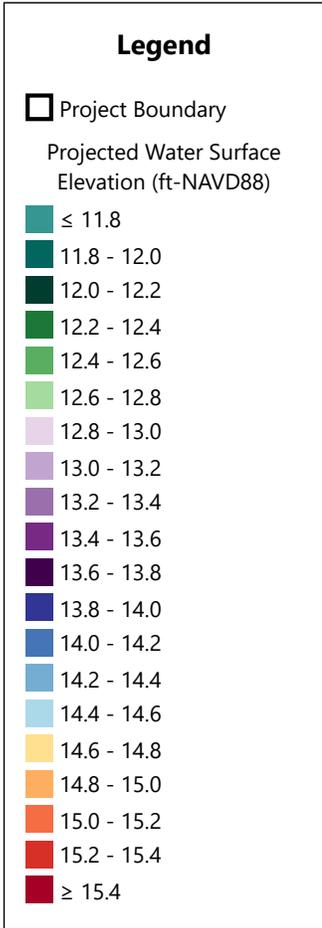
Project Name: Sesuit Harbor Improvements  
Location (Town): Dennis



Created by: grounseville  
Date Created: 9/2/2025  
Tool Version: 1.4

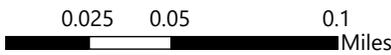


Asset Name	Planning Horizon	Return Period	Area Weighted Average (ft-NAVD88)		
			Max	Min	Area Weighted Average
Harbor Master Office & Public Restroom Facilities	2030	0.5% (200-yr)	11.9	11.8	11.8



**Climate Resilience Design Standards Tool:  
Sea Level Rise/Storm Surge Design Criteria  
Projected Water Surface Elevation Map: 2050, 0.5% (200-yr)**

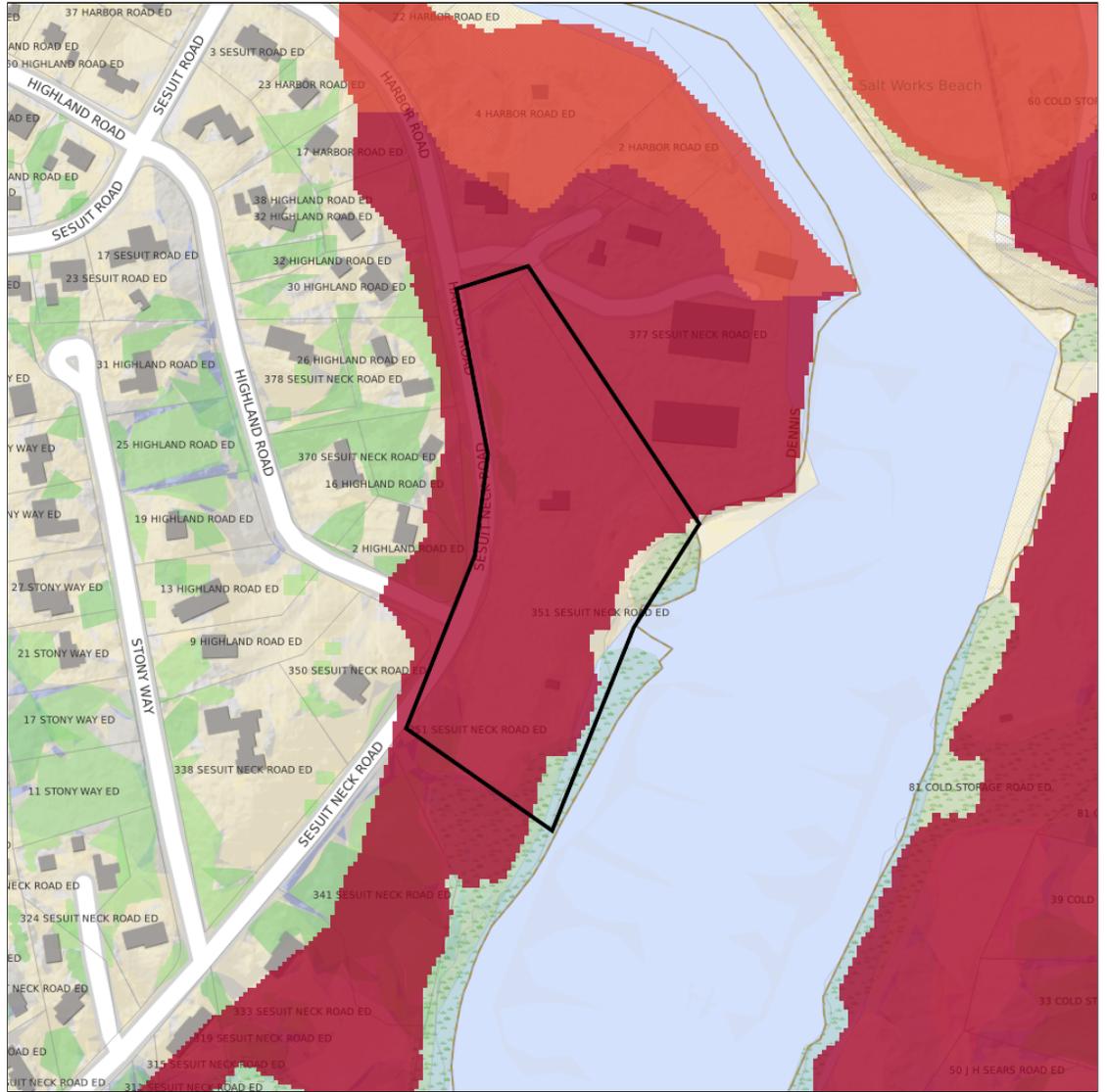
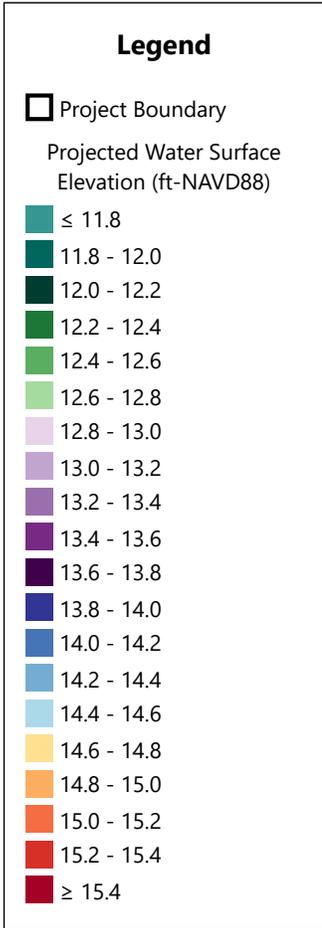
Project Name: Sesuit Harbor Improvements  
Location (Town): Dennis



