Falmouth Climate Action Plan

Prepared for the Town of Falmouth, Maine. September 2023.

Letter from Falmouth's Climate Action Planning Committee

Dear Neighbors and Members of the Town Council,

The Climate Action Planning Committee is pleased to present the Climate Action Plan to the Town Council and the broader community.

As we are witnessing on an almost daily basis, the effects of climate change are here in Maine. We are seeing negative impacts on ecosystems, infrastructure, the health of Maine people, wildlife, and our economy. As described in this plan, climate change hazards may result in risks to Falmouth's critical infrastructure, resident safety, local economy, and natural resources.

The Climate Action Plan is the product of many hours of visioning, planning, discussion, review, and collaboration by the planning committee members, Town staff, consultant team, Town residents, business owners, the Recycling and Energy Advisory Committee, and the Conservation Commission. This plan follows several years of climate planning work, including signing the U.S. Mayors' Climate Protection Agreement in 2007, the 2010 Energy and Climate Protection "Green Ribbon" Report, and the 2018 Municipal and School Department Energy and Sustainability Plan.

This plan will position Falmouth well for a more climate-resilient future. We recognize that this plan and the proposed strategic actions are based on current information. The plan is understood to be a living document and will be updated as new research, modeling, technology, and infrastructure improvements become available. It is also recognized that this plan includes strategies that may become obsolete or unachievable based on many factors, including conditions beyond the Town's control.

Successful implementation of this plan will rely on collaborative efforts between many entities beyond the Town, including state and federal government, local organizations, businesses, and individual community members. Resident engagement will be critical moving forward.

As fellow neighbors, we ask that you join us in envisioning a Falmouth willing to make decisions and take action to lead the Town toward a healthier, more resilient future. Please join us as we continue to build a climate-forward Falmouth. Every member of our community has a role to play.

Thank you,

Falmouth Climate Action Planning Committee

Acknowledgements

This plan was made possible by the many dedicated people who contributed time, energy, and ideas into the development of the plan. We thank the community members who attended meetings, answered surveys, and offered feedback on the plan. Your efforts are greatly appreciated.

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Photo credits: Town of Falmouth

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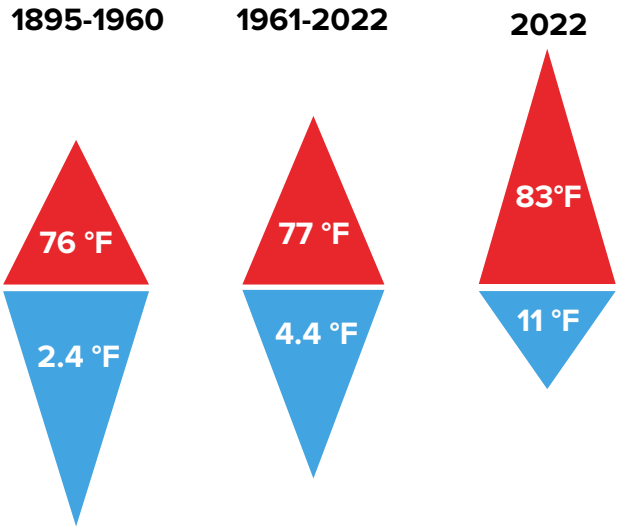
Executive Summary

What is a CAP?

Climate change is here in Maine, and it is causing impacts to our infrastructure, natural ecosystems, and socioeconomic systems. In order to best prepare the people and environment of Falmouth for the effects of localized climate effects, this Climate Action Plan, or CAP, was created. This plan contains strategies and actions that will guide decisions and development for the Town until 2050. The recommendations of this CAP primarily considered the input from Falmouth residents collected through community workshops, surveys, and events. To support a data-based approach to this process, a Greenhouse Gas Inventory (refer to Appendix C for the full report) and a Vulnerability Assesment (Appendix D) were created.

Climate Hazards



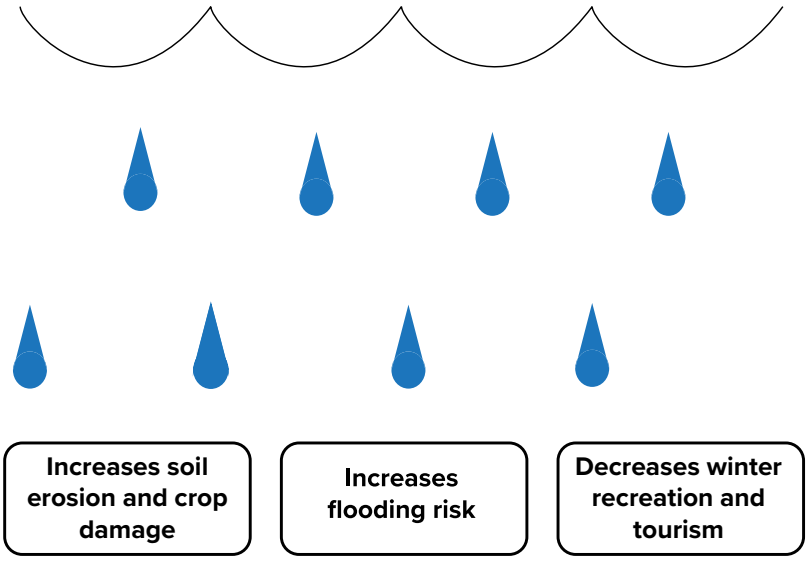
Temperature

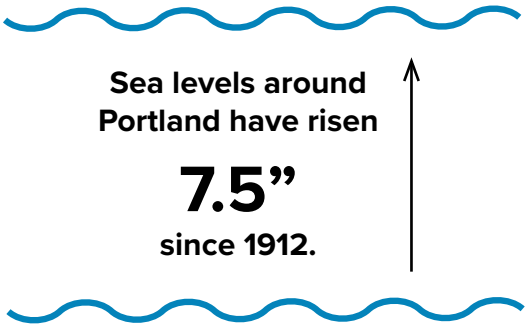
Greenhouse gas emissions have increased the average annual temperature in Maine 3°F since 1895. By 2050, average annual temperatures are projected to increase 3.5 to 4 °F.

The graphic to the left shows the average high temperature for July and the average low temperature for January for the time range indicated.

Precipitation

Annual precipitation has increased by 15% since 1895, but snowfall has decreased due to warming. Maine is also projected to have longer periods of dryness despite the overall increase in rainfall.





Ocean

The water around Falmouth is getting warmer and more acidic. The Gulf of Maine is warming faster than 99% of the world’s oceans, and the surface temperature has increased 2.9°F since 1895. Ocean acidification and sea level will continue to increase, depending on mitigation efforts.

Global climatic change influences how weather and extreme events are affecting Maine. To view the full Vulnerability Assessment, refer to Appendix D. For additional information on Maine’s climate hazards, visit https://www.maine.gov/climateplan/climate-impacts

Climate Impacts

Human Health

Disease

- Increase in heat-related illnesses and fatalities
- Increase in vector-borne illnesses (e.g. lyme, zika, babesiosis)
- Additional strain on the healthcare system, reducing accessibility to medical care

Resource Degradation

- Worsening water and air quality from pollution
- Changes in food supply and availability
- Increased contamination of groundwater sources

Economic Systems

- Changes to property value and municipal tax base
- Decreased resources for industries like fishing and shellfish harvesting
- Reduced opportunities for winter recreational activities

Infrastructure

Damage to Built Environments

- Increase in flooding damage to buildings, roads, bridges, marinas
- More buckling/cracking of pavement
- Disruptions to emergency services and transportation systems

Overloading Systems

- Strain on stormwater and wastewater management systems
- Increased strain on the electrical grid during high heat events

Ecosystem

Changes to Agricultural Systems

- Growing season changes (shorter/longer, depending on the plant)
- More damage to crops

Terrestrial Ecosystem Damage

- Fluctuations in groundwater levels and increased salt accumulation in the soil
- More pest outbreaks and invasive species
- Higher likelihood of wildfires during drought

Marine Ecosystem Damage

- More ocean stratification, disrupting nutrient distribution
- Increase in algal blooms
- Disruptions to native species from invasives

Greenhouse Gas Emissions

Science-Based Emissions Reduction Targets

Phase 1
A 65% emissions reduction by 2030, following guidelines from the most recent Intergovernmental Panel on Climate Change report

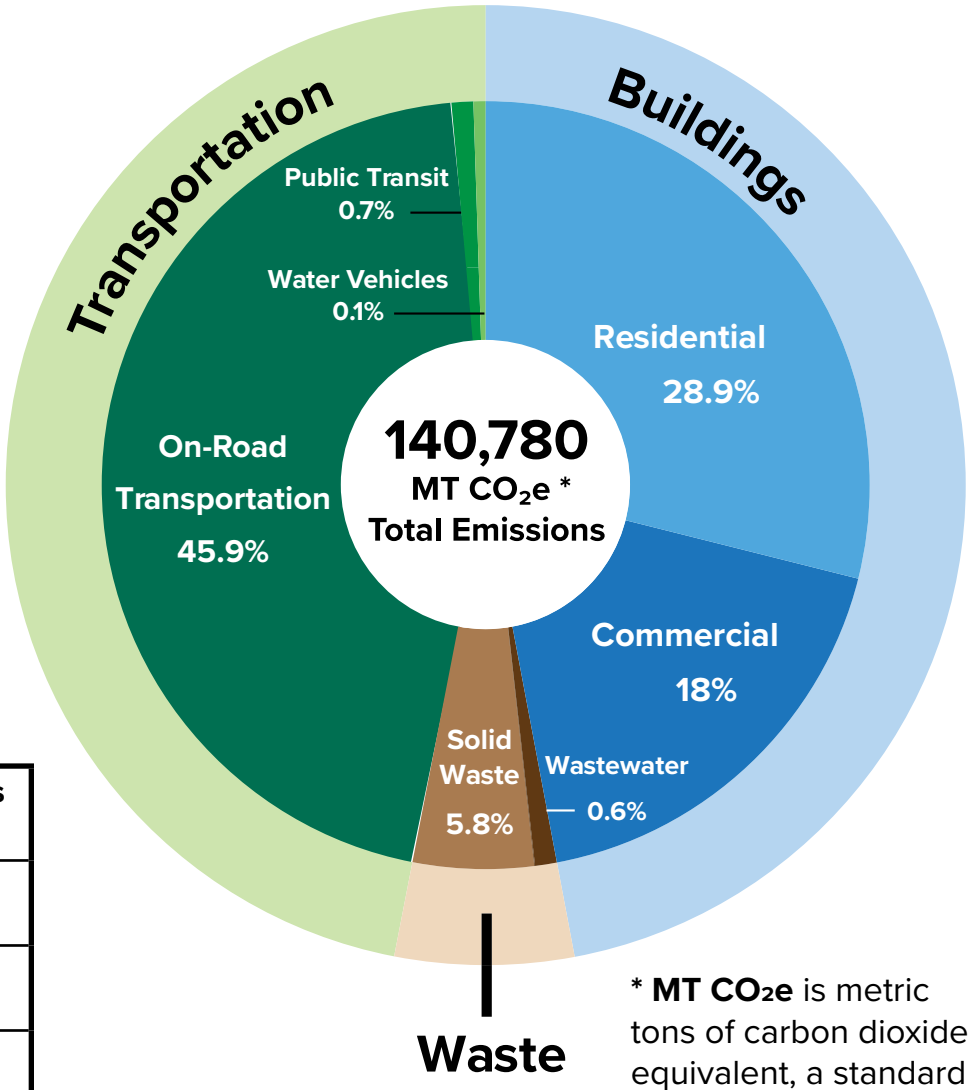
→

Phase 2
An 85% emissions reduction by 2040, as a suggested intermediate goal

→

Phase 3
A push to eliminate community-wide emissions by 2050 and maintain a net-zero emissions output

In support of a data-driven approach to this Climate Action Plan, the 2019 Greenhouse Gas (GHG) emissions for Falmouth were inventoried. The major findings of the 2019 inventory are described in the charts below. The full inventory and explanation of methodology can be viewed in Appendix C.



Sector	Energy Use (MMBtu)	Emissions (CO_2e)
Buildings	1,007,979 (52%)	65,969 (46.9%)
Transport.	920,469 (48%)	65,755 (46.7%)
Waste	-	9,056 (6.4%)
Total	1,928,448 (100%)	140,780 (100%)

* **MT CO_2e** is metric tons of carbon dioxide equivalent, a standard unit for measuring GHG emissions.

Climate Action Strategies

Municipal Operations

Target: The Town of Falmouth has pledged to transition to emissions-free operations by 2040.

Achieving this target willl involve electrifying heating and cooling systems, switching out fuel-based municipal vehicles, retrofitting buildings to increase their energy efficiency, and transitioning to renewable sources of electricity. By moving quickly to reduce emissions the Town will act as an example for the community, helping lead the way in the changes required to create a more resilient community.

Strategies

1.1 Complete energy audits of government operations.

1.2 Reducing fossil fuel use in government facilities.

1.3 Electrify municipal fleet vehicles and provide adequate charging infrastructure for municipal needs.

1.4 Pursue 100% renewably sourced electricity generation for government operations.

1.5 Reduce municipal waste stream and ensure sustainably sourced government consumption.

1.6 Develop project ideas for at-risk infrastructure or ecosystems.

1.7 Ensure department staff has capacity to enact Climate Action Plan.

Climate Action Strategies

Buildings & Energy Usage

Targets:
Produce 20% of residential energy needs from on-site renewable sources.
Reduce energy needs by 8% through energy retrofits by 2050.

Residential and commercial energy usage combined make up 46% of Falmouth's total greenhouse gas emissions, making this an essential area of action. To achieve the targets, actions in this section will focus on electrification of building systems and improvements in efficiency. This section also includes strategies to make buildings more resilient as climate impacts threatens the safety and security of Town residents, especially our most vulnerable groups.

Did You Know?

The federal tax credit for installing on-site renewable energy is **30%** until 2032.

Efficiency Maine offers rebates up to **$2,000** for air-source heat pumps, **$3,000** for geothermal heat pumps, and **$8,000** for insulation.

Strategies

2.1 Increase community uptake of electric heating and cooling systems.

2.2 Develop an energy benchmarking program.

2.3 Incentivize fuel and energy efficiency retrofitting in buildings.

2.4 Adopt more efficient building codes.

2.5 Accelerate residential renewable energy usage.

2.6 Expand opportunities for community energy memberships.

2.7 Require new residential and commercial construction to have capacity for sustainable energy.

2.8 Ensure design of new construction incorporates planning for future climate hazards.

2.9 Improve understanding of community vulnerability and engage in adaptation techniques.

Climate Action Strategies

Transportation & Land Use

Target:
Transition 90% of passenger vehicles to EVs by 2050.

Transportation and land use strategies to reduce emissions focus on transitioning to electric vehicles, expanding ease and access of public transit systems, and prioritizing development that makes alternative forms of transportation safer and easier. Transportation emissions accounted for the largest single source of Falmouth's greenhouse gas emissions at 47%, making the minimization of fuel-based transportation the largest opportunity for the Town to meet emission reduction goals. Additionally, building a resilient transportation network is a public safety issue, given the large portion of residents who commute to and from Falmouth every day for work as well as the interconnected system of resources between Falmouth and its neighboring communities.

Strategies

3.1 Promote electric vehicle purchasing.

3.2 Expand public and private charging infrastructure.

3.3 Support medium and heavy-duty electrification in the region.

3.4 Explore options for electric marine motors.

3.5 Prioritize accessible and safe walking, biking, and active transportation in planning.

3.6 Build out public and active transit-oriented infrastructure.

3.7 Adapt transportation infrastructure to climate impacts.

3.8 Ensure safe workforce commuting and transportation networks.

On average, an electric vehicle will save you over 60% on fuel and maintenance costs annually.

From AAA, https://www.aaa.com/autorepair/articles/true-cost-of-ev

Climate Action Strategies

Waste Reduction

Target: Falmouth aims to reduce its waste and commit to recycling to the greatest extent possible.

Waste reduction strategies will expand current efforts to improve recycling and organic composting access, prevent items from entering the waste stream, and develop a resource sharing economy. Fostering resource sharing will discourage overconsumption, which will significantly reduce "upstream" emissions from processes that fall outside of Town boundaries. Communities that produce and re-use resources at the local level whenever possible will also be more resilient to supply shocks or price volatility caused by climate-related impacts such as severe weather.

Strategies

4.1 Promote "circular" resource-sharing economy.

4.2 Expand community recycling services.

4.3 Expand composting and organics recycling.

4.4 Phase out of single-use waste items.

4.5 Work to electrify waste collection services.

In 2019, Falmouth generated:

- **2,234 tons of waste**
- **1,305 tons of recycling**
- **125 tons of compost**
- **1,139 tons of specialty waste***.

This alone generated **744 MT CO_2e** of emissions.

**Specialty waste refers to items that cannot be processed with other MSW, such as hazardous waste, tires, fish wastes, or ammunition. Refer to Ecomaine's page on what they do not accept for waste processing.*

Climate Action Strategies

Social Resilience

Target: Build the adaptive capacity of Falmouth's neighborhoods, ecosystems, and infrastructure.

Social resilience strategies focus on building the capacity to withstand and rebound from shocks to Falmouth's neighborhoods, ecosystems, and infrastructure in the face of climate change. Improving climate resilience means developing a community better able to respond to and recover from hazards such as sea level rise, warming temperatures, and severe weather events.
The actions presented in this section are to mitigate factors that make a group more vulnerable. While some actions are proactive and will reduce existing barriers, others will focus on providing resources to community members in the face of disaster.

Strategies

5.1 Update emergency management plans and techniques.

5.2 Organize infrastructure to reduce public health risks from high heat.

5.3 Pursue equitable access to housing and community services.

5.4 Develop resilient local energy systems.

5.5 Prioritize green infrastructure.

5.6 Promote local food and resource networks.

5.7 Protect wetland and coastal habitat.

5.8 Preserve forests and wetlands and promote conservation to offset carbon and climate impacts.

6.0 Monitor invasive species and native species migration.

Community resilience is a community's ability to react to and recover from disturbances. It is not restricted to climate hazards, but to any internal or external adversities a locality may face. A resilient community is one that will continue to thrive despite challenge.

Funding Opportunities

In order to achieve the mitigation and adaptation targets set in this CAP, Falmouth will require funding. There are many federal, state, and local funding opportunities available that are designed to finance resilience-building developments. This page includes a variety of examples of programs and grants that are applicable to projects in Falmouth's plan. For additional funding sources and more detail on the programs listed, refer to Appendix B.

Resilience

- $50 billion (nationally) from the IIJA (Infrastructure Investment & Jobs Act)
- FEMA grant programs
- National Coastal Resilience Fund
- Biennial Budget Items:
  - $40 million for land conservation
  - $4.75 million for preparing for climate impacts
  - $3 million for culvert upgrades
  - $900k for DEP projects

Public Transit

- $234 million from IIJA
- $5 million from the MJRP (Maine Jobs & Recovery Plan)

Clean Water

- $390 million from IIJA

Electric Vehicle Infrastructure

- $7.5 billion from IIJA for a national charger network
- $8 million from MJRP to expand charging station
- Efficiency Maine

Power Infrastructure

- Energy Efficiency and Conservation Block Grant
- $8 million from MJRP
- $3.1 million from the State's biennial budget

Buildings and Housing

- Efficiency Maine
- $36.9 million for the Weatherization Assistance Program
- Energy Efficiency Revolving Loan Fund Capitalization Grant

Looking for where to get started with your sustainable home upgrades?

Efficiency Maine (https://www.efficiencymaine.com/) has organized educational and financial resources for Mainers. Explore Efficiency Maine's website for more information on heat pump installation and rebates, home heating assistance, electric vehicle rebates, and more!

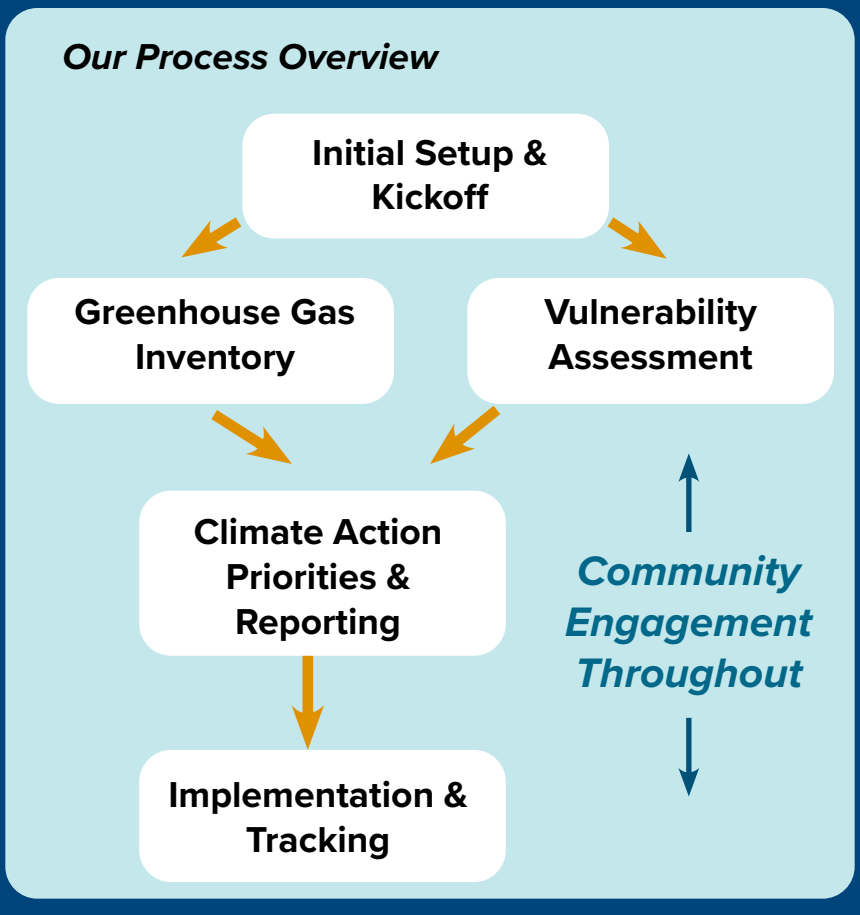
Introduction

The Falmouth Climate Action Plan identifies a path of action for the Town to reduce greenhouse gas emissions and prepare for the impacts from climate change, with the goal of creating a more livable future for all. It is the culmination of over a year's worth of data collection, analysis, and public engagement work. Discussions around the global temperature and health of the Earth often use future tenses, describing what "will" happen, but the Town is experiencing costly impacts from climate change already. This plan is an acknowledgement that we cannot hold off any longer as climate hazards increase, we need to make impactful and beneficial changes now. The plan presents actions the Town will take to protect our corner of Maine for all residents. Change begins with a single community or resident; every town in Maine can be doing something to support climate action. This plan will position Falmouth well for a more climate-resilient future. We recognize that this plan and the proposed strategic actions are based on current information. The plan is understood to be a living document and will be updated as new research, modeling, technology, and infrastructure improvements become available. It is also recognized that this plan includes strategies that may become obsolete or unachievable based on many factors, including conditions beyond the Town's control.

The goals achieved through this CAP, created for the Town of Falmouth, were to:

- Collect data to define scope of greenhouse gas emissions and impacts of climate hazards
- Set targets that align with municipal priorities
- Identify actions and implementatin plans that achieve climate targets
- Engage community to support climate action
- Integrate climate considerations into municipal processes

Our Process Overview



How to Read this Plan

There are 5 sectors in this plan. The sectors are broken down by the category the applicable actions affect: buildings, transportation, waste, social resilience, and municipal operations.

Each sector is organized by priority areas. These 13 priorities were identified by Falmouth residents as the most crucial changes the town needs. The resident feedback aligns with supported scientific data and modeling.

40 total strategies were created, all pertaining to a priority area. The strategy describes the planned changes to systems or locations.

The actions under each strategy describe specific and measurable ways that the Town will act to achieve the applicable strategy.

Community Spotlight

The Community Spotlights throughout this plan highlight projects Falmouth has completed or is involved in relating to resilience and/or decreasing human impact on the environment.

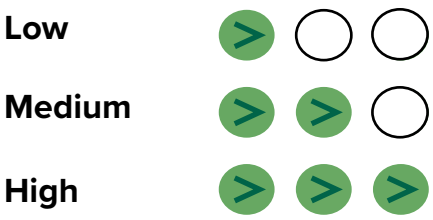
You may note the "Actions to Avoid" in this plan. This is to address that some well-intentioned ideas can hinder progress and may create more expenses down the road.

To provide context for strategies, two metrics are assessed: resiliency building and emissions reduction. A chart similar to the one to the right is present for each strategy.

Resiliency Building indicates the action strengthens community infrastructure and/or systems.

Emissions Reduction refers to the strategy's potential to reduce greenhouse gas emissions when applied.