Created by: grounseville  
Date Created: 9/2/2025  
Tool Version: 1.4

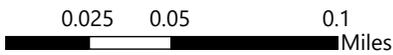


Asset Name	Planning Horizon	Return Period	Area Weighted Average (ft-NAVD88)		
			Max	Min	Area Weighted Average
Harbor Master Office & Public Restroom Facilities	2050	0.5% (200-yr)	13.6	13.6	13.6



**Climate Resilience Design Standards Tool:**  
**Sea Level Rise/Storm Surge Design Criteria**  
**Projected Water Surface Elevation Map: 2070, 0.5% (200-yr)**

Project Name: Sesuit Harbor Improvements  
 Location (Town): Dennis



Created by: grounseville  
 Date Created: 9/2/2025  
 Tool Version: 1.4



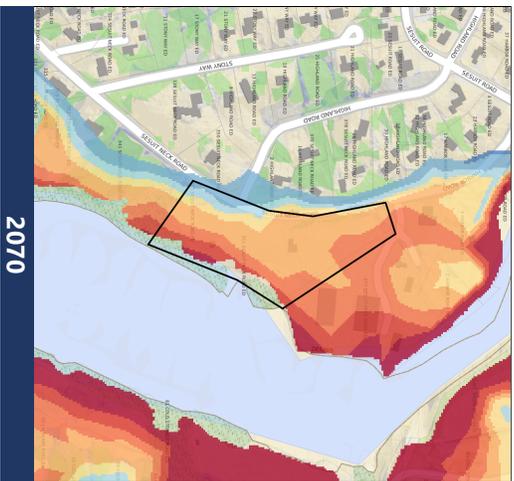
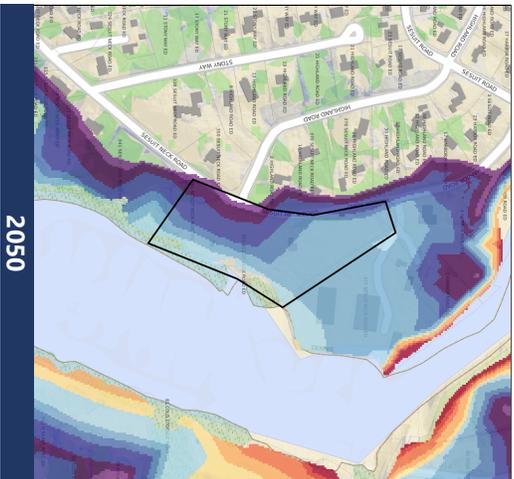
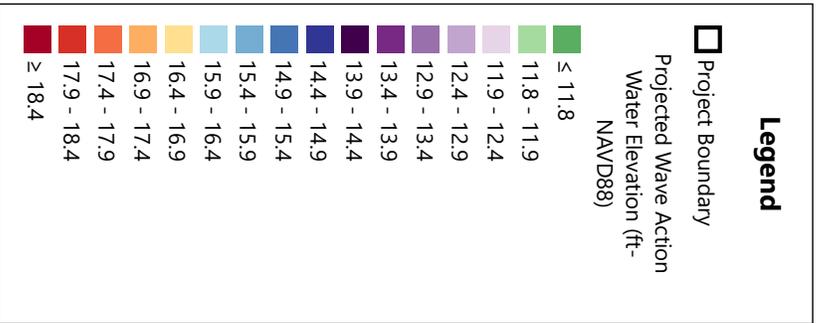
Asset Name	Planning Horizon	Return Period	Area Weighted Average (ft-NAVD88)		
			Max	Min	Area Weighted Average
Harbor Master Office & Public Restroom Facilities	2070	0.5% (200-yr)	15.4	15.4	15.4

## Sea Level Rise/Storm Surge Project Maps

The following three maps illustrate the Projected Wave Action Water Elevation for the 2030, 2050, and 2070 planning horizons corresponding to the lowest return period (largest design storm) recommended across the assets identified for this project in the Tool. For projects that only have Natural Resource assets, the maps will show the Projected Wave Action Water Elevations corresponding to the 5% (20-year) return period. Refer to the Climate Resilience Design Standards Output - Sea Level Rise/Storm Surge Section for additional values associated with other assets. The maps include the project area as drawn by the user with a 0.1 mile minimum buffer, but do not reflect the location of specific assets on the site.

**LIMITATIONS:** The recommended Climate Resilience Design Standards for the Sea Level Rise / Storm Surge Design Criteria are based on the user drawn polygon and relationships as defined in the Supporting Documents. The projected values and maps provided through the Tool are based on the Massachusetts Coast Flood Risk Model (MC-FRM) outputs as of 9/13/2021, which included GIS-based data for three planning horizons (2030, 2050, 2070) and six return periods (0.1%, 0.2%, 0.5%, 1%, 2%, 5%). These values are projections based on assumptions as defined in the model and the LiDAR used at the time. For additional information on the MC-FRM, review the additional resources provided on the Start Here page.

The projected values, maps, Standards, and Guidance provided within this Tool may be used to inform plans and designs, but they do not provide guarantees for future conditions or resilience. The projected values are not to be considered final or appropriate for construction documents without supporting engineering analyses. The guidance provided within this Tool is intended to be general and users are encouraged to do their own due diligence.



**Climate Resilience Design Standards Tool:  
Sea Level Rise/Storm Surge Design Criteria  
Projected Wave Action Water Elevation Map: 0.5% (200-yr)**