Each strategy and its actions are given a relative rating of:



Definitions

Adaptation . . . . . To change to be better suited for new conditions

Climate-related hazard . . . . . An effect of climate change

Climate-related impact . . . . . A harm to people, ecosystems, or infrastructure caused by a climate hazard

Greenhouse Gas Emission . . . . . Release of a gaseous compound (such as carbon dioxide) that adds to atmospheric warming

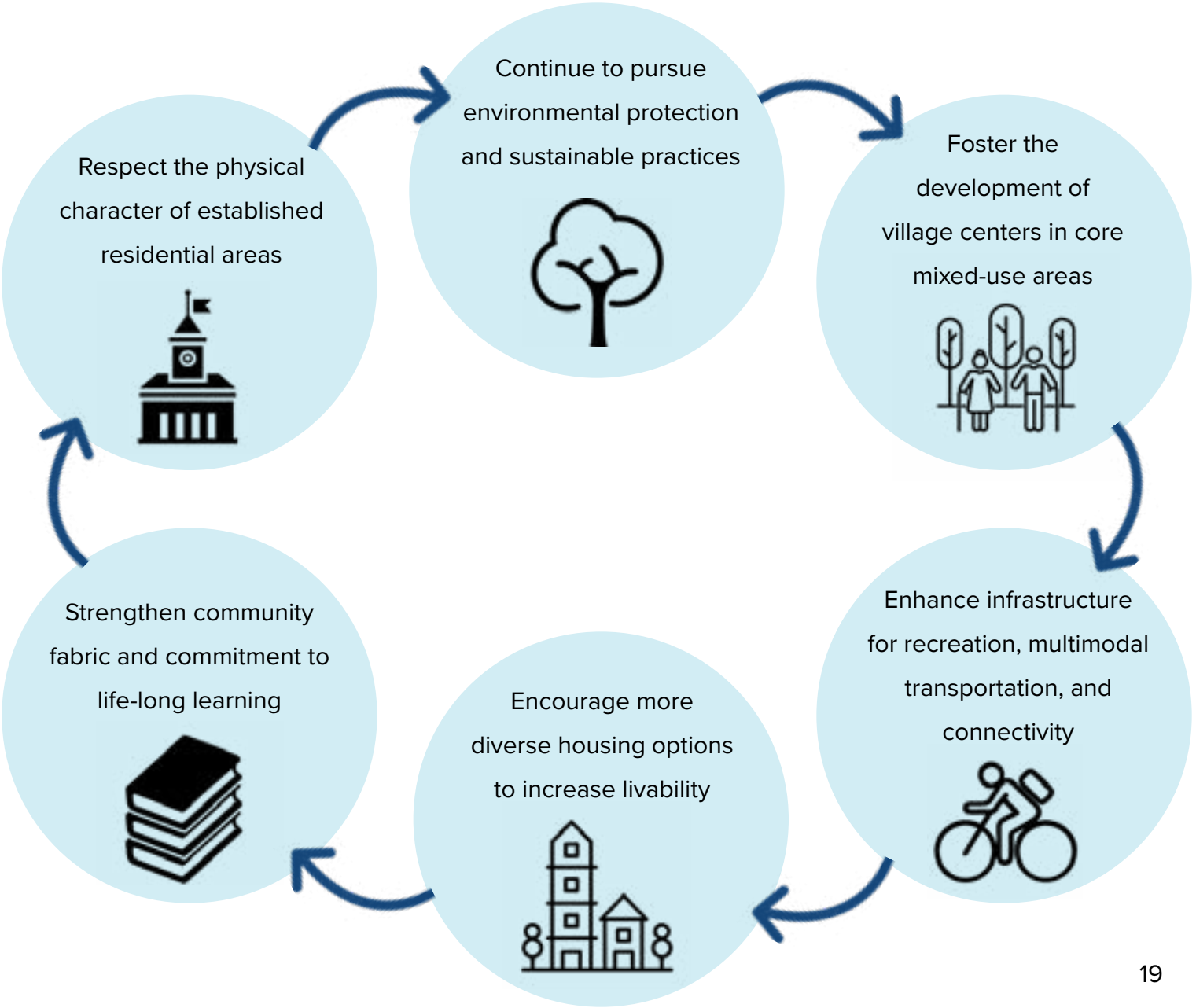
Resilience . . . . . The capacity to adapt well and/or recover quickly from challenges

Vulnerability . . . . . The state of being unprotected or exposed to possible hazards, both physical and social

Falmouth's Visions & Values

In February 2022, the residents of Falmouth selected six pillars that encompass their values and vision for the future of the town. The process, which began in November 2022, enagaged Falmouth residents in every step of the way, through surveys, online discussion boards, focus group sessions, and summits.

The Falmouth CAP process similarly sought out community member input. To demonstrate that the strategies and actions contained in this plan align with Falmouth's vision and values, every strategy appeals to one or more pillar. Throughout this CAP, icons associated with a vision/value are included with strategies that support their implementation. To learn more about Falmouth's Vision and Values project, please visit the project webpage.



Community Outreach

Municipal Outreach

June, 2022 - Falmouth's Climate Action Plan (CAP) outreach began with internal engagement of municipal staff. describing likely climate hazards for Maine and the potential impacts in the Greater Portland region. Municipal staff discussed and identified at-risk areas in their department already in place to jump-start progress.

After meeting with municipal staff, GPCOG conducted 1-on-1 interviews with department heads to get an in-depth view on primary concerns and priorities for each department. Department head interviews also provided information on current and future challenges to consider when completing the CAP.

Website

To simplify community outreach and information sharing, Falmouth created a CAP website to centralize data and give updates to Falmouth residents such as upcoming public events. Visit the website.

Workshops

September, 2022 - The Town of Falmouth hosted a priority-setting workshop in collaboration with GPCOG to set climate priorites with diverse stakeholder groups. This workshop provided an overview of the climate action planning process and defined relevant terms to the public. Attending members also viewed a summary of the findings from the Town's greenhouse gas emissions inventory and vulnerability assessment. The Climate Action Plan Committee met prior to the workshop to discuss potential priority areas, which were presented to the workshop to guide discussion. Watch the workshop.

Community Events

Fall, 2022 - There was a series of workshops for the town that provided education on topics related to climate change. Topics ranged, including vector-borne diseases, sea level rise, and waste reduction and recycling.

Surveys

Falmouth developed surveys to engage residents who could not attend public workshops, collecting data on climate related priorities and information about existing vulnerabilities.

Emission Reduction Targets

As part of Falmouth's climate action planning process an inventory of the town's community-wide greenhouse gas (GHG) emissions for the year 2019 was made. Using that inventory as a baseline, two emissions reduction scenarios were created for the consideration of the Climate Action Planning Committee (CAPC). The first scenario followed reduction targets established by the state climate action plan, Maine Won't Wait. The second scenario provided more ambitious milestones following science-based targets. The CAPC chose to present the more ambitious scenario to the town. On July 25, 2022, the Falmouth Town Council voted to accept the new emissions reduction target proposed by GPCOG and the CAPC. To view the full inventory and a breakdown of suggested targets, refer to Appendix C.

Falmouth's Emission Reduction Targets

- → **65% by 2030**
- → **85% by 2040**
- → **Net-zero emissions by 2050**
- → **100% for Municipal Operations by 2040**

Maine Won't Wait Targets

- → **45% by 2030**
- → **65% by 2040**
- → **80% by 2050**

Transportation and Mobile Sources	Falmouth CAP Targets
Number of Electric Vehicles in Falmouth	**Vehicles/Year**
Through 2030	700
Through 2040	300
Through 2050	250
Total Number of EVs by 2050	**11,100**
Community VMT Reduction	**Miles Reduced/Year**
Through 2030	2,500,000
Through 2040	2,000,000
Through 2050	20,000
Total Annual VMT Reduction by 2050	**36,000,000**

These suggested milestones were created using ClearPath's emissions reduction calculators. These numbers are not a hard-set guide, but suggestions to guide Falmouth to achieving their targets.

Building Energy Usage	Falmouth CAP Targets
Fuel Switching through Heat Pump Installations	**Installations**
Total Installations by 2050	4,550
Rooftop Panel Installations (Residential)	**Number of 4 kW Solar Panel Installations**
Total panels by 2050	5,700
Energy Retrofits (Commercial)	**Square Feet Retrofit**
Total area retrofit by 2050	12,000,000

Vulnerability In Falmouth

The two largest risks in Falmouth are loss of access to goods and services due to flooded roads, and the human-health impacts from rising temperatures. Falmouth has comparatively low social vulnerabilities in the region; however, climate change will amplify existing vulnerabilities and increase social inequity. To view the full Vulnerability Assessment, refer to Appendix D.

Risks to Critical Infrastructure

Flooding of Critical Transportation Infrastructure	Strain on Wastewater Assets	Vulnerable Power and Communication Systems
↑ Repair & Maintenance Costs	↑ Flooded Pump Stations	↑ Demand
↓ Access to Community Services	↓ Hydraulic Capacity	↑ Damage from Storms

Vulnerable Community Assets

- Impacts to the economy and local livelihoods: *the biggest impact to businesses in Falmouth is lack of access in the event of severe storms or sea level rise.*
- Residential and Commercial Security and Affordability: *climate change impacts threaten property values, which reduce the Town's tax base, and increases the financial burden on residents.*
- Disruption to Community Services: *the need for social services and community resources will likely increase due to the financial, physical, and emotional stressors created by climate change.*
- Challenges to public health: *heat-related illnesses, asthma from worsened air quality, and vector-borne diseases are all likely to increase in the future.*
- Ecosystem migration: *Falmouth is likely to experience significant marsh degradation due to sea level rise along Mussel Cover and the Presumpscot Estuary. These tidal wetlands provide tremendous benefit as a protective barrier against storm surge and rising sea levels.*

Geographic Areas of Vulnerability

These locations in Falmouth have been identified as high risk for flooding by 2050. Inundated roads and bridges will prevent residents from accessing and/or leaving homes, businesses, and community services.

1. The Flats and Upper Presumpscot
2. Foreside and Mill Creek
3. Inland Assets Along Falmouth, Winn, and Mountain Roads

The Future of the Electrical Grid

Modernization & Expansion in Response to the Push to Electrify

Strains on the Grid

- Increased electricity demand can stress the grid's capacity to generate, transmit, and distribute electricity.
- Widespread electrification can result in load growth and can lead to a change in timing and magnitude of peak demand.
- Increased electrification can require upgrades to the distribution system, including local transformers and distribution lines.

Benefits of Electrifying

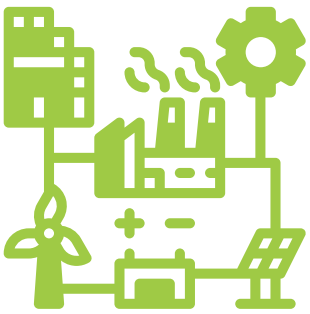
- Maine's electrical grid is one of the cleanest in the country and 72% of Maine's electricity was generated from renewable sources in 2021.
- Electrifying various sectors, such as transportation and heating, can significantly reduce GHG emissions.
- Electrification provides an opportunity to improve overall energy efficiency, reducing energy waste and lowering energy costs.

The federal and state governments in Maine and the electricity industry are actively working on solutions to ensure the grid can accommodate this growth. Utility companies, policymakers, and other stakeholders are collaborating to plan for future demand and make informed decisions about grid upgrades.

Improvements to the Grid

Improvements to the energy system include increase use of advanced technologies, grid upgrades, expanded energy storage, and transmission improvements that will all be part of a multipronged solution to modernizing our energy system.

- The use of smart grid technologies enable better monitoring, control, and management of the electricity flow, allowing for more efficient distribution and load balancing.
- The integration of energy storage systems at various points in the grid can help manage the fluctuating demand and supply of electricity.



Funding for this Growth

The federal government and the state of Maine are investing heavily in grid upgrades already, this was a target of much of the federal bipartisan infrastructure law and the inflation reduction act. Below are some examples.

- The $2.5 billion Transmission Facilitation Program has been the largest investment in transmission alone and is only one of the first payments of over $20 billion from the DOE's Building a Better Grid Initiative.
- The State of Maine was allocated $4,364,534 for 2022 and 2023 funding through the Grid Resilience Formula Grant Program and it is expected that approximately $2.2 million will be allocated to the State in each remaining three years of the program. These funds will be used to improve resiliency and adapt new technologies for Maine's electric grid.

Falmouth CAP

Action Plan

Mitigation & Adaptation

Climate Action Strategies

This section of the Falmouth Climate Action Plan identifies actions needed to achieve a more sustainable and resilient community. It is divided up by sector and includes actions that reduce greenhouse gas (GHG) emissions to help achieve the net-zero by 2050 target Falmouth has set, and actions that reduce our risk and exposure to climate hazards and enhance overall environmental health of the Town. Each sector has top level priority areas, highlighted strategies, and detailed actions to achieve those priorities. Implementation responsibilities and a high-level timeline are included in Appendix A.

The actions set forth in this section respond to the baseline vulnerability assessment and greenhouse gas emissions inventory by addressing the specific risks and emissions sources identified in those reports. These actions also align with the State of Maine's Climate Action Plan, Maine Won't Wait, and reflect best practices for municipal climate action from around the country.

Falmouth CAP

Municipal Operations

Sector

Municipal Operations

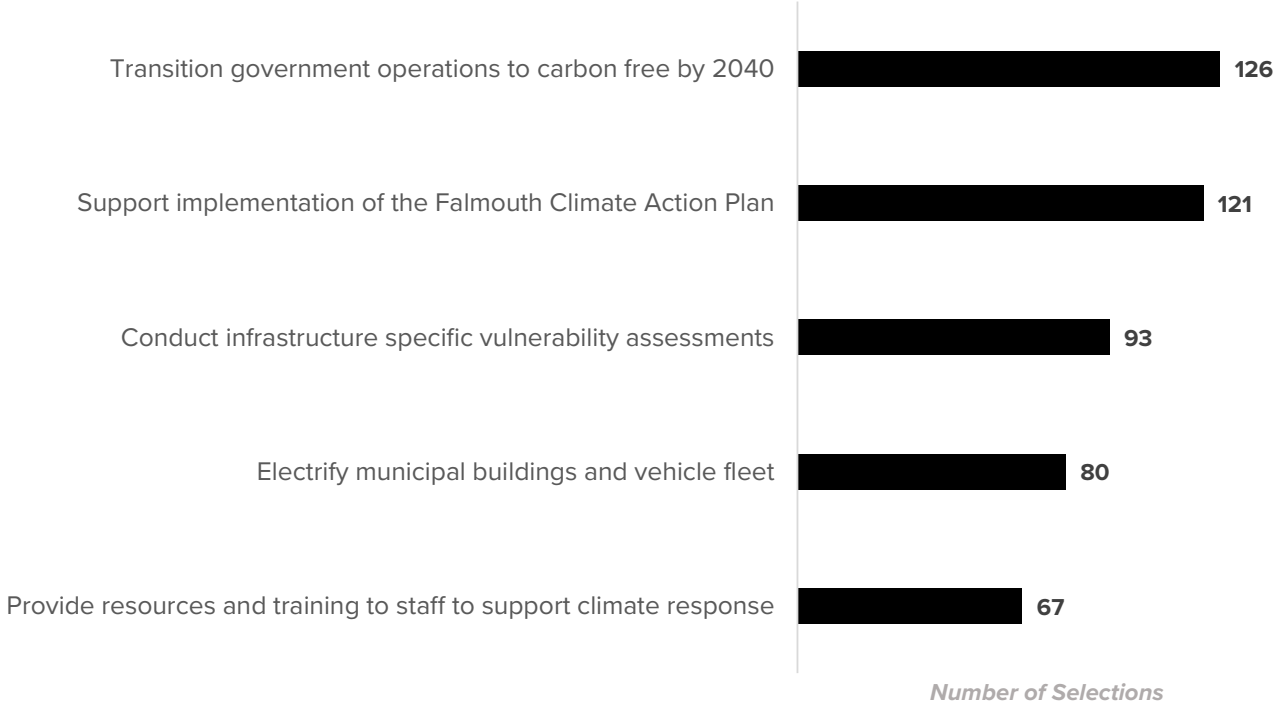
The Town of Falmouth has pledged to transition to emissions-free operations by 2040. This will involve electrifying heating and cooling systems, switching out fuel-based municipal vehicles, retrofitting buildings to increase their energy efficiency, and transitioning to renewable sources of electricity. By moving quickly to reduce emissions, the Town will act as an example for the community, helping lead the way in the changes required to create a more resilient community.

Priority Areas

- Decarbonize municipal facilities and operations
- Prepare municipal infrastructure for climate impacts

What We Heard

Falmouth survey respondents selected their top three priorities for government operations:



Priority Area:
Decarbonize municipal facilities and operations

1.1

STRATEGY: Complete energy audits of government operations

Assessing energy efficiency of government-owned buildings is a first step in reducing overall municipal energy consumption. An assessment will help guide fossil fuel phase-out by identifying the highest emitting operations and buildings with higher-than-average energy usage. Once audits have taken place, Falmouth can identify costs and viability for increasing building efficiency.

Town Partners

Sustainability Coordinator

Resiliency Building

Emissions Reduction

Actions

a. Update asset management plans to reflect the identified improvements needed and plan for implementation of those actions

b. Identify municipal buildings most in need of energy efficiency upgrades

c. Evaluate anticipated electricity needs of buildings after electrifying

d. Determine which facilities could host rooftop solar or renewable energy

1.2 STRATEGY: Reducing fossil fuel use in government facilities

Reducing fossil fuel use will involve replacing on-site fossil fueled appliances with energy-efficient electric systems in existing buildings and only installing electric heating and cooling systems in new construction. This will reduce emissions and increase energy efficiency of government buildings. Retrofitting heating and cooling systems should start in more energy efficient buildings, for optimal emissions reduction and cost savings. The Town will consider new technology and alternatives to electrification when those become readily available and affordable. Any new construction will follow the 2021 IECC Energy Conservation code until further updated.

Town Partners

Sustainability Coordinator

Resiliency Building

Emissions Reduction

Actions

a. Discontinue use of fossil fuel heating and cooling systems in newly constructed facilities
b. Switch all fossil fuel-based building energy systems with electric heating and cooling systems
c. Explore additional power purchase agreements and new renewable energy sources to increase use of renewable energy to the greatest extent possible
d. Retrofit government facilities to reduce energy usage intensity

1.3 STRATEGY: Electrify municipal fleet vehicles and provide adequate charging infrastructure

Switching to electric vehicles (EVs) is an effective method for directly reducing emissions, as the transportation sector is a major contributor to carbon and air pollution. It also encourages private use of EVs through increased availability of infrastructure. The switch to EVs will be financially beneficial to the Town as a long-term investment, as costs associated with powering municipal vehicles will be significantly decreased. Electric technology is not readily available and cost effective for all vehicle types yet, such as snowplows or fire trucks. As technology becomes affordable and available, the Town will continue to plan for transitioning these vehicles.

Town Partners

Finance Director

Resiliency Building

Emissions Reduction

Actions

a. Complete a municipal vehicle fleet assessment

b. Establish an electric vehicle procurement plan that phases out purchases of fossil-fuel based vehicles when electric equivalent is available and cost effective

c. Invest in electric landscaping and off-road equipment to further reduce emissions in operations

d. Install EV charging stations at strategic government buildings, with the aim of creating enough capacity to accommodate an entirely electric fleet

e. Replace vehicles to the extent technology allows to achieve a completely electric municipal fleet by 2040

Work in Progress: The Parks and Community Programs Department is actively working with local and national professional organizations to provide continuing education on electric park maintenance equipment. Multiple departments have purchased EV vehicles and future EV purchases are included in their Capital Improvement Plans.

1.4 STRATEGY: Pursue 100% renewably sourced electricity generation for government operations

Renewable energy provides buildings with an independent source of energy and improves municipal resilience to climate hazards and impacts, such as a severe storm that damages power lines. This will only become more essential as departments continue electrifying their heating and vehicle fleets, particularly for departments which provide essential services during emergency events. The Town will consider forms of on-site renewable energy including solar panels, wind, co-generation, and other technologies that do not use fossil fuels. Off-site energy sources, such as those obtained through power purchase agreements, will be considered when necessary.

Town Partners

Finance Director

Resiliency Building

Emissions Reduction

Actions

a. Evaluate energy needs for municipal operations to understand scope of demand

b. Estimate future energy demand of government operations factoring in completing electrification of buildings, facilities, and municipal fleet

c. Develop any future projects or purchase agreements to meet current and forecasted municipal electricity needs

d. Select department buildings for renewable energy (such as rooftop solar panels) based on need, cost-effectiveness, and priority of government department

e. Achieve a complete renewable energy portfolio for municipal electricity by 2040

Actions to Avoid

Avoid committing to use of systems that lock in fossil fuel use in the future, for example, through the incentivization of natural gas conversions. Buildings that switch from a stationary fuel like oil to natural gas for heating are less willing (and less financially able) to switch over to electric systems in the future, leading to locked-in greenhouse gas emissions.

Community Spotlight

Woods Road Municipal Solar Array

The Town of Falmouth has already entered into a power purchase agreement with Tangent Energy Solutions, to develop a solar array along a capped-in landfill on Woods Road. The solar array, completed in 2022, produces approximately 1.5 million kilowatt hours per year of energy and provides roughly 70% of current government electricity needs. The project and agreement are expected to save the Town an estimated $2 million dollars over 20 years. As departments continue to electrify fossil fuel powered operations, the Town of Falmouth can pursue future power purchase agreements to ensure increasing electricity needs are met with renewable sources or develop additional local renewable projects.

1.5

STRATEGY: Reduce municipal waste stream and ensure sustainably sourced government consumption

Sustainable consumption entails evaluating and prioritizing environmental impacts when selecting goods or services to purchase. Falmouth recently developed purchasing standards for appliances and goods to reduce reliance on fossil fuel-based technologies. The procurement policy will also help reduce the Town's waste stream by setting a standard for goods and services purchased to avoid disposable waste products and to prioritize locally sourced vendors. The Town will also reduce waste volume by continuing operation of the three compost drop-off sites available to residents.

Town Partners

Sustainability Coordinator and Finance Director

Resiliency Building

Emissions Reduction

Actions

a. Prioritize locally sourced procurement of food for town events

b. Continue to expand and promote municipal composting programs

c. Incorporate a focus on reducing fossil fuel-based appliances into the green procurement policy

Community Spotlight

Green Procurement Policy

The Town of Falmouth has already acted to incorporate sustainable practices and reduce waste from operations. One of the most recent updates is the adoption of an environmentally preferable procurement policy in the Town's purchasing guidelines. The policy ensures that environmental impacts are considered for all purchases the Town makes, and that life-cycle costs (total costs considering operations, maintenance, and disposal) are considered over up-front purchasing costs. The policy describes additional criteria to consider for purchases, such as if the product was created in Maine and the amount of packaging used for the product.

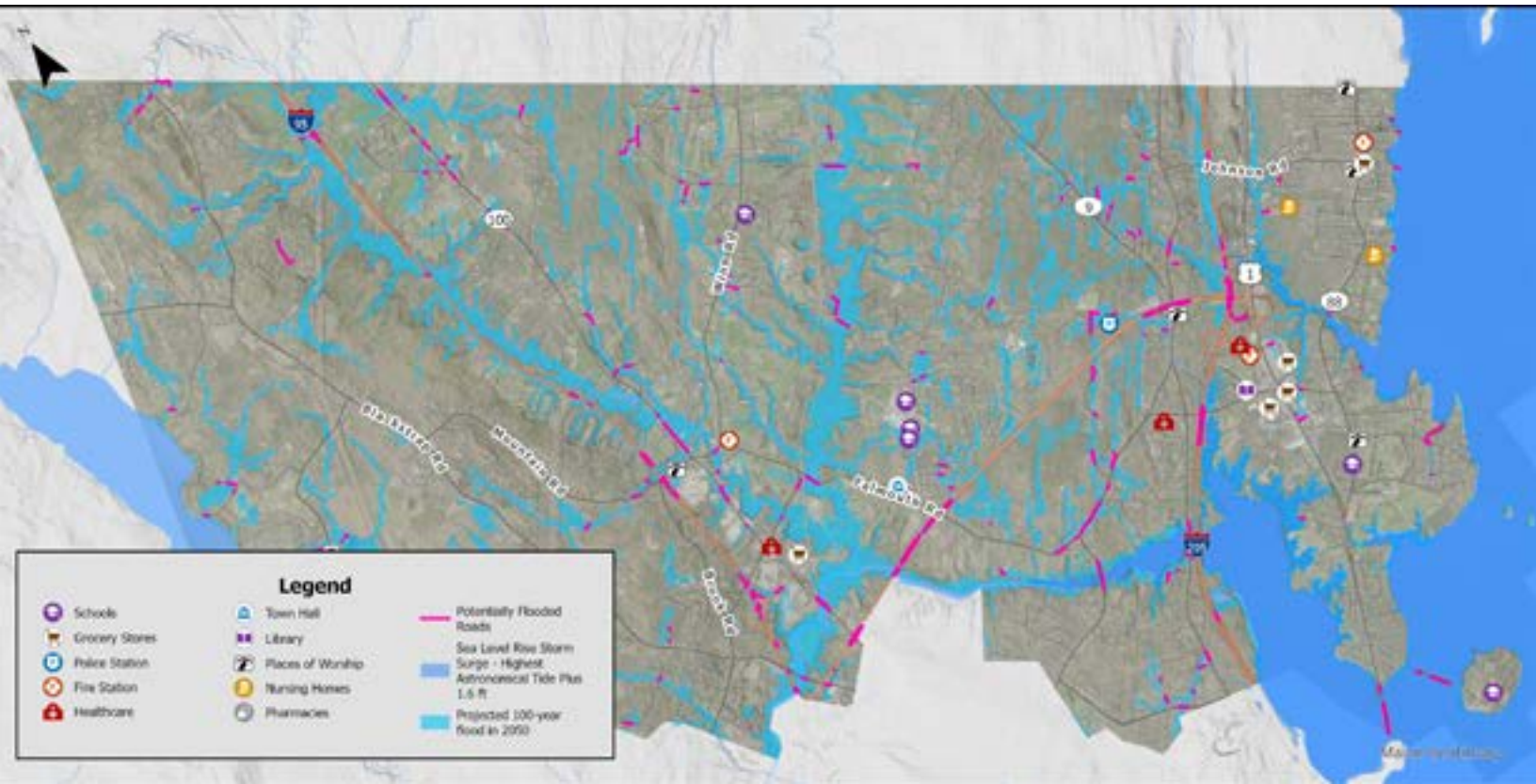
The sustainable purchase policy also affects the bidding process, as bids are required to consider how their services will support the Town's environmentally preferable purchasing policy. Bidders can also choose to disclose general sustainable efforts made by their company, allowing Falmouth to have a complete picture of the environmental impacts of selecting a bid.

Priority Area:
Preparing municipal infrastructure for climate impacts

1.6

STRATEGY: Develop project ideas for at-risk infrastructure or ecosystems

There is significant federal funding available now and over the next few years for hazard mitigation projects. This funding comes through FEMA to the state government to advance projects that protect communities against identified hazards – in Maine those include climate hazards like flooding, storms, drought, or wildfires. To be ready to apply for funding it is important to understand the site-specific projects that could be developed if funding were available. The Town will develop a pipeline of infrastructure project ideas to address at-risk sites identified in the vulnerability assessment. Some additional analysis of complex assets may be necessary, similar to the Town Landing Resiliency Study completed in 2023.



Town Partners

Sustainability Coordinator and Public Works Director

Resiliency Building

Emissions Reduction

Actions

a. Conduct site-specific vulnerability impact assessments for at-risk infrastructure within each department for assets identified as vulnerable in the Vulnerability Assessment Report

b. Convene department heads and emergency management professionals to prioritize sites

c. Consistently track coastal and inland flooding occurrences to develop an understanding of flooding trends and adjust planning for the future as conditions change

d. Conduct a full assessment of all culvert upsizing requirements

e. Work with consultants to develop concepts for resilience projects

f. Explore restoring native vegetation or developing "no mow" landscaping to mitigate environmental effects

Work in Progress: The EMA and Public Works Departments are working with Cumberland County to keep the county's Hazard Mitigation Plan up to date for Falmouth. They are also seeking funding opportunities for projects identified in the plan, such as stabilization for Shoreline Drive or a culvert for Northbrook Drive.

Community Spotlight

Wastewater Vulnerability Assessment

The wastewater department recently completed an assesment to determine the assets most vulnerable to future climate impacts. Tracking changes in water levels and inundation events, as well as assessing vulnerability of existing infrastructure, provides Falmouth with information to identify the highest risk areas for prioritizing projects.

1.7 STRATEGY: Ensure department staff has capacity to enact Climate Action Plan

Falmouth will consider options for resources to expand staff capacity to plan, implement, and enforce new policies as part of its climate resilience strategies. Municipal departments will determine whether this will require new training, consultations, or hiring new staff.

Town Partners

Town Manager

Resiliency Building

Emissions Reduction

Actions

a. Provide educational opportunities to municipal staff on best practices for climate action

b. Assess need for additional staff

c. Ensure future collaboration between departments to facilitate sharing of resources and information in future adaptation management

d. Appoint a liaison to coordinate sustainability programs for residents and provide outreach to connect residents with resources

Sector

Buildings & Energy Usage

Buildings and Energy Use

Residential and commercial energy usage combined make up 46% of Falmouth's total GHG emissions, making this an essential area of action. The emission targets for the town are to:

- Produce 20% of residential energy needs from on-site renewable sources.
- Reduce energy needs by 8% through energy retrofits by 2050.

There are multiple channels available to achieve these targets. ClearPath's modeling software suggests a path that has the Town increasing the number of electric heat pumps from 705 to 4,550 in residential and commercial buildings, and increasing the energy provided by solar panels community-wide to 36 million kwh by 2050. This section will focus on electrification of building systems and improvements in efficiency, and includes strategies to make buildings more resilient as climate impacts threaten the safety and security of Town residents, especially our most vulnerable.

Priority Areas

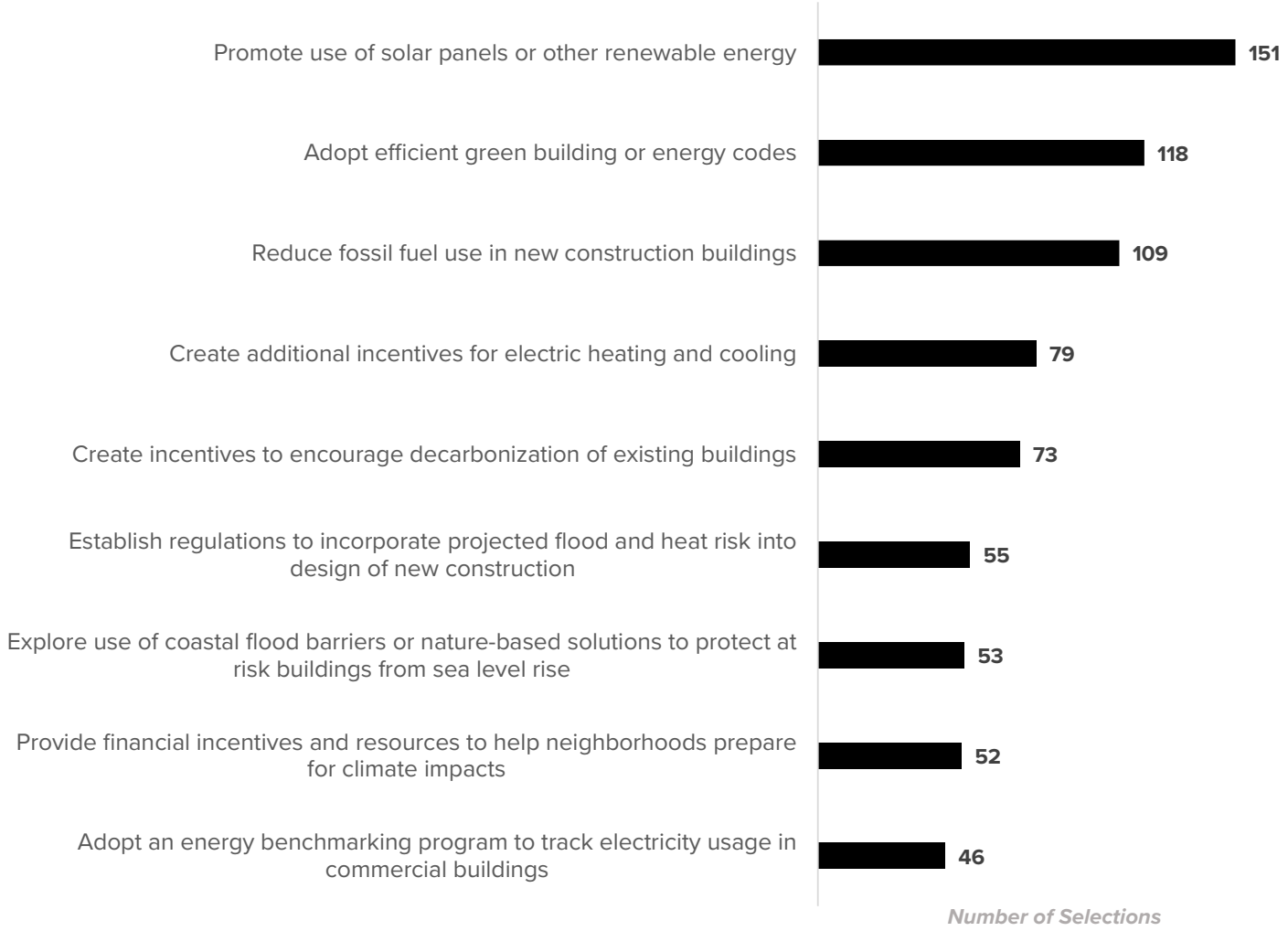
→ Reduce fossil fuel use in new and existing structures

→ Promote clean and renewable energy infrastructure

→ Build neighborhood resilience in the face of climate impacts

What We Heard

Falmouth survey respondents selected their top four priorities for reducing community emissions and improving neighborhood resilience:



Greenhouse Gas Emissions

Energy use for buildings was the greatest source of greenhouse gas emissions in Falmouth in 2019.

65,969 MT CO_2e
Total Building Emissions

The greatest emissions source within this sector is fossil fuel heating sources, such as kerosene and petroleum.

Priority Area:
Reduce fossil fuel use in new and existing structures

2.1

STRATEGY: Increase community uptake of electric heating and cooling systems

Electrifying heating sources in households and businesses uses existing technology to directly and indirectly reduce emissions from heat. Systems such as air-source heat pumps have the added benefit of providing a cooling system in the summer, protecting home and office building tenants from increasingly common high heat events. By developing public information campaigns and financial incentives for adapting sustainably sourced energy sources, Falmouth will reduce emissions and overall energy costs.

Town Partners

Sustainability Coordinator

Resiliency Building

Emissions Reduction

Actions

a. Track annual Efficiency Maine rebate data to assess progress in electrifying homes in Falmouth

b. Launch electrification campaign with general outreach and education on financial incentives and technical details of electric heat pumps

c. Develop additional Town-wide financial incentives to reduce the cost of electric heating and cooling installations for low and middle-income residents, such as partnering with local installers or tax-increment financing

Community Spotlight

Heat Pump Rebates

Image Credits: Efficiency Maine, 2023

Within Maine, there is already a rebate system set up at the State level for any homeowner (of any income level) through Efficiency Maine. Efficiency Maine currently offers up to $1,200 in rebates for homeowners who install electric heat pumps through one of their vendors. The rebate program also requires that installed heat pumps meet certain efficiency standards. Homeowners interested in switching to a more sustainable heating method can obtain more information through Efficiency Maine's website page.

In addition to the state-wide incentive, several municipalities in Maine have also developed their own rebates and grants. In South Portland, through the city's Electrify Everything initiative, residents can receive up to $2,000 in addition to Efficiency Maine's rebate. This is available to residents who earn less than or equal to the median household income for the area. This program allows for electric heat pumps to be more accessible to low-income families.

The City of Bangor has taken a slightly different approach; they allow residents below a specific income limit to apply for grants of up to $2,000. These grants can also be used in conjunction with state incentives and have the added benefit of funding heat pumps prior to installation. This makes installing electric heat pumps even more accessible to families that wish to make the switch, but do not have funds to cover the up-front cost.

2.2 STRATEGY: Develop an energy benchmarking program

An energy benchmarking system is used to help households and businesses compare their general energy usage to a national average or to similar types of establishments in the region. Providing an online resource will make it easier for individuals to compare their current energy costs and potential savings. Energy benchmarking will also help guide the Town in creating financial incentives for retrofitting and in developing priorities for future building energy codes.

Town Partners

Sustainability Coordinator

Resiliency Building

Emissions Reduction

Actions

a. Encourage utilities to provide whole building data (energy and/or water data summed for an entire property) access to property owners and Efficiency Maine with reasonable accommodations for data privacy

b. Work with PUC utilities and neighboring municipalities to develop energy benchmarking program for Falmouth

c. Implement benchmarking program, starting with municipal buildings and large commercial facilities as a pilot

d. Expand benchmarking to multifamily residences and smaller commercial buildings

e. Develop program to help establishments not meeting benchmarking requirements

Community Spotlight

Energy and Water Benchmarking in Portland and South Portland

In the Fall of 2021, both Portland and South Portland passed ordinances requiring certain types of buildings to report on their energy and water use. The ordinances apply to municipal and school buildings, non-residential buildings*, single-tenant residential buildings*, and residential buildings with fifty or more units. Currently, reporting is only required for the first three categories of buildings. The Sustainability Office of each city will introduce reporting deadlines for other building types when the information is found to be reasonably accessible online.

Portland and South Portland utilize the free Energy Star Portfolio Manager tool through the EPA. Residents and building owners can create an account and use a unique building ID to submit the relevant information annually. The Portfolio Manager generates a report, which can then be submitted to the city. The cities provide online training and tutorials, as well as live workshops, to educate property owners on the process of benchmarking and its benefits.

For more information on energy benchmarking in general: https://www.energy.gov/eere/slsc/building-energy-use-benchmarking

For more information on energy benchmarking in Portland: https://www.portlandmaine.gov/579/Energy-Benchmarking

**Over 20,000 square feet*

Community Spotlight

C-PACE from Efficiency Maine

To further incentivize Mainers to increase energy efficiency in their homes, the Maine legislature has allowed for the establishment of Commercial Property Assessed Clean Energy Programs (C-PACE). This funding program allows commercial property owners to obtain funding for renewable energy and energy efficiency projects and pay it back over time. Funding is borrowed from a third party and the loan is secured using a property tax assessment on the building – owners repay through their property taxes. This allows for the cost of the installation to be spread over a greater amount of time and be less burdensome for the property owner. The payments transfer over if a property is sold, so property owners do not have to be concerned with making the full return on the investment.

Efficiency Maine is currently forming the program and there may be a possibility for municipalities to adopt a C-PACE for their communities.

For more information from Efficiency Maine: https://www.efficiencymaine.com/c-pace/

Resources for homeowners: https://www.efficiencymaine.com/energyinformation/resources-for-homeowners/

2.3 STRATEGY: Incentivize fuel and energy efficiency retrofitting in buildings

Reducing energy usage will be essential in meeting emissions reduction goals, especially as the state's electricity is not expected to be completely sourced from renewable energy until 2050. Reducing the energy usage intensity of buildings will also reduce utility costs and strain on energy grids as households continue to electrify household systems.

Town Partners

Sustainability Coordinator

Resiliency Building

Emissions Reduction

Actions

a. Join other communities to advocate for additional funding for Efficiency Maine rebates

b. Track annual Efficiency Maine rebates to assess progress in weatherizing homes, see the implementation section in Appendix A.

c. Deploy additional incentives to speed up energy efficiency retrofitting of buildings

d. Collaborate with large energy-using commercial facilities and multi-family residences to determine feasible energy retrofitting solutions

e. Evaluate costs and benefits of creating a C-PACE ordinance that would incentivize commercial property owners to retrofit their properties (see C-PACE Community Spotlight on preceding page)

2.4 STRATEGY: Adopt more efficient building codes

To meet Falmouth's emission reduction goals, it is necessary to phase out fossil fuel-based systems in new construction. Adopting the most recent stretch building code will support this transition and encourage more efficient buildings. There are also co-benefits to enforcing stricter building codes. According to the National Institute of Building Sciences, **for each $1 invested in new buildings that meet the most recent code editions, there is a return of $11 in resilience to natural hazards and weather events.**

Town Partners

Community

Development Director

Resiliency Building

Emissions Reduction

Actions

a. Explore the most recent edition of IECC building energy stretch codes as updated

b. Move towards restricting fossil-fuel use in new construction, starting with financial incentives or rebates to encourage the use of electrification over fossil fuels

c. Collaborate with neighboring municipalities to encourage uniform regional pledge of stretch code adoption

d. Restrict large fossil fuel emitting facilities for future construction

Actions to Avoid

Avoid building in areas of Town that are at risk for future flooding. New construction that is not built with future climate impacts in mind will be a waste of resources, no matter how energy efficient it is.

Avoid "voluntary" energy efficiency standards without mandatory building codes in new construction and robust incentives for existing buildings.

Priority Area:
Promote clean and renewable energy infrastructure

2.5

STRATEGY: Accelerate residential renewable energy usage

Incentivizing renewable energy generation will reduce the community's demand for fossil-fuel driven electricity and indirectly help the state meet its renewable portfolio standards goals of 100% renewably sourced electricity by 2050. Localized energy generation will also indirectly improve community climate resilience by reducing the strain on regional grid capacity as higher average heat and appliance electrification drives up electricity demand. Households and businesses that produce their own independent source of energy will also be less vulnerable to the impacts of storms that may damage ICT (information and communication technology) infrastructure.

Town Partners

Sustainability Coordinator

Resiliency Building

Emissions Reduction

Actions

a. Provide resources to residents to assess the feasibility of clean energy installations

b. Review existing zoning and regulation to ensure streamlined installation process of renewable energy installation

c. Track progress of renewable energy installations by number of annual applications from codes and planning department

d. Launch general outreach on financial incentives and benefits of clean energy

e. Educate homeowners on the available rebates and financial incentives for installing individual renewable energy systems

f. Provide additional discounts or incentives to Falmouth residents

Climate Action at Home: Renewable Energy

Many actions suggest incorporating renewable energy into private properties, but what does that mean? Renewable energy refers to energy generated from a source that is not used up - such as the sun or wind. There are many benefits to investing in on-site renewable energy for your home or business.

- Long term financial savings on electricity costs
- No or reduced dependency on the electrical grid
- Reduced individual carbon footprint, and helps to eliminate pollution

Residential renewable energy often looks like rooftop solar panels, a backyard solar array, small wind electric systems, micro-hydropower systems, or hybrid systems. The most common types of renewable energy are described below:

Energy System[1]	Description	Pros	Cons
Solar or Photovoltaic	Energy from the sun's radiation interacts with the surface of the solar panels, generating electricity.	-Clean and renewable energy -Set up quickly and often mobile -No noise, air, or water pollution while operating -Low operating cost	-Energy collected can vary due to location, season, and weather -High upfront cost
Wind	Wind interacts with the wind turbine's blades, causing them to generate kinetic energy which drives a generator to produce electricity	-Clean and renewable energy -Can work in a variety of settings -Cost effective	-Turbines produce noise and affect visual aesthetic -Can have negative impacts on wildlife
Hydro (water)	Running water is diverted towards a turbine, causing the blades to turn and allows the generator to turn rotational energy into electricity	-Clean and renewable energy -Low operating cost -Helps control flooding and support irrigation	-Must have running water on your property -High upfront cost -Can cause damage to aquatic ecosystems

No form of energy generation is perfect, but it is important to keep in mind that solar, wind, and water power have significantly less of an impact on the environment than fossil fuel energy. The typical lifetime emissions for coal energy is about 20 times higher than for renewable energy [2].

*The federal tax credit for installing on-site renewable energy is 30% until 2032. Additional incentives from Maine and local organizations can be found here: https://programs.dsireusa.org/system/program/me

[1] The Office of Energy Efficiency and Renewable Energy of the U.S. Department of Energy
[2] The National Renewable Energy Laboratory of the U.S. Department of Energy

2.6 STRATEGY: Expand opportunities for community energy memberships

A community energy membership is an opportunity for a participant to select where their energy comes from, and to support a local energy-producing project that does not use fossil fuels. Members purchase credits from a community energy project, which are applied against their energy bill. Participating in community energy memberships directly funds the generation of renewable energy projects and reduces the proportion of utility electricity generated from fossil fuel plants. By enrolling in memberships, Falmouth residents can contribute to making renewable energy more prevalent in the state energy grid.

Town Partners

Sustainability Coordinator

Resiliency Building

Emissions Reduction

Actions

a. Expand awareness of community solar partnerships to benefit households that are less likely to incorporate renewable energy systems due to unfavorable location or burdensome cost

b. Explore financial incentives to encourage community energy memberships for households least likely to afford individual energy retrofitting

Community Spotlight

Community Solar in Maine

Community solar is a type of energy membership that connects consumers with developers of solar farms to make renewable energy more affordable and accessible. Community solar companies register with the Maine Public Utilities Commission and receive one credit for every 1 kWh of energy generated from their solar project. As a participant, you may purchase credits from the solar company which are then applied directly to your utility bill, covering your electricity consumption, and reducing your electrical bill.

For general information on the Maine Community Solar Project: https://www.maine.gov/meopa/electricity/community_solar

For enrollment information: https://mainecommunitysolar.org/how-community-solar-works/

2.7 STRATEGY: Require new residential and commercial construction to have capacity for sustainable energy

In addition to educating and incentivizing Falmouth residents to switch to renewable energy, it will be essential to ensure new construction in Falmouth installs renewable energy on site when possible. Adding building level renewable energy to new buildings will reduce the need for future retrofits and emission reduction efforts. This strategy will also contribute to the state's renewable portfolio standards goal and improving grid capacity.

Town Partners

Sustainability Coordinator and Community Development Director

Resiliency Building

Emissions Reduction

Actions

a. Encourage building of solar on impervious surfaces such as parking lots

b. Establish relationship with local private contractors to provide logistics support and guide a feasible decarbonization process

c. Add requirement for installing electric vehicle charging in new developments

d. Ensure reasonable permitting process for renewable energy installment

e. Investigate development of an on-site solar requirement for new construction

Priority Area:
Build neighborhood resilience in the face of climate impacts

2.8

STRATEGY: Ensure design of new construction incorporates planning for future climate hazards

As new data projecting impact from climate hazards becomes more readily available, the Town will update all requirements for new construction to ensure new infrastructure is built to withstand future weather. This will include considering projections of sea level rise and storm surge flooding, as well as requirements for central cooling or air conditioning in new residential construction to improve resilience to higher average temperatures.

Town Partners

Community Development Director

Resiliency Building

Emissions Reduction

Actions

a. Incorporate sea level rise and flooding projections in all municipal planning documents to inform developers and residents of the potential damage from floods and coastal erosion. Ensure inclusion of inland flooding

b. Restrict development in areas with high flood risk by amending shoreline zoning laws, and require that construction in these areas be elevated at least one foot over the base flood elevation

c. Require water efficiency standards in future buildings codes to improve resistance to drought or water shortages in new construction

2.9 STRATEGY: Improve understanding of community vulnerability and engage in adaptation techniques

In addition to the social disruptions caused by natural hazards, there is also a high cost associated with disaster relief and repairing infrastructure. Adapting buildings to the newest codes will save taxpayers and individual homeowners money in the long-term. Some portions of Falmouth's built environment will require retrofits and improvements to withstand impacts of sea level rise, increased storm severity, and high heat. The Town will consider prioritizing informing households and businesses most vulnerable to impacts, using the Vulnerability Assessment as a document to prioritize the neighborhoods and regions that will feel increasing impacts first.

Town Partners

Sustainability Coordinator

Resiliency Building

Emissions Reduction

Actions

a. Explore enrolling in the National Flood Insurance Program's Community Rating System by incorporating floodplain management techniques that exceed the minimum requirements, to benefit from reduced premiums for homeowners that pay flood insurance

b. Provide education through town-led campaigns on the relationship between climate hazards and personal risk

c. Collaborate with State agencies to better understand the risk of coastal erosion for existing construction along inland waterways

d. Explore viability of nature-based solutions to protect vulnerable neighborhoods from sea level rise

e. Map town services and access to amenities to identify potential gaps in service and to better understand if there are issues with accessibility of cooling centers or other town provided services for underrepresented populations

Transportation & Land Use

Sector

Transportation and Land Use

Transportation and land use strategies to reduce emissions focus on transitioning to electric vehicles, expanding ease and access of public transit systems, and prioritizing development that makes alternative forms of transportation safer and easier. Transportation emissions accounted for the largest single source of Falmouth's greenhouse gas emissions at 47%, making the minimization of fuel-based transportation the largest opportunity for the Town to meet emission reduction goals. Additionally, building a resilient transportation network is a public safety issue, given the large portion of residents who commute to and from Falmouth every day for work as well as the interconnected system of resources between Falmouth and its neighboring communities.

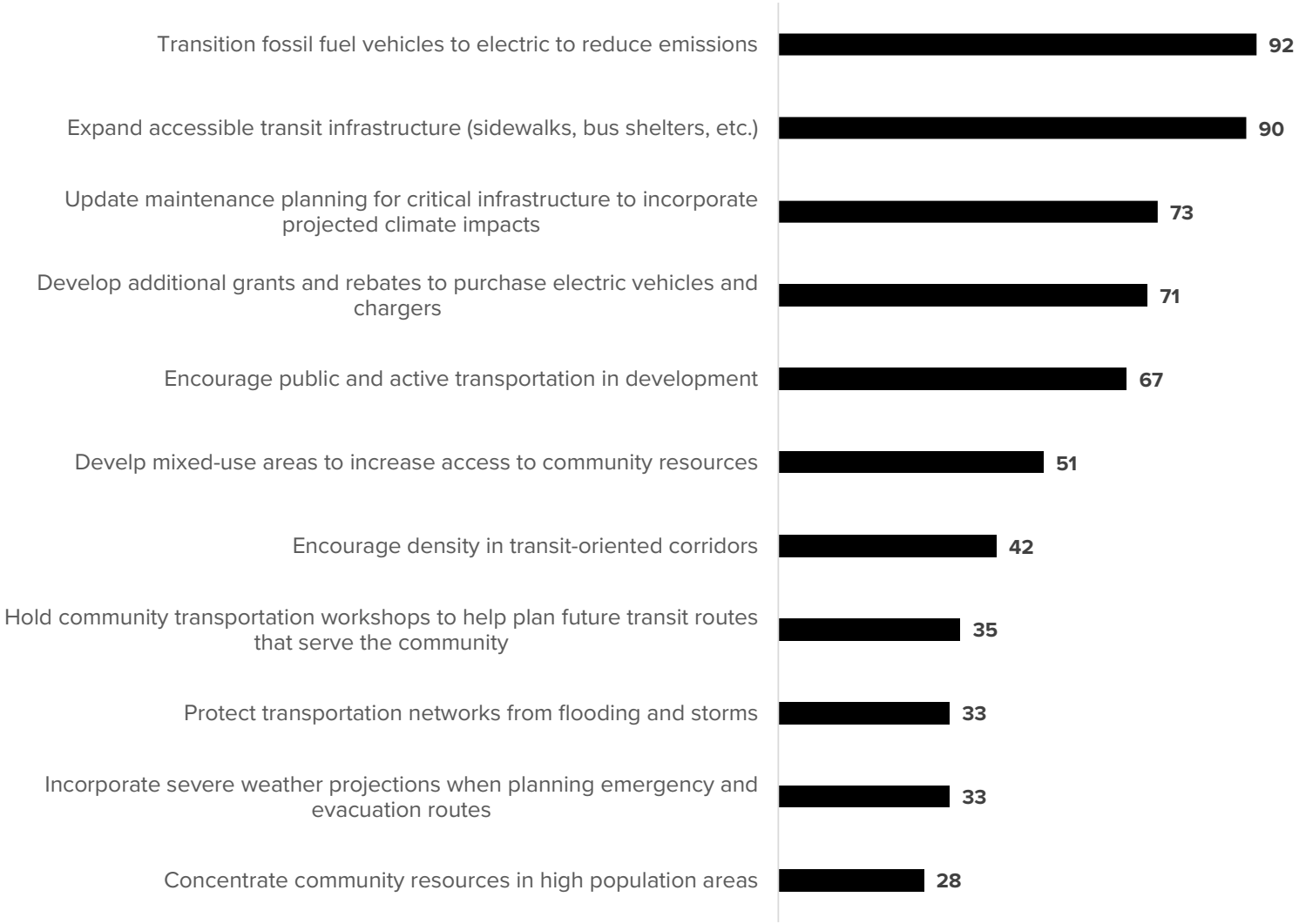
Potential channels for achieving net-zero emissions in Falmouth by 2050 include reducing vehicle miles traveled and increasing electric vehicle ownership. Models suggest this goal is achievable through a 46% reduction in vehicle miles traveled and increasing the number of EVs to 11,100 town-wide by 2050. These are not the only available channels, actions such as emphasizing public transit and reduced idling can also contribute to reducing transportation emissions.

Priority Areas

- → Electrification of transportation
- → Reducing community vehicle miles traveled
- → Resilient Transportation Networks

What We Heard

Falmouth survey respondents selected their top three priorities for improving transportation networks and land use strategies:

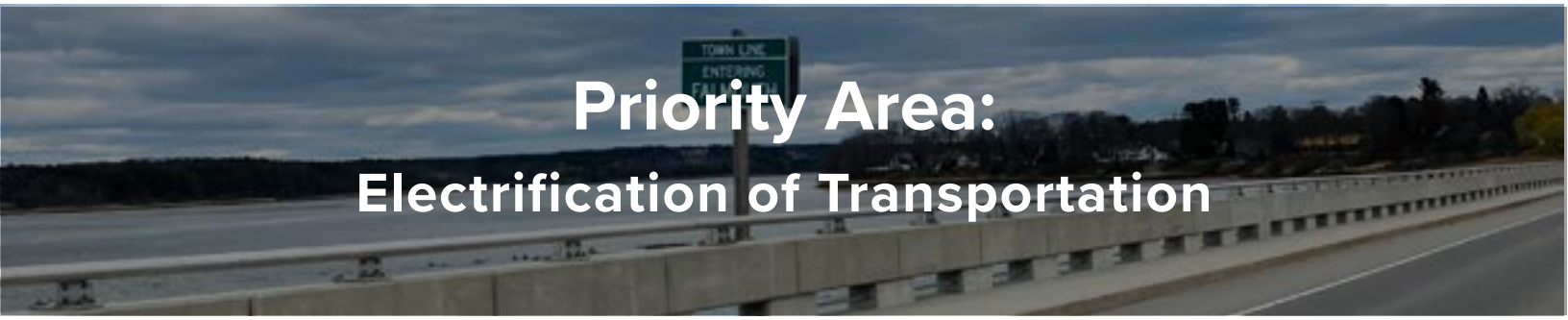


Greenhouse Gas Emissions

Energy use for transportation was the second greatest source of greenhouse gas emissions in Falmouth in 2019.