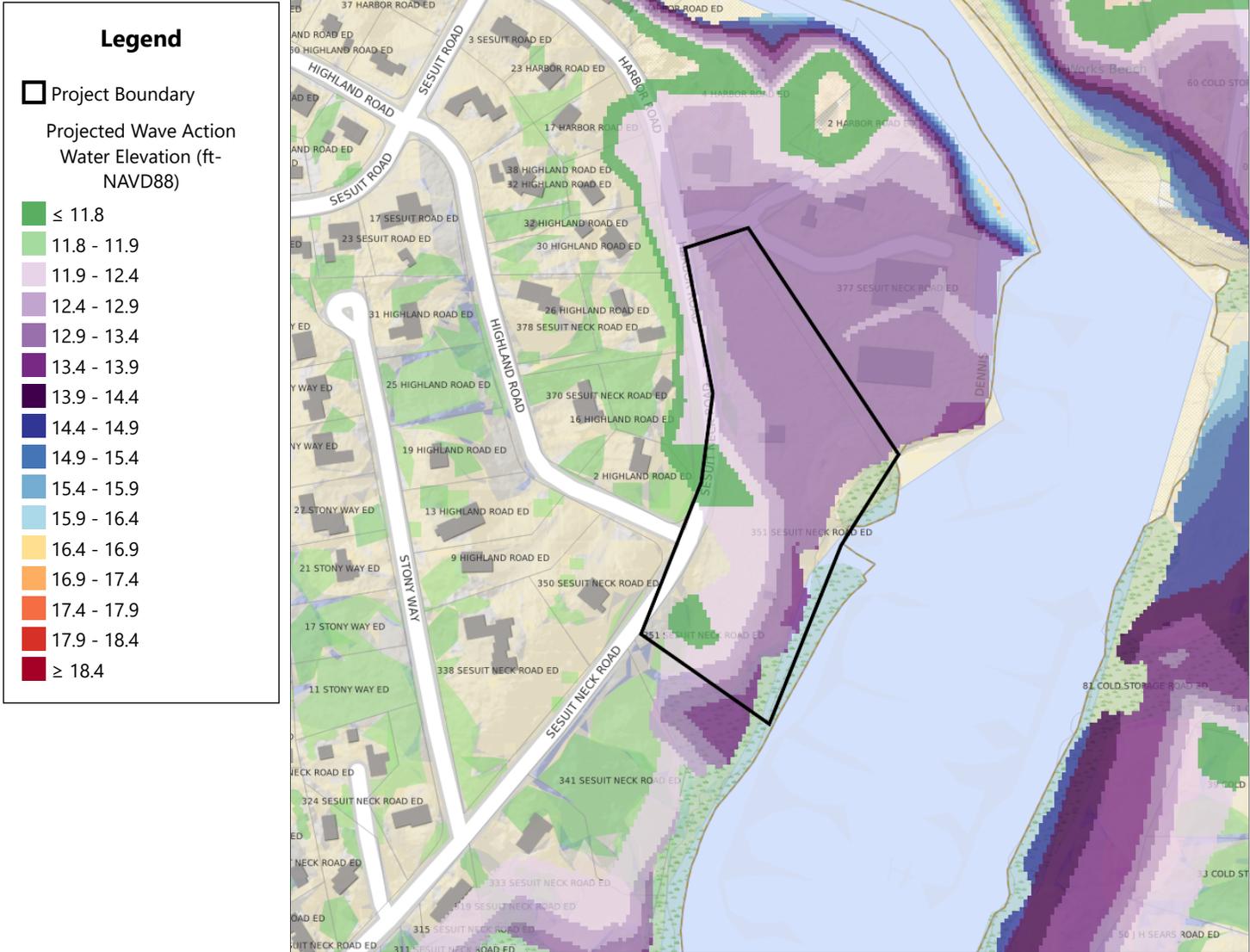
Project Name: Sesuit Harbor Improvements  
Location (Town): Dennis



Created by: grounseville  
Date Created: 9/2/2025  
Tool Version: 1.4



Asset Name	Planning Horizon	Return Period	Max/Min/Area Weighted Average (ft-NAVD88)		
			Max	Min	Area Weighted Average
Harbor Master Office & Public Restroom Facilities	2030	0.5% (200-yr)	13.8	11.8	12.7
	2050	0.5% (200-yr)	16.2	13.6	15.1
	2070	0.5% (200-yr)	18.4	15.4	17.2



**Climate Resilience Design Standards Tool:  
Sea Level Rise/Storm Surge Design Criteria  
Projected Wave Action Water Elevation Map: 2030, 0.5% (200-yr)**