65,755 MT CO_2e
Total Transportation Emissions

The greatest emissions source within this sector is gasoline -fueled individual vehicles.



Priority Area:
Electrification of Transportation

3.1 STRATEGY: Promote electric vehicle purchasing

Incentivizing the uptake of electric vehicles, particularly light duty passenger vehicles, will reduce the largest direct source of emissions in Falmouth. Ride Electric events, partnerships with Efficiency Maine, and other public outreach on the utility and affordability of EVs will help encourage residents to opt for electric vehicles. The Town will prioritize making the option to purchase electric vehicles as easy and affordable as possible.

Town Partners

Sustainability Coordinator

Resiliency Building

Emissions Reduction

Actions

a. Launch electrification campaign to expand use of electric vehicles

b. Track annual progress in Town wide vehicle electrification from state DOT vehicle population statistics

c. Widely promote existing rebates through Efficiency Maine, and hold events to explain incentives through federal funding

Climate Action at Home: Electric Vehicles

Electric vehicles (EVs) use significantly less energy than fossil fuel powered vehicles. EVs have a lower impact on the environment by producing less carbon emissions and air pollution. One of the biggest barriers to making the switch to EVs is the associated cost.

While electric vehicles generally have a higher purchase price than gasoline-powered vehicles in the modern economy, there is also the consideration of the long-term financial benefits of purchasing an EV. As can be seen in the table below, in 2021, the average price for a new electric vehicle was over $19,000 more than the average price for a new gasoline sedan [1]. However, the average costs for both fueling and maintaining a gas sedan were higher than their hybrid and electric competitors.

	Avg. Sticker Price (USD) [2]	Avg. Fuel cost/mile (cents, USD) [3]	Avg. Maintenance cost/mile
Gasoline	$19,900	6.84	8.83
Hybrid	$30,800	5.93	8.78
Electric	$39,000	3.66	7.70

There are also online tools available to compare costs and search for rebates. The U.S. Department of Energy hosts a tool through the Alternative Fuels Data Center that allows users to compare costs for makes and models of most vehicles. The same site also provides information on laws and incentives for alternative fuel vehicles by region.

Data Used for Vehicle Cost Comparison

To provide a simplified assessment of cost savings from switching to a partially or fully renewably powered vehicle, data was taken from the AAA 2021 Driving Costs report.

[1] https://newsroom.aaa.com/wp-content/uploads/2021/08/2021-YDC-Brochure-Live.pdf

[2]The figures used for Average Sticker Price in this table are based on the average MSRP of the five top-selling vehicles of 2021 in each category.

Medium Sedan — Chevrolet Malibu, Honda Accord, Hyundai Sonata, Nissan Altima, Toyota Camry

Hybrid Vehicle — Ford Explorer, Honda CR-V, Hyundai Ioniq, Toyota Prius Liftback, Toyota RAV4

Electric Car — BMW i3, Chevrolet Bolt, Hyundai Kona Electric, Nissan Leaf, Tesla Model 3

[3]Data points for fuel and maintenance costs included in this table are based on the five top-selling vehicles of 2021 in each respective category. The gasoline vehicle figure uses averages attributed to a small, or compact, sedan.

3.2 STRATEGY: Expand public and private charging infrastructure

By improving and expanding available electric vehicle infrastructure, Falmouth will encourage individuals to make the switch to an EV. The Town will introduce allotments for EV charging into building codes to standardize the availability of the infrastructure. Through these methods the Town will also contribute to education and understanding of EV infrastructure.

Town Partners

Sustainability Coordinator and Community Development Director

Resiliency Building

Emissions Reduction

Actions

a. Explore partnership with private installers to facilitate rapid build out of fast charging stations

b. Track expansion of EV charging through number of applications submitted to codes/ planning

c. Integrate EV charging requirements and readiness requirements into codes

d. Offer grants for charging stations to businesses

e. Track statewide infrastructure planning strategies and align local efforts to this plan

3.3 STRATEGY: Support medium and heavy-duty electrification in the region

In conjunction with the Maine Won't Wait climate plan, the State produced the Maine Clean Transportation Roadmap, which outlines a goal of reducing vehicle miles traveled by 4% for heavy-duty vehicles by 2030. The Town will support reducing transportation-related emissions by advocating for sustainable freight, assessing alternative fuel options for medium and heavy-duty municipal fleet vehicles and supporting electrified public transit options. The Town will also support the use of electrified vehicles for school transportation.

Town Partners

Sustainability Coordinator and Public Works Director

Resiliency Building

Emissions Reduction

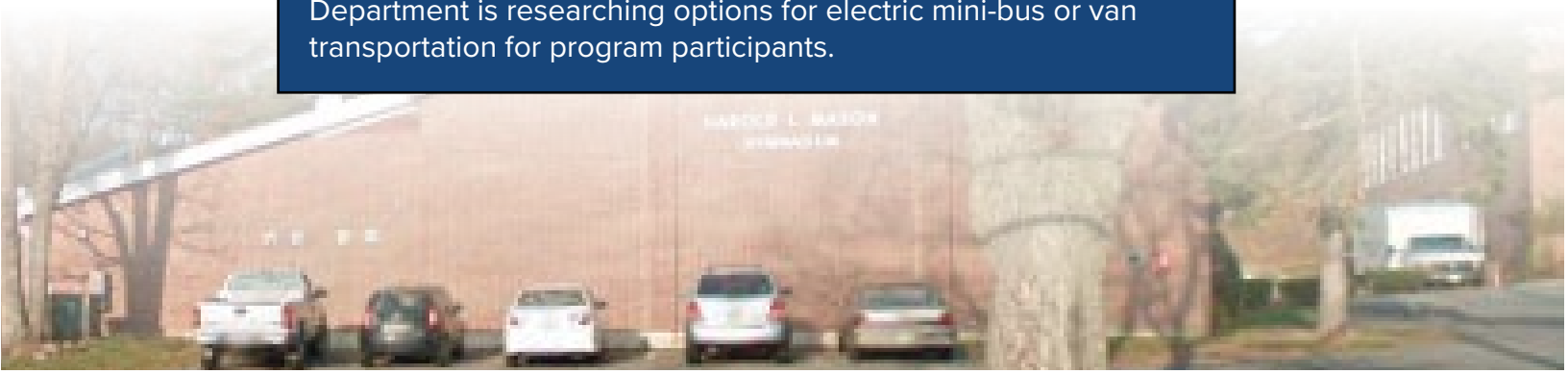
Actions

a. Assess medium and heavy-duty fleet vehicles and identify options for alternative fuels

b. Collaborate with other municipalities to set goals for transit electrification and strategic construction of charging stations

c. Work with school partners to support transitioning school bus fleet to electric vehicles

Work in Progress: The Parks and Community Programs Department is researching options for electric mini-bus or van transportation for program participants.



3.4 STRATEGY: Explore options for electric marine motors

Marine transportation contributes emissions to the Town GHG inventory. Advocating for electric marine vessels will contribute to the State's transition to sustainable transportation and help to meet emission reduction goals for the Town and State.

Town Partners

Police Chief

Resiliency Building

Emissions Reduction

Actions

a. Support and increase awareness of electric commercial and passenger marine vessel producers in Southern Maine

b. Assess feasibility of providing boat charging stations at Town Landing

c. Collaborate with private marinas to assess interest in developing electric charging stations

Priority Area:
Reducing community vehicle miles traveled

3.5 STRATEGY: Prioritize accessible and safe walking, biking, and active transportation in planning

Reducing the proportion of community vehicle miles traveled by car will be essential in meeting transportation emission reduction goals. The Town will prioritize land use development that encourages a variety of forms of transportation other than private vehicle usage, focusing first on accessibility of alternative transportation forms in areas designated for future planned development.

Town Partners

Long Range Planning Director

Resiliency Building

Emissions Reduction

Actions

a. Consider developing a Vision Zero Plan for Falmouth that improves road safety and reduces accidents

b. Include diverse voices to participate in community decision making around transportation

c. Update the 2016 Bicycle Pedestrian Plan

d. Continue to provide safe, equitable, convenient, and accessible infrastructure for pedestrians and cyclists

e. Launch a local bike sharing program

f. Require sidewalks and bike lanes in future reconstruction or re-design of roads, especially along major routes or roads in residential areas

Community Spotlight

No Idling Campaign

Discussions around reducing transportation emissions tend to center on electrification. There are a range of other initiatives that don't require a large up-front investment and reduce pollutants. Falmouth is taking the lead with introducing a "No Idling" campaign. Falmouth's initiative focuses on encouraging drivers to turn their engines off when they are waiting in parking lots or outside buildings. Other situations where idling is common, but unnecessary, include waiting in the drive-thru line, at a draw bridge, or railroad crossing. Idling a vehicle in these situations increases fuel costs, lowers vehicle fuel efficiency, and contributes additional pollution to the air.

The U.S. Department of Energy reported that, in total, 3 billion gallons of fuel are wasted annually across the country from idling vehicles [1]. All that idling contributes another 30 million tons of carbon dioxide to the atmosphere, adding up to a big problem. Exhaust fumes can cause irritation to the eyes and throat, and aggravate respiratory conditions, like asthma [2].

You can save money, reduce your carbon footprint, and protect public health by turning off your vehicle when stopped for more than 10 seconds.

MYTH: Restarting your engine uses more fuel than idling.

FACT: Idling for more than 10 seconds uses more fuel than turning off and restarting your engine [3].

MYTH: In cold weather, it takes several minutes of idling for the engine to "warm up".

FACT: It only takes about 20-30 seconds of running your vehicle for the engine lubricant to reach the vital components [4]. Your car warms up faster while driving than idling.

1 https://afdc.energy.gov/files/u/publication/idling_personal_vehicles.pdf
2 https://www.sciencedirect.com/science/article/pii/B9780128146941000075?via%3Dihub\
3 https://afdc.energy.gov/files/u/publication/which_is_greener.pdf
4 https://www.aaa.com/autorepair/articles/how-long-to-warm-up-the-engine-before-driving

3.6 STRATEGY: Build out public and active transit-oriented infrastructure

The Town can align future development in high density neighborhoods with transportation infrastructure that is both walkable and accessible to pedestrians. Aligning with the Town's 2022 Vision and Values Plan, which has identified development of village centers and core-development areas as a priority to residents, focusing on transit-oriented development will reduce reliance of individual passenger vehicle use. Falmouth has made major investments on Route 1 South and Route 100 to make them more pedestrian and bicycle friendly.

Town Partners

Long Range Planning Director

Resiliency Building

Emissions Reduction

Actions

a. Increase accessibility of current and future public transit networks by identifying areas with high commuting populations through surveys and community workshops

b. Collaborate with PACTS and regional partners (such as the Bicycle Coalition of Maine) to plan ways to improve regional active and public transportation accessibility and improve the safety of Falmouth's commuter workforce

c. Continue to develop a Complete Streets approach to roadway design

d. Prioritize infrastructure for active and public transportation networks, including bus shelters and bike lanes

e. Encourage density in transit-oriented corridors to ensure accessibility of public transportation

f. Prioritize mixed-use areas to help increase access to community resources

Priority Area:
Resilient Transportation Networks

3.7 STRATEGY: Adapt transportation infrastructure to climate impacts

The Town of Falmouth will incorporate climate projections and data from flood events to guide planning in future construction of transportation infrastructure. Roads and transportation infrastructure are essential to the regular functions of the Town and must be accessible to allow for emergency services to access all parts of the Town.

Town Partners

Long Range Planning Director

Resiliency Building

Emissions Reduction

Actions

a. Ensure that planning for critical road infrastructure updates incorporates projected climate impacts, examples of climate resilient designs include elevated roadways or creation of natural flood barriers

b. Collaborate with GPCOG and PACTS to join regular convening with regional partners to track most at-risk regional infrastructure

c. Consider and prioritize street connectivity in roadway design

Actions to Avoid

Avoid construction of new transportation infrastructure that encourages increased car usage whenever possible. New highway exits, multi-lane roads, and expansive parking infrastructure only encourage increased usage of private transportation. To reduce transportation emissions, future infrastructure must focus on alternatives to automobile transportation.

3.8 STRATEGY: Ensure safe workforce commuting and transportation networks

Investing in the effectiveness and resilience of public transportation networks that are efficient, affordable, and resilient will be essential in ensuring the well-being of residents. Reliable transportation networks also play a crucial role in ensuring access to evacuation routes and resources in the event of a disturbance. Actions:

Town Partners

Long Range Planning Director

Resiliency Building

Emissions Reduction

Actions

a. Prioritize collaboration with regional organizations and municipal partners in the PACTS Region to coordinate accessible local routes

b. Incorporate severe weather projections when planning future evacuation routes

c. Support the Community Transportation Leadership Program to increase the representation of residents in Falmouth regarding workforce commuting and access of public resources in nearby communities

d. Update flood management plan to anticipate areas of new flooding as local and state-wide data is made available, coordinate this data with emergency management plans

e. Prioritize workforce housing development in Falmouth, located near public transportation routes

Work in Progress: The Falmouth EMA annually evaluates the Town's Emergency Operations Plan, and will continue to make updates and changes as information becomes available.

Regional Inspiration

Community Transportation Leaders Program

The Community Transportation Leaders Program (CTLP) is an example of local ingenuity in transforming public transportation systems. The CTLP was established in 2019 with the direction of the Greater Portland Council of Governments to provide resources and training for community members to advocate for more accessible public transportation to decision-makers. The program creates space for individuals who experience challenges with transportation and/or mobility in the decision-making process for public transportation.

The need for CTLP in the City of Portland was due to discrepancies in public transportation systems other communities, like Falmouth, face. Challenges include limited bus route hours, difficulty reading or understanding schedules and maps, and language barriers. For those without access to cars, it can be very challenging to have reliable transportation, whether that be to work, school, doctor's appointments, or seeing friends.

Falmouth CAP

Waste Reduction Sector

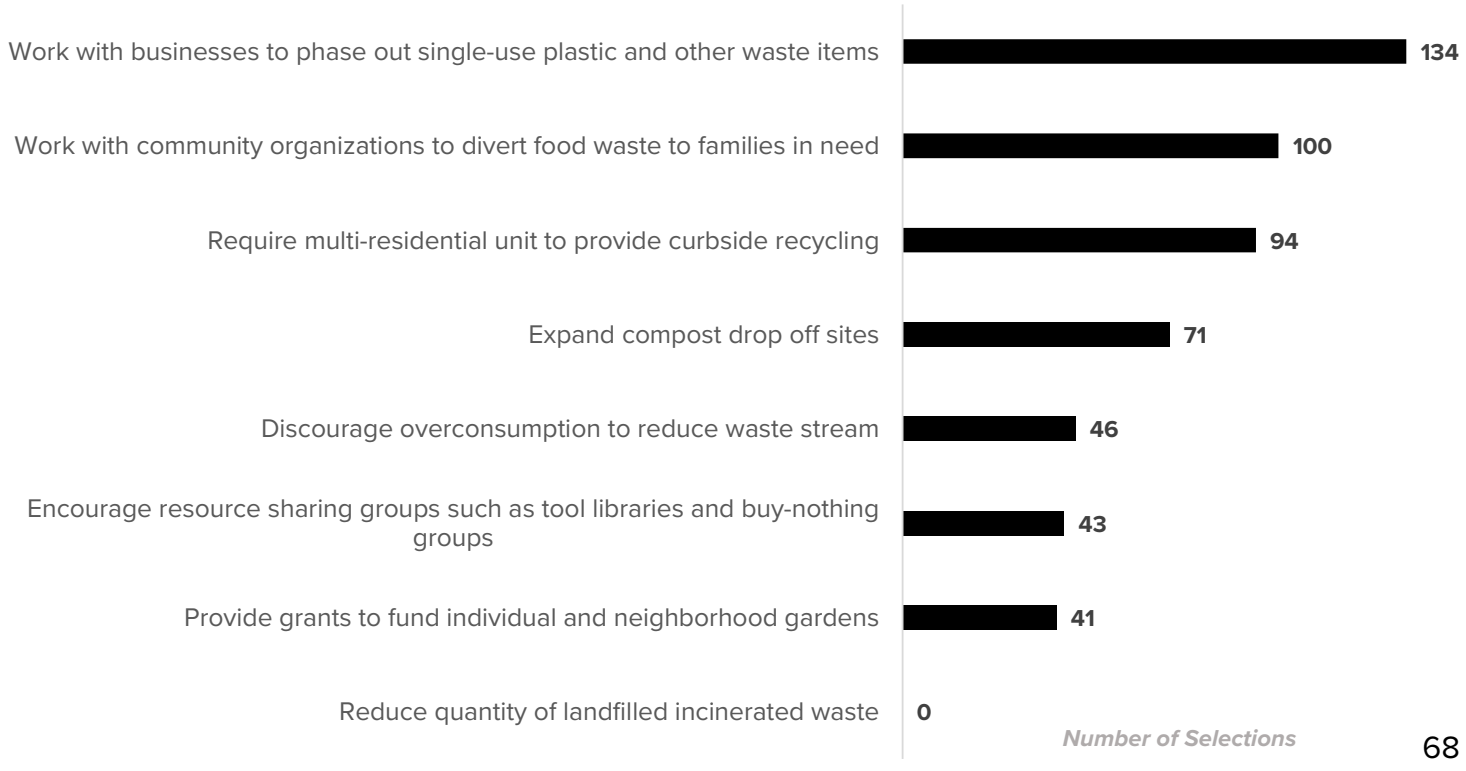
Waste Reduction

Waste reduction strategies will expand current efforts to improve recycling and organic composting access, prevent items from entering the waste stream, and develop a resource sharing economy. Fostering resource sharing will discourage overconsumption, which will significantly reduce "upstream" emissions from processes that fall outside of Town boundaries. Communities that produce and re-use resources at the local level whenever possible will also be more resilient to supply shocks or price volatility caused by climate-related impacts such as severe weather.

Priority Areas

- Community waste reduction
- Commercial and municipal waste

What We Heard Falmouth survey respondents selected their top three priorities for improving waste management:



Priority Area:
Community Waste Reduction

4.1

STRATEGY: Promote "circular" resource-sharing economy

In a circular, or sharing economy, goods and materials are repurposed and kept in use for as long as possible. By keeping commodities in circulation, promoting a sharing economy within the community would help reduce the annual waste stream while incentivizing households to consume less new materials. It also increases accessibility to goods and services for low-income households.

Town Partners

Sustainability Coordinator

Resiliency Building

Emissions Reduction

Actions

a. Promote the use of workshops or online forums where community members can distribute or collect goods

b. Establish a community tool library with electrified options and pursue other options to provide community resources through municipal facilities. By creating community resources for infrequently used items, such as power washers, landscaping equipment, trimming shears, or sewing machines, Falmouth helps reduce waste and makes them more accessible to low-income households.

c. Provide grants to fund individual and neighborhood community gardens

d. Host public events to support social exchanges, thrift, re-use, and "buy nothing" groups in Greater Portland area

4.2 STRATEGY: Expand community recycling services

Though Falmouth offers curbside recycling for households through Ecomaine's services, the Town can go further to reduce incinerated and landfilled waste by encouraging commercial businesses and owners of rented residential units to opt into recycling as well. Recycling programs are essential for discouraging waste at the individual level, as well as reducing pollution globally.

Falmouth's Recycling and Energy Advisory Committee has been working to establish a dialogue with local business leaders. This provides Falmouth with the opportunity to work directly with property owners and commercial facilities to understand any potential constraints or barriers that can be addressed before developing any community-wide recycling requirements.

Town Partners

Public Works Director

Resiliency Building

Emissions Reduction

Actions

a. Identify business leaders, commercial facilities and property owners to discuss recycling opt-in

b. Require recycling in commercial and multifamily residential buildings by 2030

c. Advocate with ecomaine to expand the number of products they accept for recycling, for example, flexible plastics, pipes, or garden hoses

4.3 STRATEGY: Expand composting and organics recycling

The Town will explore methods to divert food waste from the waste stream, namely by means of establishing food recovery programs and expanding access to composting services. Recycling food waste locally is an accessible way to reduce the total waste produced by the town. When recycled in community or private gardens, recycling food waste also has the added benefit of creating nutritious soil which can be used to grow plants and produce. Even if food waste does not stay within the Town, composting services help to eliminate waste and manage organic matter responsibly.

Town Partners

Public Works Director

Resiliency Building

Emissions Reduction

Actions

a. Encourage organics recycling for businesses and apartments

b. Continue and expand workshop offering to educate residents on composting

c. Work with community organizations to divert food waste to families in need

d. Expand community compost drop off sites

e. Incentivize and spread awareness of private curbside composting services

f. Incentivize recycling and compost in businesses and multi-family residences

g. Explore partnerships with other municipalities to advocate for a statewide mandate for food waste diversion in commercial buildings

Climate Action at Home: Composting

For community members with adequate outdoor space, consider starting a compost at home. Composting allows for organic materials to be returned to natural cycles, reduces waste going into landfills, and provides users with rich, fertile soil as the end product. Many items that we throw away in the trash are compostable, including vegetable scraps, eggshells, coffee grounds, and even unwaxed cardboard and paper. Rather than adding additional volume to landfills, organic material can be easily processed in your back yard. There are three basic components to consider when starting a compost:

There are many resources available for residents interested in beginning their own compost projects, including the EPA's guide to composting and the University of Maine's course on gardening and composting (sliding scale cost).

Community Spotlight

Composting Programs in Falmouth

Falmouth already hosts three operational compost drop-off sites for residents to discard organic waste. The drop off site at the transfer station is available during opening hours, and the sites located in Community Park and Village Park are available at any time. Between 2015 and 2019, the compost sites in Falmouth successfully diverted over 56 tons of food waste into productive compost.

Priority Area:
Community Waste Reduction

4.4 STRATEGY: Phase out single-use waste items

Reducing single-use disposable waste items will limit the amount of annual incinerated waste, saving Falmouth money and improving the health of local habitats and ecosystems by reducing litter. This, along with outreach programs and incentives, will encourage individuals and businesses to opt for sustainable products when possible.

Town Partners

Sustainability Coordinator

Resiliency Building

Emissions Reduction

Actions

a. Provide incentives to encourage use of re-usable or compostable consumables, such as a business recognition program or tax credits

b. Develop ordinances that discourage use of single use plastics

c. Collaborate with neighboring municipalities to advocate for statewide restrictions on single-use plastic

Common Single-Use Items

Plastic Bags

Take-Away Containers

Cups

Wrappers

4.5 STRATEGY: Work to electrify waste collection services

Falmouth will assess how emissions can be reduced from waste collection processes as another form of minimizing- and ultimately eliminating- emissions from the transportation sector. By creating relationships with waste haulers, the Town can advocate for electrification of waste collection services, and gain information about how to reduce emissions in waste management.

Town Partners

Public Works Director

Resiliency Building

Emissions Reduction

Actions

a. Collaborate with private waste haulers to reduce emissions of collection fleet

b. Work regionally with municipalities to explore options for electrification options for trash haulers

Falmouth CAP

Social Resilience

Sector

Social Resilience

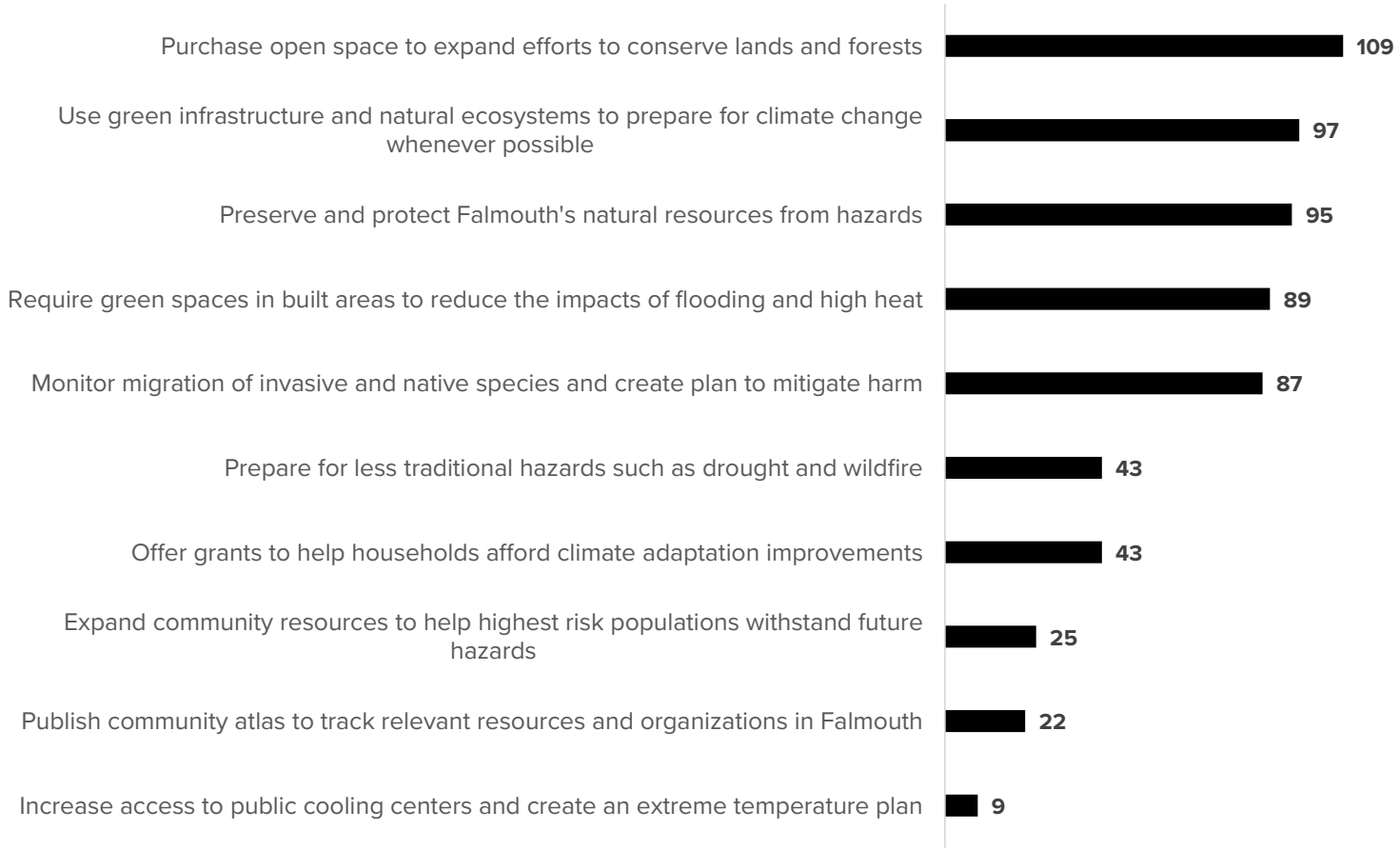
Social resilience strategies focus on building the capacity to withstand and rebound from shocks to Falmouth's neighborhoods, ecosystems, and infrastructure in the face of climate change. Improving climate resilience means developing a community better able to respond to and recover from hazards such as sea level rise, warming temperatures, and severe weather events.

Priority Areas

- → Building community resilience
- → Adapting infrastructure networks
- → Protecting natural resources

What We Heard

Falmouth survey respondents selected their top three priorities for improving climate resilience:



Priority Area:
Building community resilience

5.1

STRATEGY: Update emergency management plans and techniques

Climate action plans focus on mitigation of risk, because reducing exposure to hazards helps to decrease vulnerability. However, it is expected that not all hazards can be mitigated, and Falmouth must have infrastructure in place to manage damages after a disturbance. Developing a comprehensive hazard mitigation plan helps the community efficiently respond to resident needs in an emergency.

Town Partners

Emergency Management Agency

Resiliency Building

Emissions Reduction

Actions

a. Update the local Emergency Management Agency (EMA) hazard mitigation plan to include climate hazards and identify high priority areas of vulnerability

b. Complete the Maine Flood Resilience Checklist

c. Develop or enhance early warning systems and community evacuation plans

d. Develop a storm debris management plan

e. Follow the latest information on emerging climate threats, such as droughts and wildfires, to best inform hazard mitigation plans

Work in Progress: The Falmouth EMA will continue to work with various public and private entities in town to update their Emergency Operations Plans, as well as continue to update their own EOP annually.

5.2 STRATEGY: Organize infrastructure to reduce public health risks from high heat

The immediate priority in protecting public health will be preparing Falmouth for increased average temperatures and a higher frequency of heat waves. Extreme heat events can be deadly to vulnerable populations, and Maine is expected to experience more extreme heat events in the summer months as the climate warms. It is essential to provide cooling centers as a safety measure for residents who do not have adequate cooling in their homes. These actions will help to protect the safety and comfort of Falmouth residents during high temperatures.

Town Partners

Emergency Management Agency

Resiliency Building

Emissions Reduction

Actions

a. Identify potential public and private facilities viable to act as cooling center, based on size and location to population areas

b. Consider a heat wave management plan to provide an organized list of actions to reduce community vulnerability during heat waves. Collaborate with Police, Fire/EMS, and Parks department

c. Map access to waterfront in Falmouth and identify opportunities to improve equitable access to Falmouth waterways

d. Collaborate with large commercial facilities and multi-residential households to ensure cooling systems can be installed

e. Develop volunteer directory for the Town to staff cooling/heating centers

5.3 STRATEGY: Pursue equitable access to housing and community services

In addition to improving the standards of energy efficiency and climate resilience in the housing stock, Falmouth will collaborate with regional and state partners to find solutions to the burden of high housing costs, which make our population more vulnerable. In addition to housing, access to shared services can reduce vulnerability, especially for underrepresented communities.

Town Partners

Long Range

Planning Director

Resiliency Building

Emissions Reduction

Actions

a. Consider a community task force to address concerns of housing affordability and residential development planning in Falmouth

b. Publish a community atlas to track relevant services, resources and organizations in Falmouth

c. Cultivate neighborhood service hubs co-locate services like tool libraries, walk-in health services, cooling centers, food pantries, etc.

d. Encourage the development of neighborhoods that have a diversity of housing types within walking distance of goods and services and in connection to public transportation

e. Allow higher density construction upon the currently built environment to enable planning of community resources in areas with concentrated populations

Actions to Avoid

Avoid inequitable adaptation solutions that fail to incorporate the disproportionate needs of Falmouth's most socially vulnerable groups. The Town will explore ways to improve the affordability of individual climate resilience retrofits (such as flood barriers, building household cooling systems, and retrofitting households to protect from flooding) to reduce the cost burden.

Community Spotlight

Water Infrastructure and Sebago Clean Waters

Falmouth's drinking water is supplied by Portland Water District (PWD), which supplies ten other municipalities in the region, about 200,000 Mainers. The water comes from the Sebago Lake Watershed. The watershed has over 100 miles of shoreline and extends from Standish to Bethel, encompassing 440 square miles total. Currently, the Sebago Lake Watershed water is so clean it is exempt from filtration requirements under the Safe Drinking Water Act.

The land covering the Sebago Lake watershed is over 80% forested, which acts as a natural filtration system. However, increasing development in the region is threatening the forested ecosystems around the lake. To address this issue, Sebago Clean Waters was formed.

The organization's aim is to permanently conserve 35,000 acres of forested land in the watershed by 2032, to ensure high quality drinking water for current and future Mainers. Through collaboration with local municipalities, land trusts, and private donors, Sebago Clean Waters has already conserved nearly ten thousand acres of land. This long-term investment will protect the land and water, reduce future resource management costs, and maintain beautiful natural areas in the Greater Portland region.

Communities like Falmouth have a role to play in protecting their drinking water through commitments to conservation and protection of the watershed.

For more information on Portland Water District and Falmouth's drinking water, visit https://www.pwd.org/

For more information on the Sebago Clean Waters initiative, refer to https://www.sebagocleanwaters.org/

Priority Area:
Adapting infrastructure networks

5.4

STRATEGY: Develop resilient local energy systems

Falmouth will work to improve the resilience of local energy systems. While the Town of Falmouth has the most freedom in retrofitting its own facilities, by introducing resilient energy infrastructure and collaborating with community partners, Falmouth can act as a model for the benefits of independent and renewable energy.

Town Partners

Sustainability Coordinator

Resiliency Building

Emissions Reduction

** Microgrids are self-containing, controllable power grids that serve a small area.*

Actions

a. Consider resilience of newly installed energy systems in government operations. For example, evaluate the longevity of new technology, maintenance requirements, and if the location is at risk of being flooded, etc.

b. Collaborate with utilities and the state to evaluate current risks to the regional energy grid that may impact Falmouth

c. Develop and implement a Resilient Power Plan to develop a list of critical facilities in Falmouth that could most benefit from backup power

d. Require large commercial developments to evaluate feasibility of district energy or microgrids*. Developing energy on-site from a local central source reduces overall energy consumption and reduces stress on the grid.

e. Coordinate with Portland Water District to maintain and update drinking water infrastructure

5.5 STRATEGY: Prioritize green infrastructure

Falmouth currently enjoys a wealth of green spaces with 15% of land in conserved areas. The Town will track and monitor these open spaces and ensure that new development considers protecting green spaces. The Town will consider revising building codes to require green space guidelines in new construction to reduce the prevalence of impervious surfaces, lessen the impact of stormwater runoff, and make new neighborhoods less vulnerable to “heat island” effects that make them hotter.

Falmouth residents have a history of utilizing their many green spaces during warmer weather , the Town will collaborate with relevant partners, such as the Falmouth Land Trust, to increase availability, access to and use of outdoor spaces.

Town Partners

Community Development Director

Resiliency Building

Emissions Reduction

Actions

a. Expand the Living Lawns program to reduce water usage or soil degradation of private lawns

b. Adopt a low-impact design (LID) standard for stormwater management approaches. Prioritize green infrastructure over gray infrastructure, to help with natural cooling, groundwater replenishment from rain, and reduction of flooding

c. Develop incentives and regulations for tree cover and green space construction, both buildings and new streets

5.6 STRATEGY: Promote local food and resource networks

Falmouth can improve the resilience of local food systems by expanding access to community food programs while incentivizing local natural resource producers. The Town will explore expanding public land access for food production and identify partners to create events or programs to support local natural resource economy. The Town will also focus on understanding Falmouth's marine food economy.

Town Partners

Sustainability Coordinator

Resiliency Building

Emissions Reduction

Actions

a. Work with Falmouth Land Trust to identify land most suitable for agriculture and assess demand for additional farmland

b. Explore impact of climate change on traditional and emerging marine industries and collaborate with marine industries to ensure the sustainable use of resources

Community Spotlight

Hurricane Valley Farm

A historical homestead in Falmouth, Hurricane Valley Farm has been providing Falmouth with locally grown food and natural resource work opportunities for decades. In 2015, the land Hurricane Valley Farm is situated on was considered for development. Thanks to the initiative of the Falmouth Land Trust, Town of Falmouth, and concerned citizens, the farm became conserved land.

Hurricane Valley Farm hosts multiple market garden plots and a community garden. Residents and visitors to Falmouth can tour the farm, visit the community garden, and learn about local agriculture.

Cultivating Community is a Portland-based organization that has a long-term lease in Hurricane Valley Farm. The organization supports new Mainers by providing education on sustainable farming and aiding them in growing food on a leased plot. Since land procurement is a major financial barrier to growing local food, this program allows for more accessibility with small scale agriculture. Currently, 32 New American farmers are utilizing garden plots at the farm, growing their own produce, and developing useful skills. Thanks to a grant from GOPIF, this farm will soon be solar powered.

Hurricane Valley Farm highlights the connection between environmentally conscious planning and improved livelihoods for local people. For more information on Hurricane Valley Farm and their programs, visit https://falmouthlandtrust.org/hvf

Priority Area:
Protecting natural resources

5.7

STRATEGY: Protect wetlands, coastal habitats, and watersheds

The Town of Falmouth will continue to protect its natural ecosystems by incorporating climate adaptation strategies into short and long-term planning. The Town will collaborate with the Falmouth Land Trust, Casco Bay Estuary Partnership, and other relevant organizations in monitoring the health of marine and terrestrial habitats, understand species migration trends, and manage invasive pest populations.

Falmouth will explore opportunities to promote nature-based resilience solutions, such as facilitating tidal wetland migration to promote natural barriers to flooding and coastal erosion. By supporting green infrastructure within the built environment (such as retaining more stormwater runoff to reduce coastal acidification) to further reduce the vulnerability of its natural ecosystems.

Town Partners

Sustainability Coordinator

Resiliency Building

Emissions Reduction

Actions

a. Evaluate effectiveness and success of existing pesticide and fertilizer ordinances

b. Collaborate with regional partners to prevent net coastal wetland habitat loss

c. Explore public and private opportunities for preserving wetlands and restoring natural flood barriers. Especially those that protect public access to waterways.

d. Explore restricting removal of native vegetation from buffer zones around wetlands and coastline.

Community Spotlight

Climate Ready Casco Bay

Climate Ready Casco Bay is a two-year project to develop nature-based coastal resilience solutions across eleven Casco Bay communities, including Falmouth. The project will help Falmouth understand what nature-based solutions exist for high risk sites along Falmouth's coast. To read more about CRCB, visit https://www.climatereadycascobay.org/

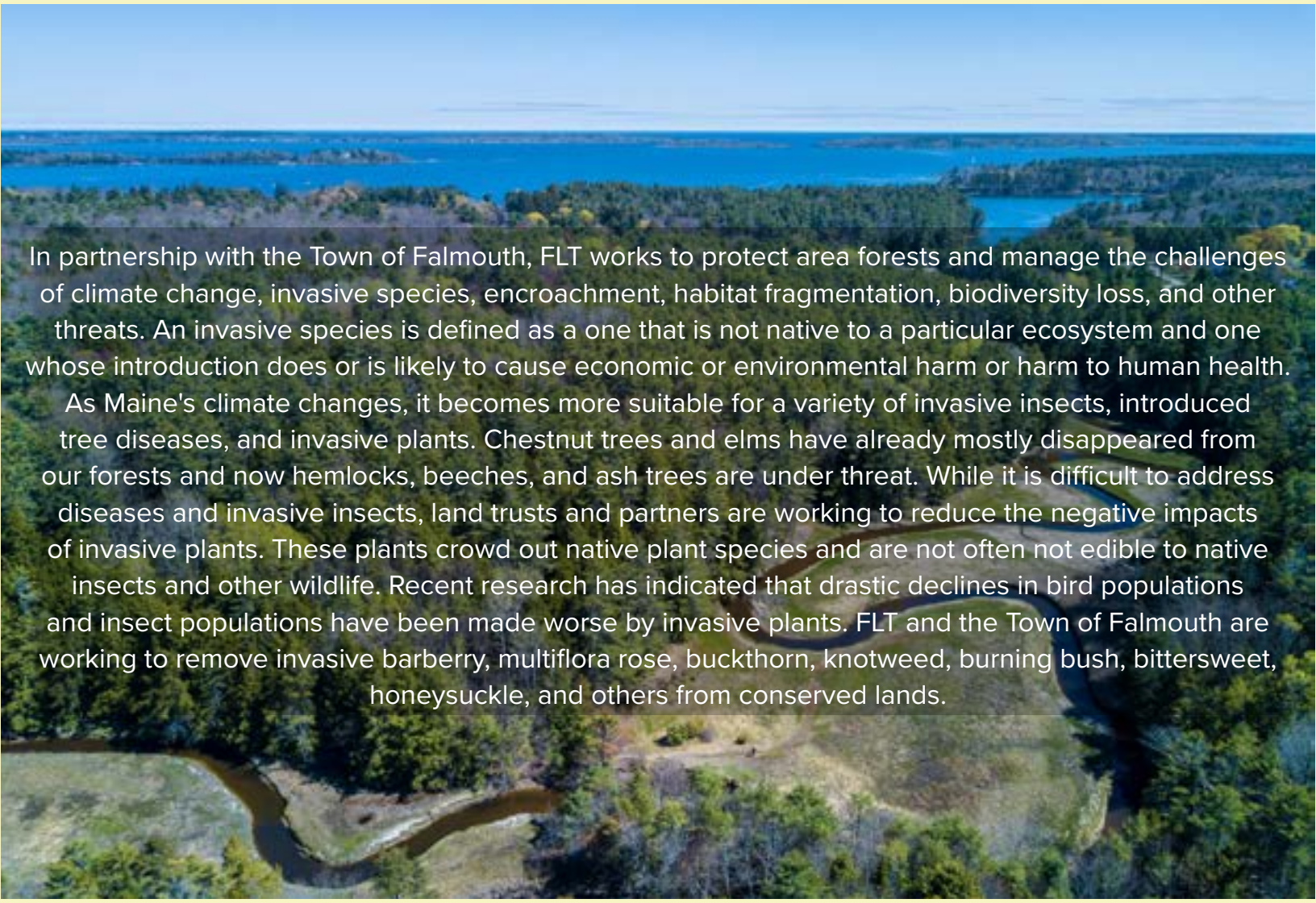
Climate Ready Casco Bay engages community members who live, work and play in Casco Bay: whose livelihoods are intertwined with the prosperity of our coastline and will be greatly affected by coastal climate hazards like flooding and erosion. The project will result in the following outcomes for Falmouth and other member communities:

- Increased municipal knowledge, capacity and plans to protect coastal habitats and infrastructure from climate impacts.
- Identification of high priority coastal resilience projects across the region
- A regional resilience plan identifying community and ecosystem resilience needs, and actions and best practices to mitigate flood risks.

Community Spotlight

Falmouth Land Trust

Falmouth's forests absorb and store carbon, decrease the risk of flooding during intense rain events, and lower summer temperature highs, along with providing myriad other benefits. The nonprofit Falmouth Land Trust (FLT) was founded in 1981 and now cares for over 2,700 acres in town, most of which are forested. Many of these lands are also open for public recreation on an extensive trail network. Maine's nonprofit land trusts collectively conserve more than 12% of the state, providing over 2.34 million acres of publicly accessible land, more than 1,000 miles of recreational trails, critical wildlife habitat, managed forests, and working waterfronts and farms.



In partnership with the Town of Falmouth, FLT works to protect area forests and manage the challenges of climate change, invasive species, encroachment, habitat fragmentation, biodiversity loss, and other threats. An invasive species is defined as a one that is not native to a particular ecosystem and one whose introduction does or is likely to cause economic or environmental harm or harm to human health. As Maine's climate changes, it becomes more suitable for a variety of invasive insects, introduced tree diseases, and invasive plants. Chestnut trees and elms have already mostly disappeared from our forests and now hemlocks, beeches, and ash trees are under threat. While it is difficult to address diseases and invasive insects, land trusts and partners are working to reduce the negative impacts of invasive plants. These plants crowd out native plant species and are not often not edible to native insects and other wildlife. Recent research has indicated that drastic declines in bird populations and insect populations have been made worse by invasive plants. FLT and the Town of Falmouth are working to remove invasive barberry, multiflora rose, buckthorn, knotweed, burning bush, bittersweet, honeysuckle, and others from conserved lands.

FLT also supports sustainable agriculture, by owning and maintaining Hurricane Valley Farm, which is farmed by New Americans working with the nonprofit Cultivating Community. FLT, the Town of Falmouth, and Cultivating Community recently partnered to solarize farm operations with financial support from the Governor's Office of Policy Innovation and the Future.

Volunteers and community support are always welcome and needed. For more information and to get involved, visit FalmouthLandTrust.org

5.8 STRATEGY: Preserve forests and wetlands and promote conservation to offset carbon and climate impacts

Natural areas, and especially established forests, uptake carbon dioxide and absorb air pollutants. The expansion of forests is key to meeting zero net emission goals and improving the overall climate impact of the Town.

Town Partners

Parks and Community Programs Director

Resiliency Building

Emissions Reduction

Actions

a. Track state and regional efforts to develop an emissions tracking system to calculate carbon offsets from wetland habitat acreage and use available data in future greenhouse gas emissions inventories

b. Commit to minimizing forest loss and encouraging climate smart forest management within town boundaries

c. Working with willing sellers/donors, commit to conserving at least 30% of Falmouth's land in perpetuity by 2040, either through fee acquisition or conservation easement, with an emphasis on forested areas, ecologically significant land and at-risk coastal property

d. Collaborate with Falmouth Land Trust and Parks department to inventory open space and identify gaps in habitat connectivity

e. Stay informed of increasing wildfire risk and work with municipal staff to identify at-risk Falmouth locations

f. Adopt post-construction soil health standards through a new Town ordinance or zoning amendments

g. Work with regional and private partners to identify lands for reforesting and pursue reforestation efforts on public lands

5.9 STRATEGY: Monitor invasive species and native species migration

As Maine's climate changes, habitats and species are shifting. The Town of Falmouth is working with State agencies and partners to monitor new or invasive species in the area or changes in migration patterns for existing species. This will allow for proactive planning for the potential of increased invasive species, wildlife encounters or vector-borne diseases.

Town Partners

Sustainability Coordinator

Resiliency Building

Emissions Reduction

Actions

a. Partner with organizations to monitor migration of invasive and native species and create plans to mitigate harm

b. Collaborate with CDC to monitor changes and inform residents of trends

c. Consider a pest management plan to organize response to changing pest population trends

d. Update the Town's 2018 Invasive Terrestrial Plants Management and Control Plan

Implementation Monitoring and Reporting

An effective plan to reduce GHG emissions will require tracking and monitoring. Greenhouse gas inventories are time consuming and resource-intensive to complete, and projects that reduce emissions take time to implement and return results. The Town of Falmouth will endeavor to conduct a GHG inventory every 3 years to track compliance with the targets of the Falmouth Climate Action Plan. Similar to the GHG inventory, the Vulnerability Assessment is time-consuming. The Town will make updates to the Vulnerability Assessment within a reasonable timeline as new climate data becomes available and additional impacts are assessed.

To monitor progress in achieving the targets of the Climate Action Plan, the Town will annually track an additional series of indicators that provide data on progress towards our goals. Efficiency Maine provides data on rebates for all their programs, which Falmouth can readily request. The Town will track the number of solar panels installed through the number of approved permits and refer to vehicle registration records documented annually from the Maine Department of Environment to track the number of electric vehicles. The Town will update this chart annually to assess progress. Although this chart only goes to 2030, the same format can be used to track indicators until 2050.

Indicator	**Projects Complete 2020**	**Number of Projects Completed Annually**										**Projects Complete 2030**	**Suggested Target for 2030**	**Suggested Target for 2040**	**Suggested Target for 2050**
		2021	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**				
Solar Panel Permits															
Solar Panels (KW)													6,400 KW	16,400 KW	28,400 KW
Air Sealing Projects	245														
Insulation Projects	310														
Heat Pumps Installed	677												3,200	3,950	4,550
Electric Vehicles													5,600	8,600	11,100

Appendix A - Implementation

The implementation table is a tool to help the Town highlight the most crucial actions to be taken immediately and to organize all actions in a realistic timeline of implementation. While Falmouth's emission reduction targets are for 2030 and 2050, this table is organized as actions by 2027 and by 2040. It takes time for actions to reflect the resulting change in emissions, and must be initiated several years before the desired emissions outcome.

Municipal Operations				
Strategy	**Responsibility**	**Immediate & Recurring**	**By 2027**	**By 2040**
1.1 Complete Energy Audits of Government Operations	Sustainability Coordinator		Identify municipal buildings most in need of energy efficiency upgrades	
			Evaluate anticipated electricity needs of buildings after electrifying	
			Determine which facilities could host rooftop solar or renewable energy	
			Update asset management plans to reflect the identified improvements needed and plan for implementation of those actions.	
1.2 Reducing fossil fuel use in government facilities	Sustainability Coordinator	Discontinue use of fossil fuel heating and cooling systems in newly constructed facilities	Explore additional power purchase agreements and new renewable energy sources to increase use of renewable energy to the greatest extent possible	Retrofit government facilities to reduce energy usage intensity
				Switch all fossil fuel-based building energy with electric heating and cooling systems

Strategy	Responsibility	Immediate & Recurring	By 2027	By 2040
1.3 Electrify municipal fleet vehicles and provide adequate charging infrastructure for municipal needs	Finance Director	Complete a municipal vehicle fleet assessment	Establish an electric vehicle procurement plan that phases out purchases of fossil-fuel based vehicles when electric equivalent is available and cost effective	Install EV charging stations at strategic government buildings, with the aim of creating enough capacity to accommodate an entirely electric fleet
			Invest in electric landscaping and off-road equipment to further reduce emissions in operations.	Replace vehicles to the extent technology allows to achieve a completely electric municipal fleet by 2040
1.4 Pursue 100% renewably sourced electricity generation for government operations	Finance Director	Develop any future projects or purchase agreements to need current and forecasted municipal electricity needs	Select department buildings for renewable energy (such as rooftop solar panels) based on need, cost-effectiveness, and priority of government department.	Estimate future energy demand of government operations factoring in completing electrification of buildings, facilities, and municipal fleet
		Evaluate energy needs for municipal operations to understand scope of demand	Install rooftop solar on all viable department buildings. Assess further energy needs to determine the need for future PPAs	Achieve a complete renewable energy portfolio for municipal electricity by 2040
1.5 Reduce municipal waste stream and ensure sustainably sourced government consumption	Sustainability Coordinator and Finance Director	Continue to expand and promote municipal composting programs	Incorporate a focus on reducing fossil fuel-based appliances into the green procurement policy	
		Prioritize locally sourced procurement of food for town events		

Strategy	Responsibility	Immediate & Recurring	By 2027	By 2040
1.6 Develop project ideas for at-risk infrastructure or ecosystems	Sustainability Coordinator and Public Works Director	Conduct site-specific vulnerability impact assessments for at-risk infrastructure within each department for assets identified as vulnerable in the Vulnerability Assessment Report	Conduct a full assessment of all culvert upsizing requirements	
		Consistently track coastal and inland flooding occurrences to develop an understanding of flooding trends and adjust planning for the future as conditions change	Work with consultants to develop concepts for resilience projects	
		Convene department heads and emergency management professionals to prioritize sites	Explore restoring native vegetation or developing “no mow” landscaping to mitigate environmental effects	
1.7 Ensure department staff has capacity to enact Climate Action Plan	Town Manager	Provide educational opportunities to municipal staff on best practices for climate action	Assess need for additional staff.	
		Ensure future collaboration between departments to facilitate sharing of resources and information in future adaptation management	Appoint a liaison to coordinate sustainability programs for residents and provide outreach to connect residents with resources	

Buildings and Energy Usage				
Strategy	**Responsibility**	**Immediate & Recurring**	**By 2027**	**By 2040**
2.1 Increase community uptake of electric heating and cooling systems	Sustainability Coordinator	Track annual Efficiency Maine rebate data to assess progress in electrifying homes in Falmouth	Launch electrification campaign with general outreach and education on financial incentives and technical details of electric heat pumps	
			Develop additional Town-wide financial incentives to reduce the cost of electric heating and cooling installations for low and middle-income residents, such as partnering with local installers or tax-increment financing	
2.2 Develop an Energy Benchmarking Program	Sustainability Coordinator	Encourage utilities to provide whole building data (energy and/or water data summed for an entire property) access to property owners and Efficiency Maine with reasonable accommodations for data privacy	Work with PUC utilities and neighboring municipalities to develop energy benchmarking program for Falmouth	Expand benchmarking to multifamily residences and smaller commercial buildings
			Implement benchmarking program, starting with municipal buildings and large commercial facilities as a pilot	Develop program to help establishments not meeting benchmarking requirements

Strategy	Responsibility	Immediate & Recurring	By 2027	By 2040
2.3 Incentivize Fuel and Energy Efficiency Retrofitting in Buildings	Sustainability Coordinator	Join other communities to advocate for additional funding for Efficiency Maine rebates	Collaborate with large energy-using commercial facilities, multi-family residences to determine feasible energy retrofitting solutions.	Deploy additional incentives to speed up energy efficiency retrofitting of buildings in the Town
		Track annual Efficiency Maine rebates to assess progress in weatherizing homes	Evaluate costs and benefits of creating a C-PACE ordinance that would incentivize commercial property owners to retrofit their properties	
2.4 Adopt More Efficient Building Codes	Community Development Director	Explore the most recent edition of IECC building energy stretch codes	Move towards restricting fossil-fuel use in new construction, starting with financial incentives or rebates to encourage the use of electrification over fossil fuels	Collaborate with neighboring municipalities to encourage uniform regional pledge of stretch codes
				Restrict large fossil fuel emitting facilities in future construction