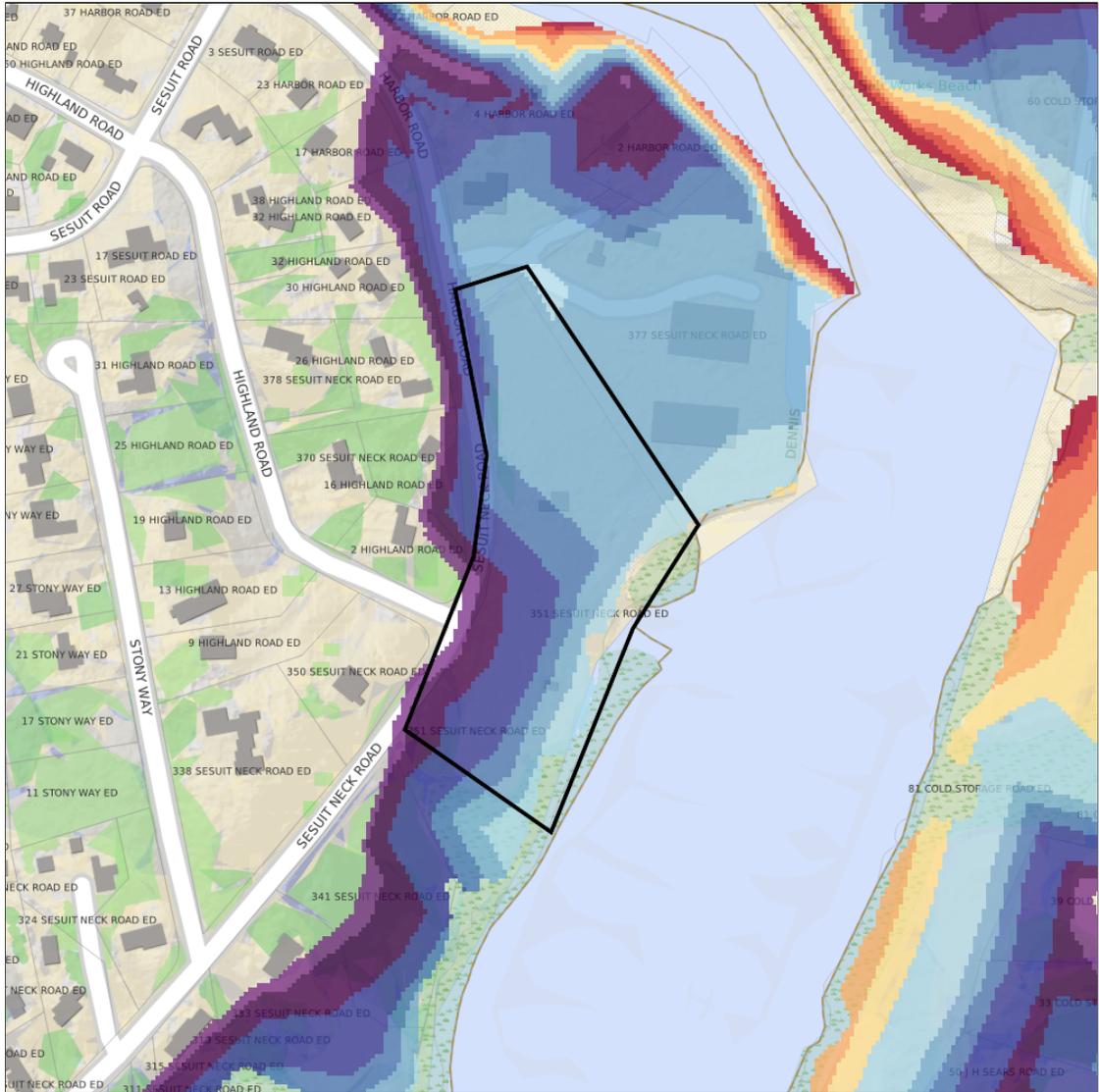
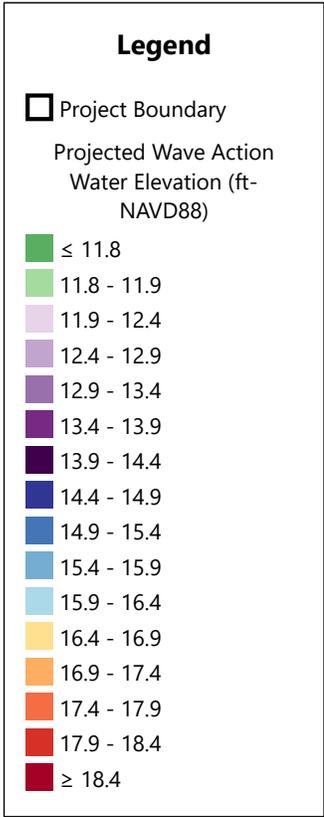
Project Name: Sesuit Harbor Improvements  
Location (Town): Dennis



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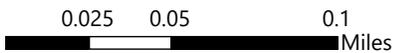


Asset Name	Planning Horizon	Return Period	Area Weighted Average (ft-NAVD88)		
			Max	Min	Area Weighted Average
Harbor Master Office & Public Restroom Facilities	2030	0.5% (200-yr)	13.8	11.8	12.7



**Climate Resilience Design Standards Tool:  
Sea Level Rise/Storm Surge Design Criteria  
Projected Wave Action Water Elevation Map: 2050, 0.5% (200-yr)**