Strategy	Responsibility	Immediate & Recurring	By 2027	By 2040
2.5 Accelerate Residential Renewable Energy Usage	Sustainability Coordinator	Review existing zoning and regulation to ensure streamlined installation process of renewable energy installation	Launch general outreach on financial incentives and benefits of clean energy	Provide additional discounts or incentives to Falmouth residents
		Provide resources to residents to assess the feasibility of clean energy installations		
		Track progress of renewable energy installations by number of annual applications from codes and planning department		
2.6 Expand Opportunities for Community Energy Memberships	Sustainability Coordinator	Expand awareness of community solar partnerships to benefit households that are less likely to incorporate renewable energy systems due to unfavorable location or burdensome cost	Explore financial incentives to encourage community energy memberships for households least likely to afford individual energy retrofitting	
2.7 Require New Residential and Commercial Construction to have Capacity for Sustainable Energy	Sustainability Coordinator and Community Development Director	Encourage building of solar on impervious surfaces such as parking lots	Add requirement for installing electric vehicle charging in new developments	Investigate development of an on-site solar requirement for new construction
		Establish relationship with local private contractors to provide logistics support and guide a feasible decarbonization process	Ensure reasonable permitting process for renewable energy installment	

Strategy	Responsibility	Immediate & Recurring	By 2027	By 2040
2.8 Ensure Design of New Construction Incorporates Planning for Future Climate Hazards	Community Development Director	Incorporate sea level rise and flooding projections in all municipal planning documents to inform developers and residents of the potential damage from floods and coastal erosion. Ensure inclusion of inland flooding.	Require water efficiency standards in future buildings codes to improve resistance to drought or water shortages in new construction	
			Restrict development in areas with high flood risk by amending shoreline zoning laws and require that construction in these areas be elevated at least one foot over the base flood elevation to protect structures from increasing sea level rise and storm surge	
2.9 Improve Understanding of Community Vulnerability and Engage in Adaptation Techniques	Sustainability Coordinator	Explore enrolling in the National Flood Insurance Program Community Rating System by incorporating floodplain management techniques that exceed the minimum requirements, to benefit from reduced premiums for homeowners that pay flood insurance	Collaborate with State agencies to better understand the risk of coastal erosion for existing construction along inland waterways	
			Explore viability of nature-based flood barriers to protect vulnerable buildings from sea level rise	
		Provide education through town-led campaigns on the relationship between climate hazards and personal risk	Map town services and access to amenities to identify potential gaps in service and to better understand if there are issues with accessibility of cooling centers or other town provided services for underrepresented populations	

Transportation and Land Use				
Strategy	**Responsibility**	**Immediate & Recurring**	**By 2027**	**By 2040**
3.1 Promote Electric Vehicle Purchasing	Sustainability Coordinator	Launch electrification campaign to expand use of electric vehicles	Widely promote existing rebates through Efficiency Maine, and hold events to explain incentives through federal funding	
		Track annual progress in fleet electrification from state DOT vehicle population statistics		
3.2 Expand Public and Private Charging Infrastructure	Sustainability Coordinator and Community Development Director	Explore partnership with private installers to facilitate rapid build out of fast charging stations	Integrate EV charging requirements and readiness requirements into codes	
		Track expansion of EV charging through number of applications submitted to codes/planning	Offer grants for charging stations to businesses	
		Track statewide infrastructure planning strategies and align local efforts to this plan		

Strategy	Responsibility	Immediate & Recurring	By 2027	By 2040
3.3 Support Medium and Heavy-Duty Electrification in the Region	Sustainability Coordinator and Public Works Director	Assess medium and heavy-duty fleet vehicles and identify options for alternative fuels Collaborate with other municipalities to set goals for transit electrification and strategic construction of charging stations	Work with school partners to support transitioning school bus fleet to electric vehicles	
3.4 Explore Options for Electric Marine Motors	Police Chief	Support and increase awareness of electric commercial and passenger marine motor producers in Southern Maine		Assess feasibility of providing boat charging stations at Town Landing Collaborate with private marinas to assess interest in developing electric charging stations

Strategy	Responsibility	Immediate & Recurring	By 2027	By 2040
3.5 Prioritize Accessible and Safe Walking, Biking, and Active Transportation in Planning	Long Range Planning Director	Consider developing a Vision Zero Plan for Falmouth that improves road safety and reduces accidents	Update the 2016 Bicycle Pedestrian Plan	Ensure access to public transit within 500 feet of large population areas
		Continue to provide safe, equitable, convenient, and accessible infrastructure for pedestrians and cyclists	Launch a local bike sharing program	
		Include diverse voices to participate in community decision making around transportation	Require sidewalks and bike lanes in future reconstruction or re-design of roads, especially along major routes or roads in residential areas	
3.6 Build Out Public and Active Transit-Oriented Infrastructure	Long Range Planning Director	Collaborate with PACTS and regional partners (such as the Bicycle Coalition of Maine) to plan ways to improve regional active and public transportation accessibility and improve the safety of Falmouth's commuter workforce	Continue to develop a Complete Streets approach to roadway design	
			Prioritize infrastructure for active and public transportation networks, including bus shelters and bike lanes	
		Increase accessibility of current and future public transit networks by identifying areas with high commuting populations through surveys and community workshops	Encourage density in transit-oriented corridors to ensure accessibility of public transportation	
			Prioritize mixed-use areas to help increase access to community resources	

Strategy	Responsibility	Immediate & Recurring	By 2027	By 2040
3.7 Adapt Transportation Infrastructure to Climate Impacts	Long Range Planning Director	Ensure that planning for critical road infrastructure updates incorporates projected climate impacts, examples of climate resilient designs include elevated roadways or creation of natural flood barriers	Consider and prioritize street connectivity in roadway design	
		Collaborate with GPCOG and PACTS to join regular convening with regional partners to track most at-risk regional infrastructure		
3.8 Ensure Safe Workforce Commuting and Transportation Networks	Long Range Planning Director	Prioritize collaboration with regional organizations and municipal partners in the PACTS Region to coordinate accessible local routes	Prioritize workforce housing development in Falmouth, located near public transportation routes	
		Incorporate severe weather projections when planning future evacuation routes		
		Support the Community Transportation Leadership Program (CTLP) to increase the representation of residents in Falmouth regarding workforce commuting and access of public resources in nearby communities	Update flood management plan to anticipate areas of new flooding as local and state-wide data is made available, coordinate this data with emergency management plans.	

Waste Reduction				
Strategy	**Responsibility**	**Immediate & Recurring**	**By 2027**	**By 2040**
4.1 Promote "Circular" Resource-Sharing Economy	Sustainability Coordinator	Promote the use of workshops or online forums where community members can distribute or collect goods	Establish a community tool library with electrified options and pursue other options to provide community resources through municipal facilities	
			Provide grants to fund individual and neighborhood community gardens	
			Host public events to support social exchange, thrift, re-use, and "buy nothing" groups in Greater Portland area	
4.2 Expand Community Recycling Services	Public Works Director	Advocate with ecomaine to expand the number of products they accept for recycling, for example, flexible plastics, pipes, or garden hoses	Identify business leaders, commercial facilities and property owners to discuss recycling opt-in	
			Require recycling in commercial and multifamily residential buildings by 2030	

Strategy	Responsibility	Immediate & Recurring	By 2027	By 2040
4.3 Expand Composting and Organics Recycling	Public Works Director	Incentivize and spread awareness of private curbside composting services	Expand community compost drop off sites	Explore partnerships with other municipalities to advocate for a statewide mandate for food waste diversion in commercial buildings
		Encourage organics recycling for businesses and apartments	Incentivize, recycling and compost in businesses and multi-family residences	
		Continue and expand workshop offering to educate residents on composting	Work with community organizations to divert food waste to families in need	
4.4 Phase Out of Single-Use Waste Items	Sustainability Coordinator	Collaborate with neighboring municipalities to advocate for statewide restrictions on single-use plastic	Provide incentives to encourage use of re-usable or compostable consumables, such as a business recognition program or tax credits	
			Develop ordinances that discourage use of single use plastics	
4.5 Work to Electrify Waste Collection Services	Public Works Director		Collaborate with private waste haulers to reduce emissions of collection fleet	
			Work regionally with municipalities to explore options for electrification options for trash haulers	

Social Resilience				
Strategy	**Responsibility**	**Immediate & Recurring**	**By 2027**	**By 2040**
5.1 Update Emergency Management Plans and Techniques	Emergency Management Agency	Update the local Emergency Management Agency (EMA) hazard mitigation plan to include climate hazards and identify high priority areas of vulnerability	Develop or enhance early warning systems and community evacuation plans	
		Follow the latest information on emerging climate threats, such as droughts and wildfires, to best inform hazard mitigation plans.		
		Complete the Maine Flood Resilience Checklist	Develop a storm debris management plan	
5.2 Organize Infrastructure To Reduce Public Health Risks From High Heat	Emergency Management Agency	Identify potential public and private facilities viable to act as cooling center, based on size and location to population areas	Collaborate with large commercial facilities and multi-residential households to ensure cooling systems can be installed	Consider a heat wave management plan to provide an organized list of actions to reduce community vulnerability during heat waves. Collaborate with Police, Fire/EMS, and Parks department.
		Develop volunteer directory for the Town to staff cooling/ heating centers		Map access to waterfront in the Town and identify opportunities to improve equitable access to Town waterways

Strategy	Responsibility	Immediate & Recurring	By 2027	By 2040
5.3 Pursue Equitable Access to Housing and Community Services	Long Range Planning Director	Consider a community task force to address concerns of housing affordability and residential development planning in Falmouth	Encourage the creation of neighborhoods that cluster a diversity of housing types within walking distance of goods and services and in connection to public transportation	Cultivate neighborhood service hubs co-locate services like tool libraries, walk-in health services, cooling centers, food pantries, etc.
				Allow higher density construction upon the currently built environment to enable planning of community resources in areas with concentrated populations
				Publish a community atlas to track relevant services, resources and organizations in Falmouth
5.4 Develop Resilient Local Energy Systems	Sustainability Coordinator	Consider resilience of newly installed energy systems in government operations. For example, evaluate the longevity of new technology, maintenance requirements, and if the location is at risk of being flooded, etc.	Develop and implement a Resilient Power Plan to provide a list of critical facilities in the cities that could most benefit from backup power	Require large commercial developments to evaluate feasibility of district energy or microgrids
		Coordinate with Portland Water District to maintain and update drinking water infrastructure	Collaborate with utilities and the state to evaluate current risks to the regional energy grid that may impact Falmouth	

Strategy	Responsibility	Immediate & Recurring	By 2027	By 2040
5.5 Prioritize Green Infrastructure	Community Development Director	Adopt a low-impact design (LID) standard for stormwater management approaches. Prioritize green infrastructure over gray infrastructure, to help with natural cooling, groundwater replenishment from rain, and reduction of flooding	Develop incentives and regulations for tree cover and green space construction, both buildings and new streets Expand the Living Lawns program to reduce water usage or soil degradation of private lawns	
5.6 Promote Local Food and Resource Networks	Sustainability Coordinator		Work with Falmouth Land Trust to identify land most suitable for agriculture and assess demand for additional farmland	Explore impact of climate change on traditional and emerging marine industries and collaborate with marine industries to ensure the sustainable use of resources
5.7 Protect Wetlands, Coastal Habitats, and Watersheds	Sustainability Coordinator	Collaborate with regional partners to prevent net coastal wetland habitat loss	Evaluate effectiveness and success of existing pesticide fertilizer ordinances Explore public and private opportunities for preserving wetlands and restoring natural flood barriers. Especially those that protect public access to waterways. Explore restricting removal of native vegetation from buffer zones around wetlands and coastline	

Strategy	Responsibility	Immediate & Recurring	By 2027	By 2040
5.8 Preserve Forests and Wetlands and Promote Conservation to Offset Carbon and Climate Impacts	Parks and Community Programs Director	Track state and regional efforts to develop an emissions tracking system to calculate carbon offsets from wetland habitat acreage and use available data in future greenhouse gas emissions inventories	Collaborate with Falmouth Land Trust and Parks department to inventory open space and identify gaps in habitat connectivity	Working with willing sellers/donors, commit to conserving at least 30% of Falmouth's land in perpetuity by 2040, either through fee acquisition or conservation easement, with an emphasis on forested areas, ecologically significant land and at-risk coastal property
			Commit to minimizing forest loss and encouraging climate smart forest management within town boundaries	
		Work with regional and private partners to identify lands for reforesting and pursue reforestation efforts on public lands	Adopt post-construction soil health standards through a new Town ordinance or zoning amendments	Stay informed of increasing wildfire risk and work with municipal staff to identify at-risk Falmouth locations
5.9 Monitor Invasive Species and Native Species Migration	Sustainability Coordinator	Partner with organizations to monitor migration of invasive and native species and create plans to mitigate harm	Collaborate with CDC to monitor changes and inform residents of trends	Consider a pest management plan to organize response to changing population trends
			Update the Town's 2018 Invasive Terrestrial Plants Management and Control Plan	

Implementation Monitoring and Reporting

An effective plan to reduce GHG emissions will require tracking and monitoring. Greenhouse gas inventories are time consuming and resource-intensive to complete, and projects that reduce emissions take time to implement and return results. The Town of Falmouth will endeavor to conduct a GHG inventory every 3 years to track compliance with the targets of the Falmouth Climate Action Plan. Similar to the GHG inventory, the Vulnerability Assessment is time-consuming. The Town will make updates to the Vulnerability Assessment within a reasonable timeline as new climate data becomes available and additional impacts are assessed.

To monitor progress in achieving the targets of the Climate Action Plan, the Town will annually track an additional series of indicators that provide data on progress towards our goals. Efficiency Maine provides data on rebates for all their programs, which Falmouth can readily request. The Town will track the number of solar panels installed through the number of approved permits and refer to vehicle registration records documented annually from the Maine Department of Environment to track the number of electric vehicles. The Town will update this chart annually to assess progress. Although this chart only goes to 2030, the same format can be used to track indicators until 2050.

Indicator	**Projects Complete 2020**	**Number of Projects Completed Annually**										**Projects Complete 2030**	**Suggested Target for 2030**	**Suggested Target for 2040**	**Suggested Target for 2050**
		2021	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**				
Solar Panel Permits															
Solar Panels (KW)													6,400 KW	16,400 KW	28,400 KW
Air Sealing Projects	245														
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Heat Pumps Installed	677												3,200	3,950	4,550
Electric Vehicles													5,600	8,600	11,100

Appendix B

Funding Sources

In order to achieve the mitigation and adaptation targets set in this plan, Falmouth will pursue external funding where appropriate. There are many federal, state, and local funding opportunities available that are designed to finance climate action projects. The following pages include a variety of examples of programs and grants that are applicable to projects in Falmouth's plan. This is not a complete list of potential funding sources for Falmouth's projects, and is only relevant in 2023. The Town will continue to evaluate new funding sources as they become available.

> **Note:** The Infrastructure and Investment Jobs Act, passed into law in 2021, guarantees significant funding for most of the listed sectors until 2026. Information about specific grants funded through IIJA can be found at https://www.maine.gov/bil/ . In addition, there will be significant funding opportunities through the Inflation Reduction Act passed in 2022, much of these programs are just now being developed and will be tracked closely through 2023 and beyond.
>
> The Maine Jobs and Recovery Plan (2021) also provides potential funding sources for mitigation, adaptation, and community-building projects. For more information, visit https://www.maine.gov/jobsplan/dashboard.

Public Transit

IIJA funding has provided the state with $234 million to improve public transportation, including projects related to modernizing systems and increasing accessibility. Most of this funding is allocated through the Federal Highway Administration and the Federal Transit Administration and flows to the Maine Department of Transportation. For more detailed funding program information visit https://www.maine.gov/mdot/bil/.

The Maine Jobs & Recovery Plan has set aside $5 million to fund innovative public transportation options, specifically in rural areas, in order to reduce commuting costs. There is also guaranteed funding for the state for public transit maintenance and expansion. Nationwide, an additional $66 billion has been authorized for the largest rail infrastructure upgrade since Amtrak's creation. The funding will go towards rail maintenance projects and improving connectivity in the Northeast corridor.

Resilience

Federal funding is included in the Infrastructure Investment and Jobs Act (IIJA) for building physical and environmental resilience against floods, heat, droughts, and wildfires. Over $50 billion will be dedicated to reducing physical vulnerability and improving infrastructure weatherization.

The **Federal Emergency Management Agency (FEMA)** supports resilience-building efforts through providing education on risks, supporting the use of climate data in planning, encouraging risk reduction projects and nature-based solutions, providing disaster insurance, and coordinating with partners to create community adaptation strategies. FEMA has created a Resources for Climate Resilience matrix, that assists state, local, tribal, and territorial (SLTT) partners in utilizing federal resources for climate adaptation.

a. Building Resilient Infrastructure and Communities (BRIC)

   The BRIC program, through FEMA, provides financial support to applicants for hazard mitigation planning and projects, as well as community capacity-building. Currently, state and territory applicants receive $1 billion dollars.

b. Flood Mitigation Assistance (FMA)

   SLTT Buildings insured under the National Flood Insurance Program are eligible to apply for FMA to reduce the risk of repetitive flooding. This funding covers projects like localized flood control, floodplain and stream restoration, stormwater management, and wetland restoration.

c. National Exercise Program (NEP)

   The NEP provides free technical support for preparedness exercises. The program provides planning and execution support, as well as educational materials.

The **National Coastal Resilience Fund**, coordinated through the National Fish and Wildlife Foundation and NOAA awards funding to coastal communities to improve environmental resilience and protect fish and wildlife habitats. The program primarily focuses on nature-based solutions that will reduce the risk of flooding and wetland disruption. Thanks to increased funding from the Infrastructure Investment and Jobs Act, the NCRF awarded $144 million total to coastal communities in 2022.

In addition to funding available to the State through federal programs, there is also funding available through the biennial budget, and the State's Jobs and Recovery Plan.

- $40 million in the biennial budget for land conservation, contributing to Maine's fight against climate change by maximizing carbon storage, supporting working farms and forests, and ensuring valuable ecosystems remain in place for future generations.
- $4.75 million from the biennial budget for community, tribal, and regional action grants to prepare for climate change effects, reduce carbon emissions, and transition to renewable energy.
- $3 million from the biennial budget to upgrade municipal culverts at stream crossings.
- $300,000 for eelgrass mapping; $200,000 for HFC, sea level rise, and appliance standards rulemaking; and $400,000 for forest carbon mapping to the Department of Environmental Protection from the biennial budget.

Clean Water

The IIJA provided $390 million to Maine to guarantee clean drinking water across the state. The targets are to expand clean water infrastructure to all homes, businesses, schools, and childcare centers, eliminate lead service lines and reduce the proliferation of PFAS and other harmful pollutants.

Electric Vehicle Infrastructure

Federal funds from IIJA provide $7.5 billion to establish a national network of EV chargers, of which Maine has been allocated $19 million. The investments will be primarily focused along highway corridors, to allow for long-distance travel, and within suburban and rural communities.

The Maine Jobs and Recovery Plan allocates $8 million to expand municipal and public charging stations. Additionally, Efficiency Maine is pursuing discretionary funding through the FHWA - https://www.fhwa.dot.gov/environment/cfi/ . All of this funding will be channeled through rebates and grant opportunities at Efficiency Maine, sign up to receive their updates https://www.efficiencymaine.com/about/newsletter-signup/ .

Buildings and Housing

Efficiency Maine is the primary distributor of energy efficiency, weatherization, and building electrification rebates and grants. Municipalities often layer on incentives to further support low and middle income families. Those incentives can be funded through a variety of sources including TIFFs, municipal funds, or external grant funds.

The IIJA will deliver Maine an estimated $36.9 million for the Weatherization Assistance Program, which helps low-income families finance projects to improve the energy efficiency of their homes, to reduce heating/cooling costs and lower emissions. This is administered regionally through community action organizations. In addition, the Maine Jobs & Recovery Plan has set aside $50 million to match funds for municipal efficiency projects, and to fund private weatherization and efficiency upgrades.

The Energy Efficiency Revolving Loan Fund Capitalization Grant Program provides money to the state to support residential and commercial energy efficiency projects. Maine's program will receive an estimated total of $884,000 to be spent statewide. The state also has $50 million dedicated to assisting affordable housing projects with energy efficient housing units. The funding focuses on housing units located near service and employment centers.

Power Infrastructure

More than $65 billion over the next 5 years will be invested in expanding and increasing the capacity of energy systems from the IIJA. Existing infrastructure will be maintained, and thousands of miles of transmission lines will be added to accommodate increased reliance on grid power. There will also be an investment in the development and deployment of clean energy systems and smart grid technologies.

The **Energy Efficiency and Conservation Block Grant Program (EECBG)**, which recently received $1.9 million from the IIJA, provides grants to communities for clean energy programs and projects. Eligible projects include residential and commercial energy audits, financial incentives for energy efficiency upgrades, installation of clean energy systems, and more. There is formula funding and discretionary grants available. For more information, visit https://www.energy.gov/scep/energy-efficiency-and-conservation-block-grant-program

Additional funding from the state is available for power infrastructure and system projects:

- $8 million from the Maine Jobs & Recovery Plan for advancing clean energy partnerships and initiatives to grow workforce and innovation in Maine's clean energy sector, in support of Governor Mills' goal of 30,000 clean energy jobs in Maine by 2030.
- $3.1 million from the biennial budget for studies, research, and staff to support power sector transformation, grid modernization and offshore wind.

Legacy Pollution

Superfund sites and brownfields are still prevalent across the U.S., and the IIJA has committed $21 billion to clean up these projects. Projects will focus on rehabilitating these areas and reclaiming former mines and fossil fuel wells to prevent future pollution. GPCOG is a partner in accessing brownfield funds.

School Buses

The EPA's Clean School Bus Program is dedicating $5 billion to replacing diesel-fueled and energy-inefficient buses with electric or low-emission alternatives. This will both lower greenhouse gas emissions and improve air quality on school buses. Twelve Maine schools were awarded electric buses in the first round of funding in 2022, there will be additional rounds in future years.

Individual and Household Resources from Efficiency Maine

Falmouth has set ambitious goals to reduce greenhouse gas emissions and to prioritize sustainability and equity in future projects. Achieving these goals cannot be achieved only through municipal action- they require individual commitment and inspiration.

If you would like to support the strengthening of your town and community but are unsure where to start, Efficiency Maine (https://www.efficiencymaine.com/) organizes educational and financial resources for Mainers looking to upgrade insulation and heating systems, receive assistance with heating costs, upgrade appliances, or purchase an EV.

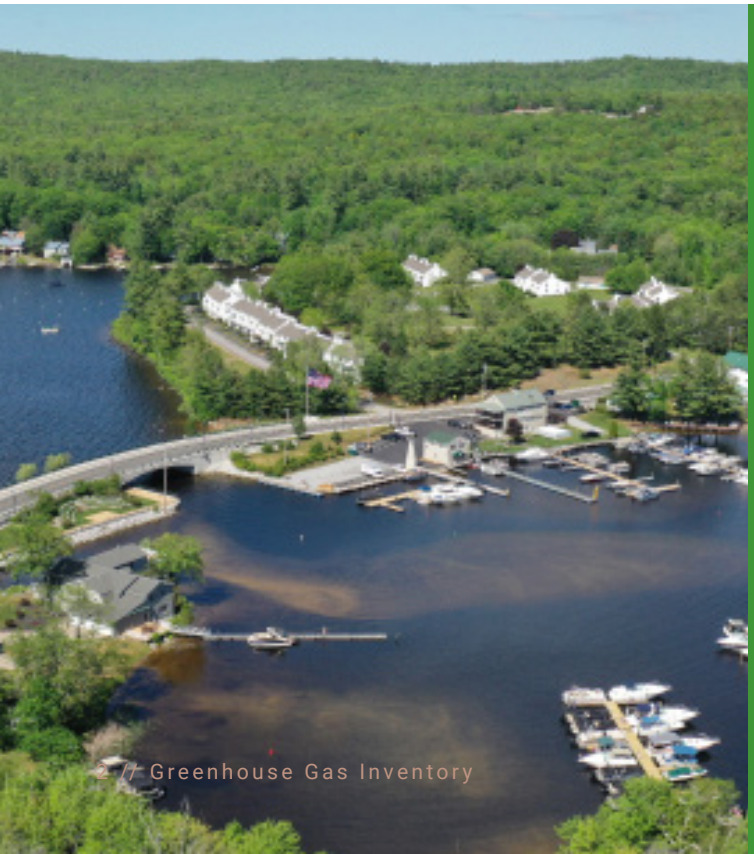
Appendix C:

2019 Greenhouse Gas Emissions Inventory and Emissions Reduction Scenario

Falmouth's Greenhouse Gas Emissions

As part of Falmouth's climate action planning process, the Greater Portland Council of Governments (GPCOG) created an inventory of the town's community-wide greenhouse gas (GHG) emissions for the year 2019. Using that inventory as a baseline, GPCOG developed two emissions reduction scenarios for the consideration of the Town's ad-hoc Climate Action Planning Committee (CAPC). The first scenario follows reduction targets established by the state climate action plan, Maine Won't Wait. The second scenario provides more ambitious milestones following science-based targets in line with the Paris Agreement's pledge to keep global warming within 1.5˚ C of pre-industrial levels. The CAPC chose to present the more ambitious scenario to the town. On July 25, 2022, the Falmouth Town Council voted to accept the new emissions reduction target proposed by GPCOG and the CAPC. This report provides the emissions reduction scenario that was accepted by the Town.

As part of Falmouth's first climate action plan in 2010, the Town commissioned its first emissions inventory for the year 2007 and set a target to reduce community emissions by 2% annually. The 2019 inventory used a different collection protocol and methodology than the original inventory. Because of the differences in collection protocols, a direct comparison to community-wide emissions between the two inventories would be inaccurate. This report uses the community's 2019 emissions inventory as a baseline for proposed emission reduction scenarios but references some data from the original 2007 inventory to provide a rough snapshot of the Town's progress in meeting its current annual reduction target so far.



What's included in this report?

- A summary of the full emissions inventory broken down by sector
- A forecast projecting community-wide emissions to 2050 using that data and following a business-as-usual projection, indicating no actions will be taken to reduce emissions
- An emissions reduction scenario that illustrates the Town of Falmouth's newly accepted emission reduction target, along with preliminary recommendations on how the Town will achieve their new goals.

Uncertainties

The inventories are compiled using collected data, projections, and models. Where data is unavailable, GPCOG used best practices to model and estimate emissions. The inventories will be regularly revised as new and better data become available, as models are improved, and as international standards and guidance evolve. The inventory is meant to identify medium to long-term trends in the direction of greenhouse gases, rather than exact absolute numbers or year-to-year changes.

Inventory Collections Protocol

The Southern Maine Planning and Development Commission created an emissions inventory protocol to provide a standardized system greenhouse gas emissions collection specifically for communities in Southern Maine. The protocol is informed by the ICLEI – Local governments for Sustainability U.S. Community Protocol for Reporting and Accounting for community greenhouse gas emissions. This emissions inventory protocol outlines the steps used to gather the emissions data for this inventory. The protocol details how to calculate emissions both with or without the usage of ICLEI's ClearPath platform; this inventory used ClearPath to calculate community GHG emissions and calculate emission reduction targets.

The greenhouse gases included in this inventory are carbon dioxide (CO2), methane (CH4), and nitrous oxide (N2O). Each greenhouse gas contributes differently to warming in the atmosphere. Global Warming Potential (GWP) is a measure of how much energy the emissions of one ton of a gas will absorb over a given period, relative to the emissions of 1 ton of carbon dioxide. Using each gas' Global Warming Potential, emissions of each gas are converted to metric tons of CO2 equivalent (MT CO2e) to show total GHG emissions impact. There are many other types of greenhouse gases, including perfluorocarbons, hydrofluorocarbons, sulfur hexafluoride, and nitrogen trifluoride, that are not addressed in this protocol. These gases are primarily a result of sectors not included in the protocol mentioned above, such as Agriculture, Forestry & Land Use.

The inventory estimates emissions resulting from the activities of a community's members, including its residents, workforce, and visitors. The GHG emissions may be either directly created (e.g. through household heating or vehicle fuel combustion) or indirectly created (e.g. through grid electricity use) by community members. This Inventory does not include indirectly attributable emissions, such as the consumption of goods produced outside of town bounds.

Summary

Community-wide emissions were catalogued and entered into an online tool called ClearPath; the emissions management software provided by the International Council for Local Environmental Issues (ICLEI) - Local Governments for Sustainability. The Town of Falmouth emitted 140,780 metric tons of carbon dioxide equivalent (MT CO2e) in the year 2019. On a per capita basis, this equates to 11.6 tons per resident. This rate is below Portland's per capita usage of 12.6 tons and South Portland's usage of 13.8 tons per resident, which is likely due more to the Cities' larger industrial sectors than it does energy efficiencies.

Total 2019 Emissions
140,780 MT CO2e

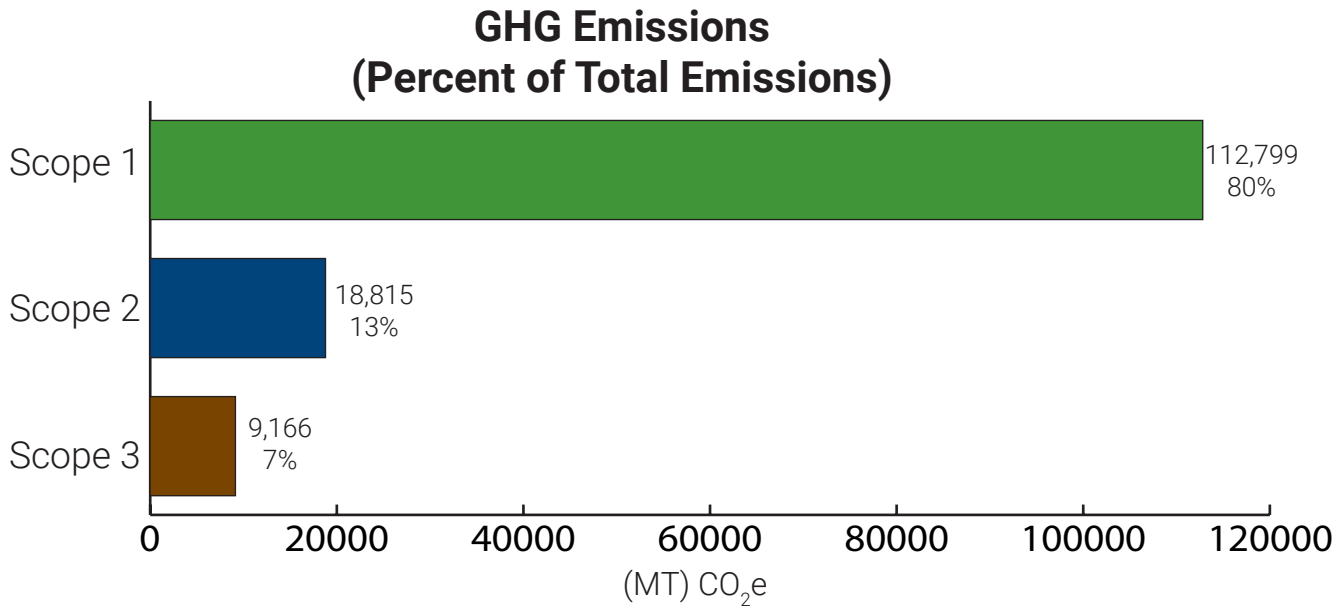
2019 Municipal Operations Emissions
3,167 MT CO2e (2.2%)

The 2019 Inventory follows an emissions collection protocol drafted by the Southern Maine Planning and Development Commission, and utilizes direct emissions from three major "scopes:"

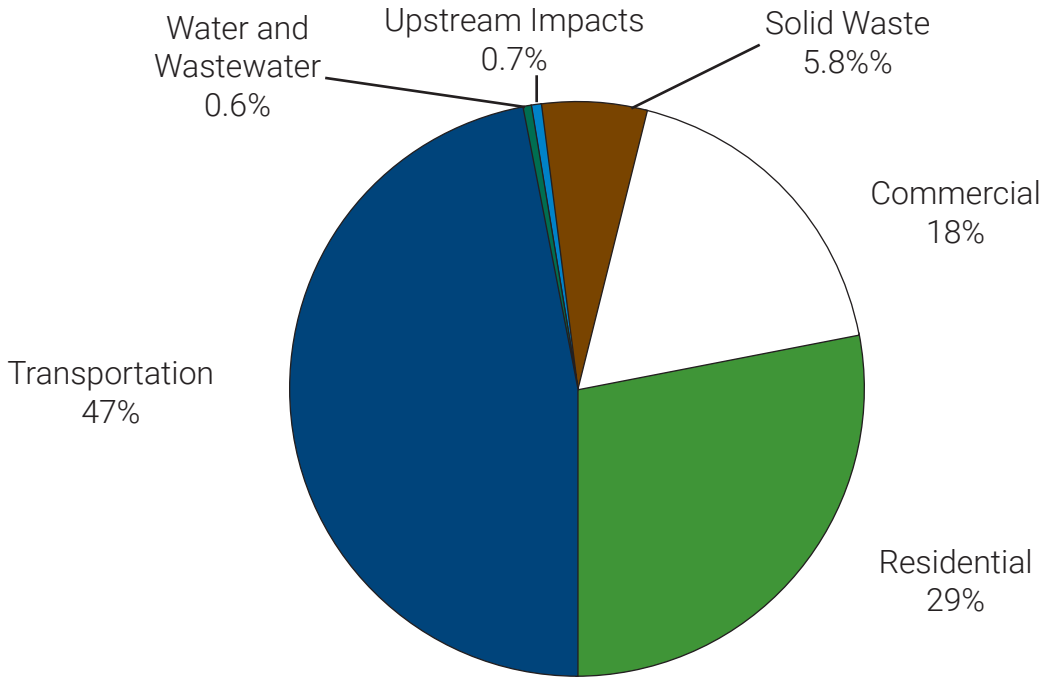
Scope 1: Emissions produced within the city (stationary fuel combustion, transportation within Town boundaries)

Scope 2: Emissions occurring within Town boundaries as a result of activity outside of the Town (grid-supplied electricity, treatment of out-of-boundary wastewater)

Scope 3: Emissions occurring outside Town boundaries as a result of Town activity (sending waste to out-of-boundary treatment plants, fugitive natural gas emissions)



Where does Falmouth's emissions come from?



Sector	Energy Use (MMBtu)	% of Energy Use	GHG Emissions (MT CO_2e)	% of GHG Emissions
Buildings	**1,007,979**	**52%**	**65,969**	**46.9%**
Residential Buildings	641,751	33%	40,652	28.9%
Commercial Buildings	366,228	19%	25,317	18%
Transportation	**920,469**	**48%**	**65,755**	**46.7%**
On-Road Transportation	905,051	47%	64,623	45.9%
On-Road Public Transit	13,296	1%	980	0.7%
Waterborne Vehicles	2,122	0%	152	0.1%
Waste	**-**	**0%**	**9,056**	**6.4%**
Solid Waste	-	0%	8,204	5.8%
Wastewater	-	0%	852	0.6%
Total Emissions	**1,928,448**	**100%**	**140,780**	**100%**

Fugitive Emissions account for the natural gas lost in the extraction and transportation across pipelines to utilities and establishments. Transmission and Distribution (T&D) loss accounts for the electricity lost in the process of supplying electricity to a consumer, primarily energy dissipated during the transmission of electricity along power lines. The table below accounts for fugitive emissions and T&D Loss in the Buildings section

All collected industrial building emissions were combined with commercial buildings for the following reasons:

- Both Natural Gas utilities present in Falmouth, Summit and Unitil, claimed they did not service any industrial facilities
- The Inventory Collection Protocol used for this report required combining commercial and industrial facilities to calculate an estimation of community-wide fuel oil consumption. This process is described in greater detail in the methodology section

What's Changed: 2007 vs 2019

Falmouth's first GHG Emissions Inventory used Clean Air and Climate Protection (CACP) software purchased from ICLEI. Like the SMPDC protocol used for the 2019 Inventory, the 2007 collection protocol used modeling calculations where usage data was not available. The methods used for emissions data modeling, as well as the data collection software available, have changed significantly since the completion of Falmouth's first inventory. Key differences in methodologies:

Building Usage - Residential Stationary Fuel

2007
Calculated using Town Assessor Records of primary heat sources. Assessor records split different fuel emissions into only three categories; "light fuel oil," "fuel wood," and "propane." This means the 2007 inventory didn't accurately reflect the different emissions intensity of the various fuel sources used by households and businesses.

2019
The SMPDC Protocol models residential fuel usage using household heating characteristics from Community Census Data and the Energy Information Administration website. This allows the 2019 inventory to estimate each type of fuel used by households (kerosene, wood, fuel oil, etc.).

Transportation and Mobile Sources

2007
On-road transportation emissions were calculated using VMT (vehicle miles traveled) data provided by the Maine Department of Transportation. However, the Town of Falmouth did not have access to data collection systems designed to collect local vehicle characteristics, meaning the 2007 Inventory was unable to distinguish between type of vehicle (passenger cars, commercial trucks, etc.). Emissions from marine vessels were also not included in the 2007 Inventory.

2019
Uses Streetlight, a transportation analytics software that collects records from smartphones and navigation devices, to estimate community VMT. Average vehicle and fuel characteristics were calculated using an On-Road Transportation calculator developed by SMPDC. While still an estimation, fuel and vehicle characteristics provide a better method of viewing community transportation emissions, and a comparison of emissions from different fuel and vehicle types. Marine vessel emissions were calculated on ClearPath using annual fuel sales from Handy Boat Marina in Falmouth, Maine.

Waste

2007
Only accounted for residential waste incinerated after curbside collection, as data for commercial waste and specialty waste handled at the Town transfer station was unavailable. The 2007 Inventory also did not account for emissions from wastewater treatment.

2019
Ecomaine provided the annual tonnage of waste, both incinerated and recycled, received from private waste services. The Public Works department provided tonnage of specialty and hazardous waste not treated by EcoMaine, such as rusted scrap metal. Those sources were recorded as landfilled waste on ClearPath. The 2019 Inventory calculated emissions from sewage treated at Falmouth's wastewater plant based on the number of sewage connections in Falmouth and imported from the Town of Cumberland. Census household data was used to estimate the number of fugitive emissions released from community septic tanks in 2019.

What's Changed: 2007 vs 2019

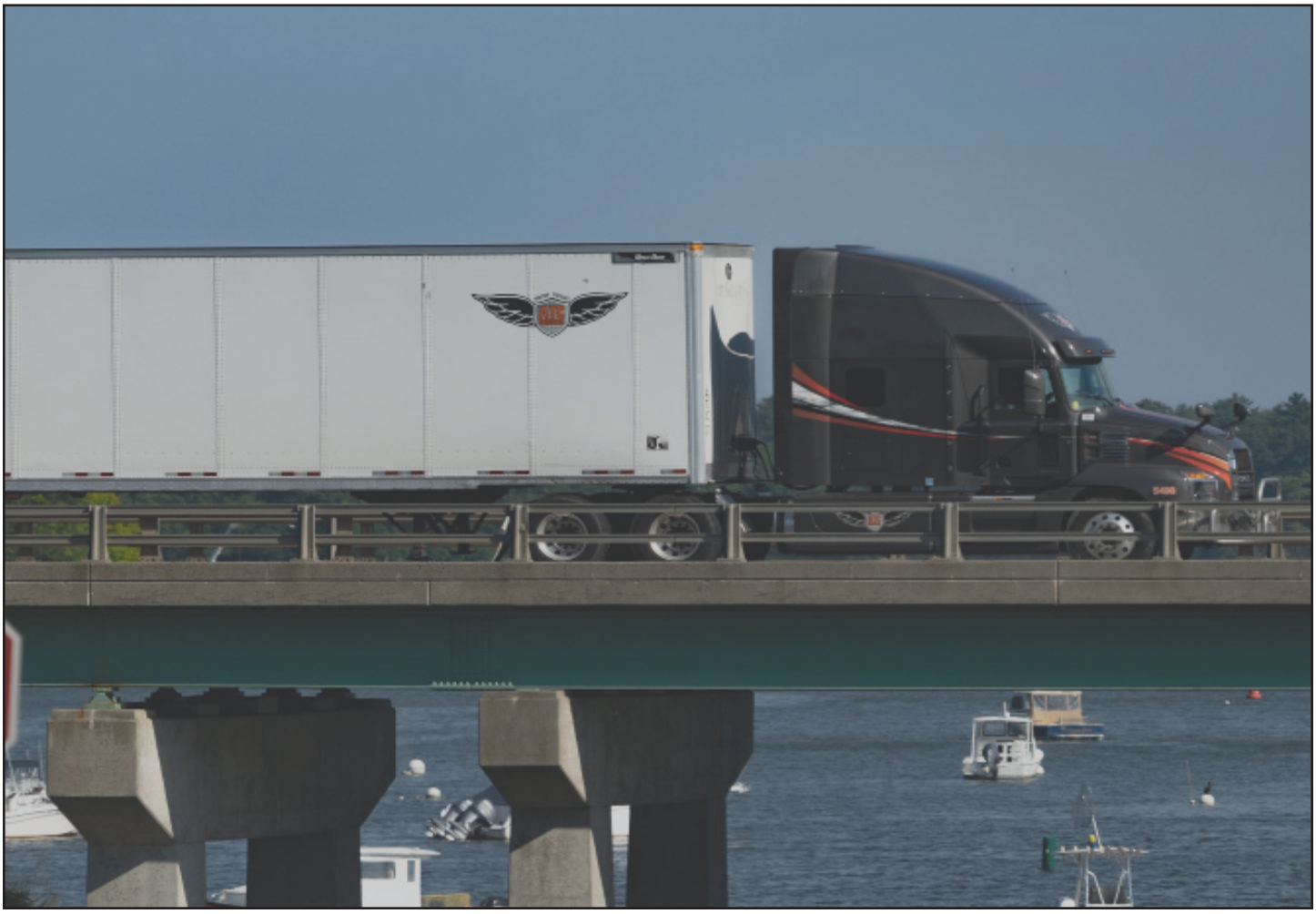
As part of the Town's first Climate Action Plan in 2010, a GHG Inventory catalogued 161,900 metric tons of CO2 for the year 2007. Comparing this to the 2019 inventory of 148,780 metric tons, the Town's progress in emissions reductions so far can roughly be seen to be at 1.2% emissions reduction annually.

Since the methods of collecting and calculating emissions data in 2007 differed greatly from the methods used for the 2019 inventory, it is difficult to provide a truly accurate comparison of community-wide emissions since 2007.

Sector	GHG Emissions (MT CO_2e)	% of GHG Emissions
Residential Energy	67,200	41.6%
Commercial Energy	24,200	16.9%
Transportation	69,600	42.9%
Waste	900	0.6%
Total Emissions	**161,900**	**100%**

Municipal Operations

6,143 MT CO2e (3.8% of total community emissions)



Residential Energy Usage

29%

Community-wide emissions from household fuel combustion and energy use

Residential Energy Use	Sector Energy (MMBtu)	% Residential Energy Use	Sector Emissions (MT CO_2e)	% of Residential Emissions
Total Grid Electricity	**166,559**	**26%**	**10,928**	**27%**
Consumption	158,477	24.6%	10,398	25.6%
Upstream T&D Loss	8,082	1.3%	530	1.4%
Total Natural Gas	**44,529**	**7%**	**2,445**	**6%**
Consumption	44,529	7%	2,368	5.8%
Fugitive Emissions	-	-	77	0.2%
Total Discrete Fuels	**430,663**	**67%**	**27,278**	**67%**
Bottled, Tank, or LPG	93,628	14.6%	5,952	14.6%
Distillate Fuel/Kerosene	278,605	43.4%	20,744	51%
Wood/Biomass	58,429	9%	582	1.4%
Total Residential Emissions	**641,751**	**100%**	**40,652**	**100%**

How?

Household emissions were calculated on ClearPath using annual town-wide electricity and natural gas consumption data. Discrete fuels and fuel oil consumption was modeled using the process outlined in the SMPDC inventory collections protocol, described in the Methodology section.

Commercial Energy Usage

18%

Community-wide emissions from commercial establishments' fuel combustion and energy use

Commercial Energy Use	Sector Energy (MMBtu)	% Commercial Energy Use	Sector Emissions (MT CO_2e)	% of Commercial Emissions
Total Grid Electricity	**134,831**	**37%**	**8,846**	**34.9%**
Consumption	128,288	35%	8,417	33.2%
Upstream T&D Loss	6,543	2%	429	1.7%
Total Natural Gas	**39,351**	**11%**	**2,172**	**8.6%**
Consumption	39,351	11%	2,102	8.5%
Fugitive Emissions	-	-	70	0.1%
Total Discrete Fuels (Distillate Fuel No. 2)	**192,046**	**52%**	**14,299**	**56.5%**
Total Commercial Emissions	**366,228**	**100%**	**25,317**	**100%**

How?

Emissions were calculated on ClearPath using annual town-wide electricity and natural gas consumption data. Fuel oil consumption was modeled using the process outlined in the SMPDC inventory collections protocol. All fuel oil was assumed to be distillate fuel oil no. 2, though in practice other grades of fuel oil were likely used.

Transportation

47%

On-road transportation emissions for motorcycles, passenger vehicles, single unit trucks, and combination trucks

How?

Emissions were calculated from total community vehicle miles traveled (VMT) using proprietary data from the transportation analytics service Streetlight and the process outlined in the SMPDC inventory collections protocol. Gasoline and diesel fuel economies were weighted based on the makeup of vehicle type.

Waterborne emissions were calculated using fuel sales data from Handy Boat Marina, the only identified source of gasoline and diesel fuel for marine vessels in Falmouth.

Transportation Energy Use	Sector Energy (MMBtu)	% Transportation Energy Use	Sector Emissions (MT CO_2e)	% of Transportation Emissions
On-Road Transportation	**905,051**	**98.3%**	**64,622**	**98.3%**
Gasoline	674,591	73.3%	47,534	72.3%
Diesel	230,460	25%	17,088	26%
On-road Public Transit	**13,296**	**1.4%**	**980**	**1.5%**
Gasoline	1,715	0.2%	121	0.2%
Diesel	11,581	1.2%	859	1.3%
Waterborne Vehicles	**2,122**	**0.3%**	**153**	**0.2%**
Gasoline	1,800	0.2%	128	0.2%
Diesel	322	0.1%	25	0.0%
Total Transportation Emissions	**920,469**	**100%**	**25,317**	**100%**

Waste

6%

Solid Waste and wastewater emissions

Waste	Sector Emissions (MT CO_2e)	% of Waste Emissions
Solid Waste	**8,204**	**90.6%**
Incineration	7,451	82.3%
Landfill	753	8.3%
Wastewater	**852**	**9.4%**
Septic Tanks	780	8.6%
Treated Sewage	72	0.8%
Total Waste Emissions	**9,056**	**100%**

How?

Most solid waste collected in the Town of Falmouth is burned at EcoMaine. The incinerator ash is not counted in this inventory because it is inert and does not produce further emissions; landfilled waste counts specialty waste (scrap metal, brush grindings, etc.) collected at the Town transfer station for disposal.

Wastewater emissions listed are estimated process emissions from the breakdown of treated water at Falmouth's wastewater plant, as well as fugitive emissions from household septic tanks. The energy used for processing wastewater is included in the commercial energy sector.

Emission Reduction Scenarios

This report explores the Science-Based Targets scenario, which is the emissions reduction strategy proposed by the CAPC and approved by the Town Council. The Science-Based Targets are calculated from the most recent assessment report released by the Intergovernmental Panel on Climate Change (IPCC). While not a standard to fully utilize, this report also suggests a series of annual "targets" meant to visualize the work Falmouth will need to do to reach their new pledge.

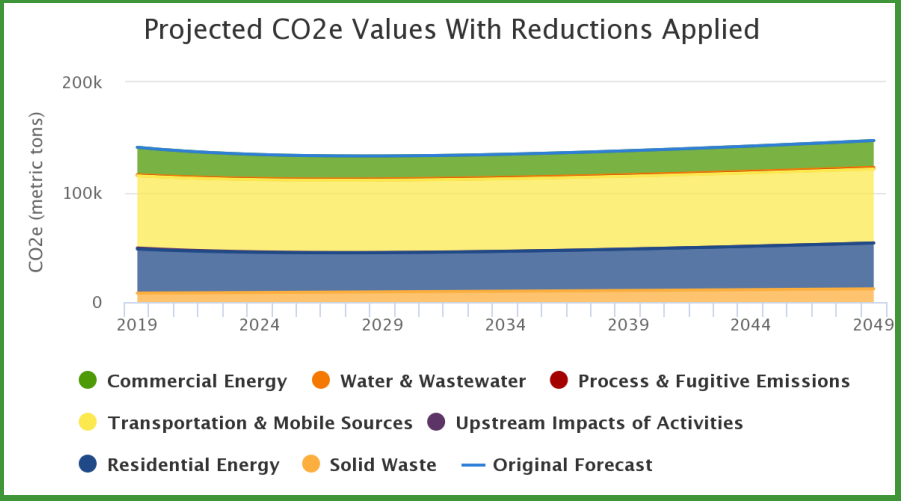
In 2021, ICLEI released a working paper outlining the need for cities to commit to a "Science-Based" emissions reduction target of 63% by 2030 in order to fulfill the Paris Agreement's pledge to hold global temperature increases to 1.5˚ C. The below scenario uses the emissions reduction strategies outlined in the working paper to create a pathway to an ambitious, but still achievable, emissions reduction scenario.

To track reductions progress, GPCOG suggests conducting a new GHG emissions inventory every three years, starting in 2023 to record community-wide emissions for 2022.

Emission Forecast: Business as Usual

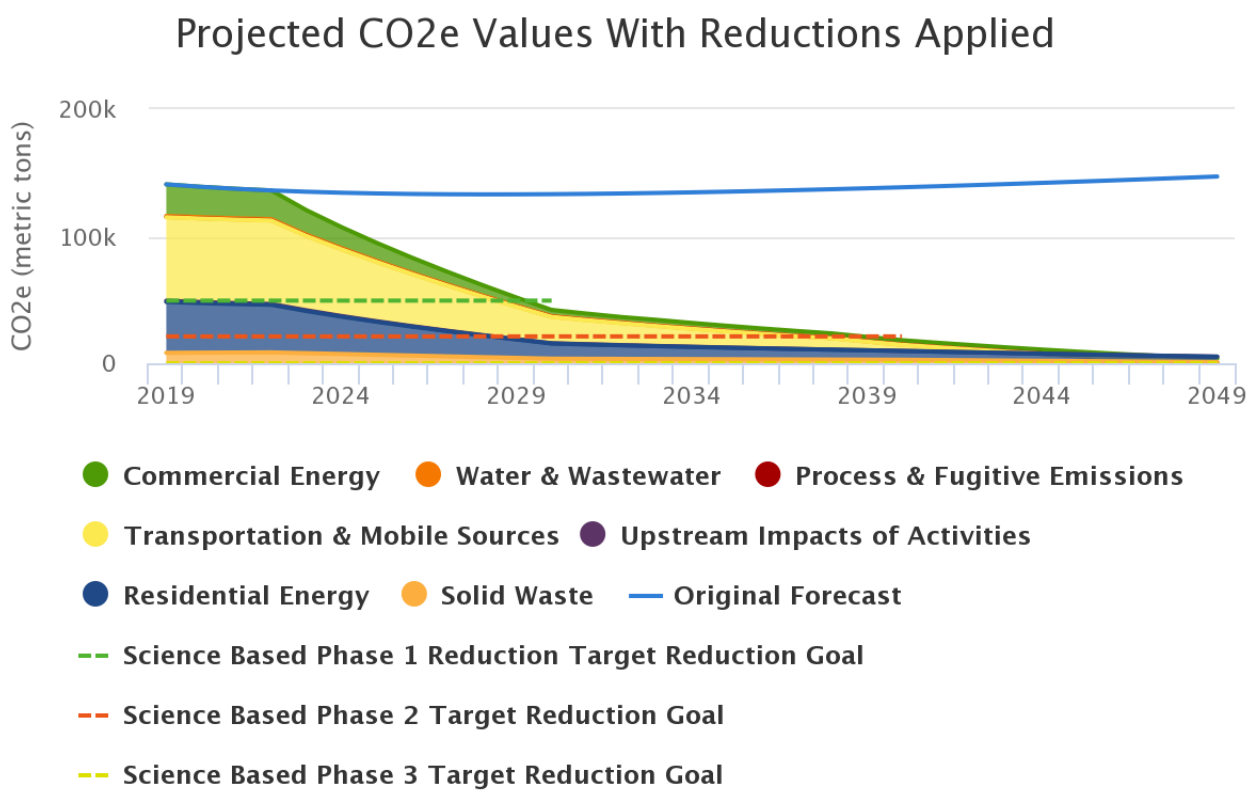
Using the 2019 Emissions Inventory as a baseline, ClearPath was able to project emissions growth along a "business as usual" scenario. Emissions growth is modeled using the most aggressive annual population growth prediction from the Town's Comprehensive Plan, 1.3%. This accounts for census undercounting inaccuracies and accelerated population growth due to covid and climate-related migration.