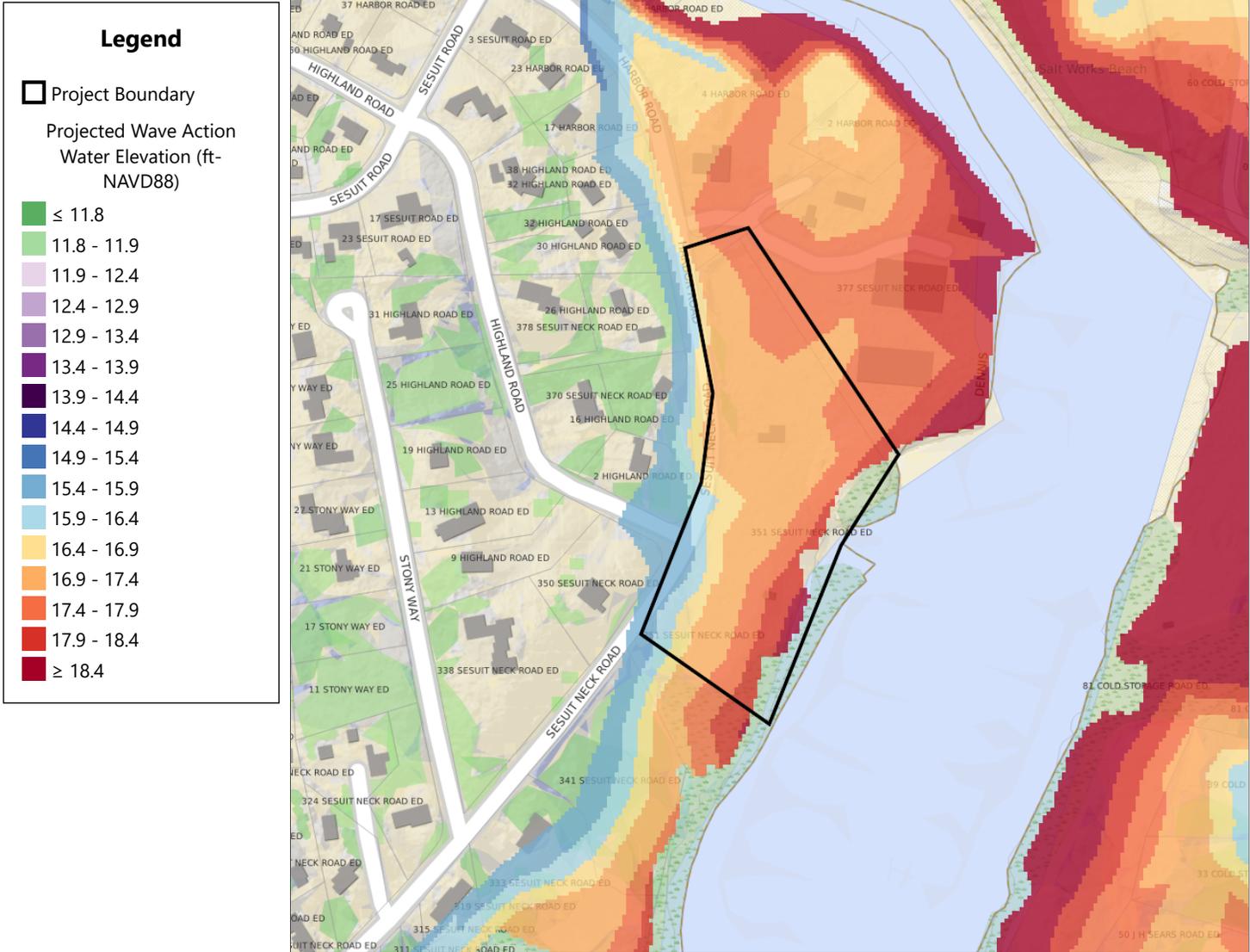
Project Name: Sesuit Harbor Improvements  
Location (Town): Dennis



Created by: grounseville  
Date Created: 9/2/2025  
Tool Version: 1.4



Asset Name	Planning Horizon	Return Period	Max/Min/Area Weighted Average (ft-NAVD88)		
			Max	Min	Area Weighted Average
Harbor Master Office & Public Restroom Facilities	2050	0.5% (200-yr)	16.2	13.6	15.1



**Climate Resilience Design Standards Tool:  
Sea Level Rise/Storm Surge Design Criteria  
Projected Wave Action Water Elevation Map: 2070, 0.5% (200-yr)**

Project Name: Sesuit Harbor Improvements  
Location (Town): Dennis



Created by: grounseville  
Date Created: 9/2/2025  
Tool Version: 1.4



Asset Name	Planning Horizon	Return Period	Area Weighted Average (ft-NAVD88)		
			Max	Min	Area Weighted Average
Harbor Master Office & Public Restroom Facilities	2070	0.5% (200-yr)	18.4	15.4	17.2

## Project Inputs

### Core Project Information

Name:	Sesuit Harbor Improvements
Given the expected useful life of the project, through what year do you estimate the project to last (i.e. before a major reconstruction/renovation)?	2076
Location of Project:	Dennis
Estimated Capital Cost:	\$8,000,000
Who is the Submitting Entity?	City/Town Dennis Greg Rounseville (grounseville@town.dennis.ma.us)
Is this project identified as a priority project in the Municipal Vulnerability Preparedness (MVP) plan or the local or regional Hazard Mitigation Plan (HMP)?	Yes
Is this project being submitted as part of a state grant application?	No
Which grant program?	
What stage are you in your project lifecycle?	Construction
Is climate resiliency a core objective of this project?	Yes
Is this project being submitted as part of the state capital planning process?	No
Is this project being submitted as part of a regulatory review process or permitting?	No
Brief Project Description:	The proposed Sesuit Harbor Improvements project is intended to be a complete renovation and modernization of the land side Harbormaster facilities and site. Proposed new Harbormaster office of ±1,000sf with adjoining ±500sf public restroom facility. A new workshop/ garage facility of ±1,524sf is proposed at a remote locate on site and will better support ongoing dock maintenance and other marina operations. All proposed new buildings will be positioned and constructed to meet or exceed the AE flood zone requirements in which they are located. The proposed site improvements include paving all parking areas and providing compliant stormwater controls for the entire site. Perimeter sidewalks are being provided to get pedestrians out of the vehicular circulation areas and directing them to the docks or harbormaster offices and public restrooms. The project has received unanimous approval from the local Conservation Commission and was seen as a significant net improvement to site.

### Project Ecosystem Service Benefits

#### Factors Influencing Output

- ✓ Project provides flood protection through nature-based solutions
- ✓ Project reduces storm damage
- ✓ Project protects public water supply
- ✓ Project promotes decarbonization
- ✓ Project recharges groundwater
- ✓ Project improves water quality
- ✓ Project protects fisheries, wildlife, and plant habitat
- ✓ Project protects land containing shellfish
- ✓ Project provides pollinator habitat
- ✓ Project provides recreation
- ✓ Project improves air quality
- ✓ Project prevents pollution

#### Factors to Improve Output

- ✓ Incorporate green infrastructure to filter stormwater

#### Is the primary purpose of this project ecological restoration?

No

### Project Benefits

Provides flood protection through nature-based solutions	Yes
Reduces storm damage	Yes
Recharges groundwater	Yes
Protects public water supply	Yes
Filters stormwater using green infrastructure	Maybe
Improves water quality	Yes
Promotes decarbonization	Yes
Enables carbon sequestration	No

Provides oxygen production	No
Improves air quality	Yes
Prevents pollution	Yes
Remediates existing sources of pollution	No
Protects fisheries, wildlife, and plant habitat	Yes
Protects land containing shellfish	Yes
Provides pollinator habitat	Yes
Provides recreation	Yes
Provides cultural resources/education	Yes

### Project Climate Hazard Exposure

Is the primary purpose of this project ecological restoration?	No
Does the project site have a history of coastal flooding?	Yes
Does the project site have a history of flooding during extreme precipitation events (unrelated to water/sewer damages)?	No
Does the project site have a history of riverine flooding?	No
Does the project result in a net increase in impervious area of the site?	No
Are existing trees being removed as part of the proposed project?	No

### Project Assets

Asset: Harbor Master Office & Public Restroom Facilities  
 Asset Type: Typically Occupied  
 Asset Sub-Type: Government building  
 Construction Type: New Construction  
 Construction Year: 2026  
 Useful Life: 50

**Identify the length of time the asset can be inaccessible/inoperable without significant consequences.**

Building may be inaccessible/inoperable during natural hazard event, but must be accessible/operable within one day after natural hazard event

**Identify the geographic area directly affected by permanent loss or significant inoperability of the building/facility.**

Impacts would be limited to local area and/or municipality

**Identify the population directly served that would be affected by the permanent loss of use or inoperability of the building/facility.**

Greater than 10,000 people

**Identify if the building/facility provides services to populations that reside within Environmental Justice neighborhoods or climate vulnerable populations.**

The building/facility does not provide services to populations that reside within Environmental Justice neighborhoods or climate vulnerable populations.

**If the building/facility became inoperable for longer than acceptable in Question 1, how, if at all, would it be expected to impact people's health and safety?**

Inoperability of the building/facility would result in moderate or severe injuries or moderate or severe impacts to chronic illnesses

**If there are hazardous materials in your building/facility, what are the extent of impacts related to spills/releases of these materials?**

Spills and/or releases of hazardous materials would be relatively easy to clean up

**If the building/facility became inoperable for longer than acceptable in Question 1, what are the impacts on other facilities, assets, and/or infrastructure?**

Moderate – Inoperability may impact other facilities, assets, or buildings, but is not expected to affect their ability to operate

**If this building/facility was damaged beyond repair, how much would it approximately cost to replace?**

Less than \$10 million

**Is this a recreational facility which can be vacated during a natural hazard event?**

Yes

**If the building/facility became inoperable for longer than acceptable in Question 1, what are the public and/or social services impacts?**

Some alternative programs and/or services are available to support the community

**If the building/facility became inoperable for longer than acceptable in Question 1, what are the environmental impacts related to natural resources?**

No impact on surrounding natural resources is expected

**If the building/facility became inoperable for longer than acceptable in Question 1, what are the impacts to government services (i.e. the building is not able to serve or operate its intended users or function)?**

Loss of building may reduce the ability to maintain some government services, while a majority of services will still exist.

**If the building/facility became inoperable for longer than acceptable in Question 1, what are the impacts to loss of confidence in government (i.e. the building is not able to serve or operate its intended users or function)?**

Loss of confidence in government agency

Asset: Harbor Master Garage  
 Asset Type: Typically Unoccupied  
 Asset Sub-Type: Maintenance facility  
 Construction Type: New Construction  
 Construction Year: 2026  
 Useful Life: 50

**Identify the length of time the asset can be inaccessible/inoperable without significant consequences.**

Building may be inaccessible/inoperable for more than a day, but less than a week after natural hazards events without consequences

**Identify the geographic area directly affected by permanent loss or significant inoperability of the building/facility.**

Impacts would be limited to local area and/or municipality

**Identify the population directly served that would be affected by the permanent loss of use or inoperability of the building/facility.**

Less than 1,000 people

**Identify if the building/facility provides services to populations that reside within Environmental Justice neighborhoods or climate vulnerable populations.**

The building/facility does not provide services to populations that reside within Environmental Justice neighborhoods or climate vulnerable populations.

**If the building/facility became inoperable for longer than acceptable in Question 1, how, if at all, would it be expected to impact people's health and safety?**

Inoperability of the building/facility would not be expected to result in injuries

**If there are hazardous materials in your building/facility, what are the extent of impacts related to spills/releases of these materials?**

Spills and/or releases of hazardous materials would be relatively easy to clean up

**If the building/facility became inoperable for longer than acceptable in Question 1, what are the impacts on other facilities, assets, and/or infrastructure?**

Significant – Inoperability is likely to impact other facilities, assets, or buildings and will likely affect their ability to operate

**If this building/facility was damaged beyond repair, how much would it approximately cost to replace?**

Less than \$10 million

**Is this a recreational facility which can be vacated during a natural hazard event?**

Yes

**If the building/facility became inoperable for longer than acceptable in Question 1, what are the public and/or social services impacts?**

Some alternative programs and/or services are available to support the community

**If the building/facility became inoperable for longer than acceptable in Question 1, what are the environmental impacts related to natural resources?**

No impact on surrounding natural resources is expected

**If the building/facility became inoperable for longer than acceptable in Question 1, what are the impacts to government services (i.e. the building is not able to serve or operate its intended users or function)?**

Loss of building may reduce the ability to maintain some government services, while a majority of services will still exist.

**If the building/facility became inoperable for longer than acceptable in Question 1, what are the impacts to loss of confidence in government (i.e. the building is not able to serve or operate its intended users or function)?**

Loss of confidence in government agency

Asset: Parking Lot

Asset Type: Typically Occupied

Asset Sub-Type: Other

Construction Type: New Construction

Construction Year: 2026

Useful Life: 50

**Identify the length of time the asset can be inaccessible/inoperable without significant consequences.**

Building may be inaccessible/inoperable for more than a day, but less than a week after natural hazards events without consequences

**Identify the geographic area directly affected by permanent loss or significant inoperability of the building/facility.**

Impacts would be limited to local area and/or municipality

**Identify the population directly served that would be affected by the permanent loss of use or inoperability of the building/facility.**

Greater than 10,000 people

**Identify if the building/facility provides services to populations that reside within Environmental Justice neighborhoods or climate vulnerable populations.**

The building/facility does not provide services to populations that reside within Environmental Justice neighborhoods or climate vulnerable populations.

**If the building/facility became inoperable for longer than acceptable in Question 1, how, if at all, would it be expected to impact people's health and safety?**

Inoperability of the building/facility would be expected to result in minor impacts to people's health, including minor injuries or minor impacts to chronic illnesses

**If there are hazardous materials in your building/facility, what are the extent of impacts related to spills/releases of these materials?**

Spills and/or releases of hazardous materials would be relatively easy to clean up

**If the building/facility became inoperable for longer than acceptable in Question 1, what are the impacts on other facilities, assets, and/or infrastructure?**

Significant – Inoperability is likely to impact other facilities, assets, or buildings and will likely affect their ability to operate

**If this building/facility was damaged beyond repair, how much would it approximately cost to replace?**

Less than \$10 million

**Is this a recreational facility which can be vacated during a natural hazard event?**

Yes

**If the building/facility became inoperable for longer than acceptable in Question 1, what are the public and/or social services impacts?**

Some alternative programs and/or services are available to support the community

**If the building/facility became inoperable for longer than acceptable in Question 1, what are the environmental impacts related to natural resources?**

No impact on surrounding natural resources is expected

**If the building/facility became inoperable for longer than acceptable in Question 1, what are the impacts to government services (i.e. the building is not able to serve or operate its intended users or function)?**

Loss of building may reduce the ability to maintain some government services, while a majority of services will still exist.

**If the building/facility became inoperable for longer than acceptable in Question 1, what are the impacts to loss of confidence in government (i.e. the building is not able to serve or operate its intended users or function)?**

Loss of confidence in government agency

## Report Comments

N/A