The decrease between 2030 and 2040 account for average transportation fuel efficiencies implemented by manufacturing industries over time and the state of Maine's proposed Renewable Portfolio Standard under Maine Won't Wait, which commits that all state consumed electricity is produced by renewable sources by 2050.



Following the current emissions reduction rate, the emissions growth rate is projected to outpace current reduction efforts after 2040, surpassing the baseline inventory to reach 146,976 MT CO2e by 2050.

Science-Based Target



Using 2019 as an inventory baseline, GPCOG suggests dividing the timeline into three phases:

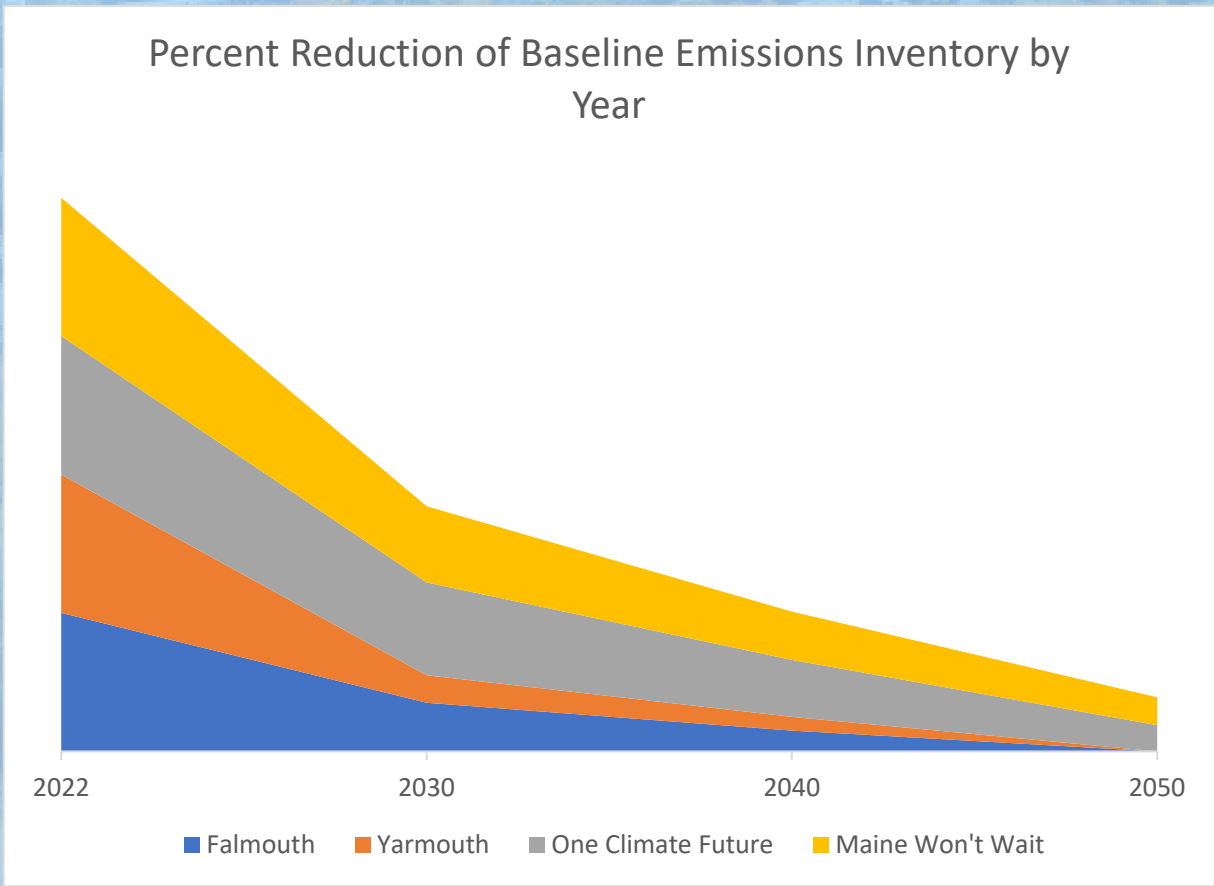
Phase 1: a 65% emissions reduction by 2030, following guidelines from the most recent IPCC report

Phase 2: an 85% emissions reduction by 2040, as a suggested intermediate goal

Phase 3: a push to eliminate community-wide emissions by 2050 and maintain a net-zero emissions output.

How does Falmouth Compare?

While the first phase is far more ambitious than Maine Won't Wait, the State Climate Action Plan, reduction milestones after 2030 are similar to other regional planning scenarios.



Emissions Reduction Timelines	Yarmouth Climate Declaration	Accepted Falmouth CAP Targets	One Climate Future (Portland and South Portland)	Maine Won't Wait (State Climate Action Plan)
By 2030	80%	65%	33%	45%
By 2040	Not specified	85%	59%	65%
By 2050	100%	100%	81%	80%
Municipal Operations	100% by 2030	100% by 2040	100% renewable by 2040	Not specified

Suggested Strategies

Building Energy Usage	Falmouth CAP Targets
Fuel switching through heat pump installation	Installations/Year
Through 2030	400
Through 2040	75
Through 2050	60
Total Installations in 2050	**4,550**
Rooftop Panel Installations (Residential)	Number of 4 kW Solar Panel Installations
Through 2030	800
Through 2040	1,000
Through 2050	1,200
Total Annual kwh by 2050	**36,000,000**
Energy Retrofits (Commercial)	Square Feet Retrofit/Year
Through 2030	1,000,000
Through 2040	300,000
Through 2050	200,000

Using ClearPath's emissions reduction calculators, each scenario includes a list of targets to reach, from household electrification to waste-stream reduction, to meet the suggested milestone goals. These numbers are not a hard-set guide, but an attempt to create tangible targets to make future mitigation strategies feel more feasible and easier to grasp in future planning.

Transportation and Mobile Sources	Falmouth CAP Targets
Number of Electric Vehicles in Falmouth	Vehicles/Year
Through 2030	700
Through 2040	300
Through 2050	250
Total EV Fleet by 2050	**11,100**
Community VMT Reduction	Miles Reduced/ Year
Through 2030	2,500,000
Through 2040	2,000,000
Through 2050	2,000,000

Emissions Reduction Indicator Tracking

An effective plan to reduce GHG emissions will require tracking and monitoring. The implementation section of the Falmouth Climate Action Plan will lay out the details of a tracking and monitoring program. Greenhouse gas inventories are time consuming and resource-intensive to complete. The Town of Falmouth will endeavor to conduct a GHG inventory every 3 years to track compliance with the targets of the Falmouth Climate Action Plan.

Additionally, the Town will track a series of indicators annually that will provide data on the progress of implementation of the Climate Action Plan. These will be laid out in the implementation section of the Climate Action Plan.

References

Analysis of U.S. Local Government Science-Based Targets and Pathways to Achieve Them in the Race to Zero. ICLEI – Local Governments for Sustainability, November 2021.

ClearPath Emissions Software Management. ICLEI – Local Governments for Sustainability.

Energy and Climate Protection Plan Appendix V: Emissions Inventory. Falmouth Green Ribbon Commission on Energy and Climate Protection, February 2010.

Greenhouse Gas Protocol for Southern Maine Cities and Towns, SMPDC, 2021.

Maine Won't Wait: A Four-Year Plan for Climate Action, Maine Climate Council, December 2020

Appendix D

Falmouth

Vulnerability Assessment

Table of Contents

Executive Summary

Climate change hazards are impacting Falmouth now. Measurable sea level rise, increased precipitation, and temperature extremes are threatening the community, and impacts will only grow as the climate crisis worsens. As part of the Falmouth Climate Action Plan process, data was collected on the impacts of these hazards in Falmouth and was analyzed to understand who is most vulnerable to these impacts, which resources and assets will be most affected, and how operations may be impacted in the future. The resulting detailed Vulnerability Assessment Report helps the Town prioritize strategies for adapting to climate change.

Key Vulnerabilities in Falmouth

The two largest risks to Falmouth are loss of access to goods and services due to flooded roads, and the human-health impacts from rising temperatures. Falmouth has comparatively low social vulnerabilities in the region; however, climate change will amplify existing vulnerabilities and increase social inequity. Below is a summary of the key Town assets vulnerable to climate change.

Risks to Critical Infrastructure

1. Flooding of Critical Transportation Infrastructure

By 2050 sea level rise and storm surge threaten to impact major local and state roadways and bridges within Falmouth, including Foreside Road, I-95, and I-295. In addition, key inland highway corridors leading in and out of Falmouth are vulnerable to flooding due to increased precipitation and strong storms, including Exit 52 and the end of the Falmouth Spur highway connector near the town's largest shopping center. Beyond roadways, portions both commercial rail lines through Falmouth and all of Falmouth's private marinas as well as Town Landing are vulnerable to flooding. Flooded or damaged transportation infrastructure increases costs for maintenance and repair; cuts off access to businesses, neighborhoods, and community services; disrupts supply chains; and creates barriers for habitat migration.

2. Strain on Wastewater Assets

Climate change poses new risks to the daily operation and structural integrity of wastewater systems. While increased precipitation and storm surges are unlikely to overburden the pipelines or the wastewater treatment plant, increased stormwater can still inundate pump stations and reduce hydraulic capacity within the collection system and treatment plant. The biggest threat to the wastewater system in Falmouth is flooded pump stations and lack of access to the pipe system for maintenance and repairs, particularly areas along the coast which by 2050 will experience higher levels of inundation during big storms.

3. Vulnerable Power and Communication Systems

Energy and information systems are growing increasingly vulnerable to climate change, with both direct and indirect impacts threatening the efficiency of the system and the reliability of supply. Utility poles and communication towers are vulnerable to damage from intense storms. While strain on the energy grid from increased demand or disruptions in equipment could increase financial burdens to residents, business owners, and the town.

Vulnerable Community Assets

4. Impacts to the Economy and Local Livelihood

The biggest impact to businesses in Falmouth is lack of access in the event of severe storms or sea level rise. Flooded roads and buildings prevents people from getting to their jobs or receiving services. In addition, the loss of access to docks limits recreational sailing and marine tourism, and could disrupt the natural resource industry.

5. Residential and Commercial Security and Affordability

Most commercial and municipal buildings in Falmouth will not be directly impacted by flooding or sea level rise. Some neighborhoods, particularly those adjacent to inland waterways, by 2050 could be inundated during extreme weather events that cause flooding. However, beyond direct impacts, climate change impacts also threaten property values, which reduces the Town's tax base, and increases the financial burden on residents.

6. Disruption to Community Services

The need for social services and community resources will likely increase due to the financial, physical, and emotional stressors created by climate change. Projected flooding by 2050 along I-295 and U.S. 1 will limit residents' ability to access resources outside of Falmouth during storms. Flooded roads could also hinder transit routes and prevent access to childcare or schools, libraries, town services, and additional community support. Additional disruption to food systems and key social services increases the overall vulnerability of the community. Households without a vehicle and those with limited income are especially vulnerable to the losing access to critical community services.

7. Challenges to Public Health

Climate change, particularly rising temperatures, is likely to exacerbate human-health impacts. Heat-related illnesses, asthma from worsened air quality, and vector-borne diseases are all likely to increase in the future. This will stress the healthcare system and impact people's mental health. Elderly residents, children, and people in poor health are at a disproportionately higher risk of experiencing health-related impacts from climate change at will be most at risk in the future.

Natural Resources at Risk

8. Ecosystem Migration

Falmouth is likely to experience significant marsh degradation due to sea level rise along Mussel Cove and the Presumpscot Estuary. These tidal wetlands provide tremendous benefit as a protective barrier against storm surge and rising sea levels. As sea levels rise, tidal marshes gradually shift inland onto formerly dry land or nontidal areas, as long as their migration is not restricted by development. In areas where marshes are bordered by the built environment, migration may not be possible, resulting in the loss of marsh and wetland and in increase of risk to the adjacent developed area. Likewise, warmer air and water temperatures cause shifts in species' geographic ranges, leading to declines in native marine and terrestrial life and increases in invasive species, pathogens, and pests. These shifts alter the local food web, making ecosystems more vulnerable to stressors such as invasive species and habitat destruction.

Geographic Priority Areas at Risk

Geographic areas within Falmouth differ in their vulnerability to climate change due to the number of climate hazards threatening the area, number of vulnerable assets, degree of impacts, and overlapping social vulnerabilities in the neighborhoods. Based on the combination of these factors, the areas below were identified as the highest risk and should be focused on for priority adaptation actions.

1. The Flats and Upper Presumpscot

Neighborhoods along the Flats and Presumpscot Estuary are significantly vulnerable to flooding by 2050 during storm events. The Mackworth Island and Martin's Point bridges are both identified as vulnerable to flooding, possibly cutting off critical access. Flooding will also impact wastewater assets in the area including a pump station. This area is also particularly vulnerable to ecosystem changes, as impact on current tidal marshes threatens to remove natural barriers that might otherwise protect low-lying neighborhoods in the area from storms and floods. These neighborhoods also have a higher concentration of socially vulnerable residents.

2. Foreside and Mill Creek

Coastal assets in this area such marinas, docks, and wastewater assets, including Town Landing, are vulnerable to sea level rise. Inland, flooding along Mill Creek is likely to impact major roadways and significant shopping and resource centers, including areas U.S. 1 and I-295. Flooding will also inundate buildings and impact wastewater infrastructure in these neighborhoods.

3. Inland Assets along Falmouth, Winn, and Mountain Roads

These roads have several stretches identified as more vulnerable to flooding during storm events by 2050, particularly along the Presumpscot River. Low-lying areas threaten to cut emergency vehicle access to neighborhoods in those areas during severe weather events. Flooding along Falmouth Road can cut off access to Town Hall, as well as the food pantry, while the flooding on the bridge adjacent to the Winn Road Fire Station threatens to cut emergency vehicle access. The neighborhoods around and west of Winn Road are also identified as having potentially more vulnerable populations.

At a Glance

These priority vulnerabilities shaped the development of climate adaptation actions identified in the action plan section. As climate hazards change the Town will frequently revisit these risks and re-evaluate changes to these priority areas.

The table on the following pages summarizes the at-risk infrastructure and natural resources in Falmouth ,and the degree to which climate hazards threaten it. This quick reference summary gathers all the data and projections from the report and puts it into one table.

Resource	Warming, More Variable Temperature	Changing Precipitation Patterns	Sea Level Rise	Ocean Acidification	Impacted Vulnerable Assets
Infrastructure					
Wastewater Treatment Plant	LOW	MEDIUM Inundation, damage, and lack of access	HIGH Permanent loss of pipe infrastructure	LOW	Treatment plant outfall pipe
Pump Stations	LOW	HIGH Inundation, damage, and lack of access	HIGH Permanent loss of pump station	LOW	Up to 7 pump stations vulnerable to flooding
Manholes	LOW	HIGH Inundation, damage, and lack of access	HIGH Permanent loss of infrastructure	LOW	Assets in Foreside, and The Flats
Pipelines	MEDIUM Stress and damage to pipeline materials	HIGH Inundation, damage, and lack of access	HIGH Permanent loss of infrastructure	LOW	Access or damage to pipeline in flooded areas
Roads and Railroads	HIGH Stress and damage to road pavement	HIGH Inundation, damage, and lack of access	HIGH Permanent loss roadway	LOW	Major roadways I-95, I-295, U.S. 1; both railroads; numerous neighborhood roads
Bridges	HIGH Stress and damage to road pavement	HIGH Inundation, damage, and lack of access	HIGH Permanent loss of bridge	LOW	Various bridges including along I-95, I-295, and U.S. 1
Stream Crossings or Culverts	LOW	HIGH Inundation, damage, and lack of access	HIGH Permanent inundation of culvert	LOW	Various culverts
Marinas	LOW	MEDIUM Inundation, damage, and lack of access	HIGH Permanent loss of marinas	LOW	Town Landing, all private marinas
Data Centers and Communication	MEDIUM Increased energy demand to cool systems	HIGH Inundation, damage, and lack of access	MEDIUM Permanent loss of infrastructure	LOW	Radio station on Foreside Road and Mackworth Island
Power Lines and Substations	MEDIUM Stress and damage to infrastructure	HIGH Inundation, damage, and lack of access	MEDIUM Permanent loss of infrastructure	LOW	Above-ground power lines; Municipal solar array
Residential and Commercial Buildings	MEDIUM Increased energy demand	HIGH Inundation, damage, and lack of access	MEDIUM Permanent loss of infrastructure	LOW	Middle School, Falmouth Shopping Center

Community Assets					
Local Economy and Livelihoods	**HIGH** Economic loss from changing livelihoods	**HIGH** Damage to buildings and properties, loss of access	**HIGH** Permanent loss of properties; economic loss from changing livelihoods	**HIGH** Economic loss from changing livelihoods	Vulnerable populations
Housing	**MEDIUM** Increased energy costs,	**HIGH** Damage to buildings and properties, loss of access	**HIGH** Permanent loss of housing	**LOW**	Vulnerable populations
Community Resources	**MEDIUM** Change in food systems	**HIGH** Damage to buildings and properties, loss of access	**HIGH** Permanent loss of buildings and properties	**LOW**	Vulnerable populations
Health	**HIGH** Increased heat-related illnesses and vector-borne diseases	**HIGH** Degraded water and air quality	**LOW**	**LOW**	Vulnerable populations
Social Equity	**HIGH** Disproportionate health risks to elderly, cost-burdened residents	**HIGH** Disproportionate vulnerability to property damage, reduced access to emergency services	**MEDIUM** Disproportionate difficulty to prepare for coastal erosion or re-locate households/businesses	**LOW**	Vulnerable populations
Natural Resources					
Marshes	**MEDIUM** Stress on vegetative health, unsuitable habitat conditions	**MEDIUM** Decline of water quality	**HIGH** Loss of vegetation or requires tidal marshes to shift inland	**HIGH** Strain on vegetative health, further impacted by species migration	Mussel Cove, Foreside, Upper and Lower Presumpscot
Coastal and Inland Erosion	**MEDIUM** Stress on natural barriers to erosion	**HIGH** Continued destabilization of shoreline and banks	**HIGH** Loss of shoreline and vegetation	**LOW**	Casco Bay coastline and inland waterways
Wildfire	**HIGH** Increases risk	**HIGH** Increases risk	**LOW**	**LOW**	Large open space areas
Natural Water Systems	**HIGH** Decline in water quality	**HIGH** Decline in water quality	**MEDIUM** Decline in water quality	**HIGH** Decline in water quality	Casco Bay and inland waterways
Acidification on Species Health	**HIGH** Decline in species health	**LOW**	**LOW**	**HIGH** Decline in species health	Various marine species
Native Species Migration and Shifting Ecosystems	**HIGH** Migration of native species not suited to increased temperatures	**LOW**	**MEDIUM** Loss of habitat	**HIGH** Ocean changes are not suitable to native species	Various marine and terrestrial species
Invasive Species	**HIGH** Increased temperatures creating habitat suitable to invasive species	**LOW**	**MEDIUM** Loss of habitat from native species could result in new invasive species	**HIGH** Changes increase viable ecosystem for invasive species	9 invasive marine species; 14 invasive plant species; 8 invasive pest species

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Introduction

As the Gulf of Maine continues to warm at an unprecedented rate, the Town of Falmouth is committed to identifying and mitigating climate-related threats to the vitality and security of its residents and businesses. In conjunction with local, regional, and State leadership, the Town is undertaking a comprehensive effort to assess and overcome those threats.

A key component of Falmouth's Climate Action Plan is increasing the Town's ability to adapt to the threats climate hazards bring, both immediate and future. The purpose of this Vulnerability Assessment is to identify the hazards that Falmouth will likely face due to climate change and provide detail on the populations, infrastructure, and natural resources most at risk.

The information presented in this report is compiled from local and national climate change scenario projections, interviews with municipal department heads, and public outreach materials including surveys and public workshops. The goal is to develop a baseline understanding of risk to inform the adaptation actions identified in Falmouth's Climate Action Plan.

Key Definitions

Climate-Related Hazard: A physical process or event, exacerbated by climate change, that can bring harm to people, communities, or ecosystems

Climate-Related Impact: The potential effect a climate hazard can have on human or natural assets and systems

Climate-Related Stressor: A chronic condition or trend related to climate change that can exacerbate pre-existing hazards

Climate-Related Shock: Acute events occurring over a specific period of time, such as heat waves or dangerous weather events, made more severe or frequent by climate change

Climate-Related Risk: The potential for negative consequences where something of value is at stake. In the context of the assessment of climate impacts, risk can be assessed by multiplying the probability of a hazard by the magnitude of the negative consequence or loss.

Vulnerability: A measure of risk to a threat, incorporating the likelihood of the threat occurring and the severity of the impact if it occurs

Adaptation: The process of adjusting to or preparing for changing conditions to reduce the vulnerability of impacted assets

Resilience: The capacity of communities or natural environments to adapt and/or recover quickly from impacts.

Source: U.S. climate Resilience Toolkit

Existing Climate Change Work in Falmouth

Falmouth has worked diligently to reduce known risks and start planning for climate change. The following are plans or actions already undertaken to reduce the Town's vulnerability to future climate impacts:

The Wastewater department is working with Public Works to complete an Asset Management Study that will create a prioritization framework for improvements to the pipe network, pump stations and wastewater treatment plant.

The Town Engineer is working to upsize culverts and install storm drains in anticipation of increased stormwater runoff caused by more intense storms. Public Works will audit storm drain infrastructure to have a more accurate idea of maintenance needs.

The Town Harbor and Police Department are developing a coastal resilience study focused on the Town Landing site, which will guide plans to improve resilience of the area to sea level rise and high tide flooding.

The Information Systems department is working on moving all department data to the cloud in order to reduce reliance on fiber-optic cable poles that could be impacted during storms.

Falmouth has started electrifying buildings to reduce emissions and reliance on external energy sources, providing electrical vehicle charging stations and undergoing energy audits to assess future efficiency standards. For example, the police department, which has purchased multiple electric vehicles and charging stations, is reviewing possibilities of solar panels for the police station

The Town offers public cooling sites in public buildings, such as the Parks & Community Programs Department's Mason–Motz Activity Center, which has seen an incrase in the number of people using its cooling services on high heat days in the past few years.

Emergency Services staff are adapting to climate change by planning secondary routes to access flooded neighborhood roads. The Town is also expanding its fire department to increase response capacity.

Climate Hazards

Climate hazards such as warmer air temperatures, increased precipitation, more severe storms, and sea level rise already have begun to take a toll on Falmouth's infrastructure, neighborhoods, and ecosystems. The following section identifies the climate hazards impacting Maine and provides resources to further explore the impacts the State is facing now and anticipating in the future.

Climate Change Scenarios

Climate change scenarios are developed on global, national, and statewide scales to understand the hazards each population may face. Most of this section pulls information from Maine's statewide climate science and the regional analysis of hazards done by Portland and South Portland in their One Climate Future plan. There is currently limited data to understand hyper-local impacts, and much of the modeling being done is at the regional or state level.

Throughout this section we reference a range of possible outcomes for each climate hazard, based on climate change scenarios (varying levels of concentration of greenhouse gas emissions in the atmosphere) created by the International Panel on Climate Change (IPCC). There are low, medium, and high emission scenarios that are dependent on the timing and level of emission reductions that the world achieves. This report focuses on the medium- level emission scenarios to understand the potential range of impacts the Town may face in the coming century. In the medium-level scenario, RCP 4.5, some mitigation efforts are enacted with a focus on local efforts.[1] By 2065, average global air temperatures will be 2.52˚F higher than the pre-industrial mean, and global mean sea levels will be 0.85 feet higher.

Due to the Town's proximity to Portland and the lack of specific data collection in Falmouth (tide gauges, weather service stations and other tools are lacking outside of Portland) many of the projections for future hazards in this assessment look at impacts to Falmouth and its surrounding region as a whole.

To read more about the scenarios and the possibility of each, please visit the IPCC's most recent climate assessment.

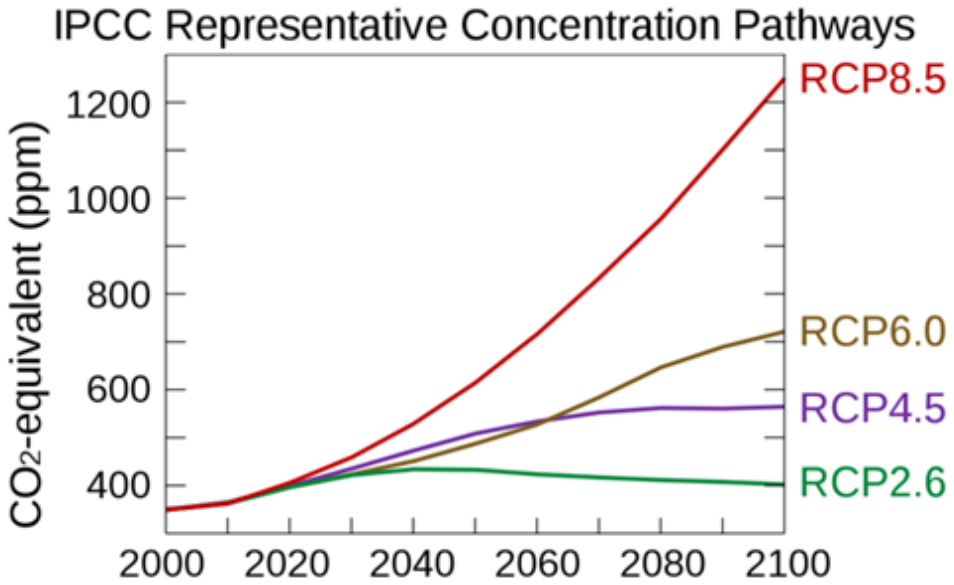


Figure 1: IPCC Representative Concentrations showing different greenhouse gas concentration trajectories based on different climate scenarios. This graph is based on the Fifth Assessment Report.

Warmer, More Variable Temperatures

Average annual temperatures across Maine have increased by 3.2 degrees Fahrenheit since 1895, with the six warmest years on record all occurring since 1998.[2] Average temperatures are expected to rise faster in coastal communities such as Falmouth, with a projected increase of 3.5-4˚ F by 2050.[3] Additionally, the Northeastern states appear to be warming faster than any other region in the United States. In the time it would take the rest of the world to reach an increase of 3.6˚ F, our region would warm by 5.4˚ F.[4]

Hotter average temperatures mean more days above 90˚ F in the summer and fewer days below freezing (32˚ F) in the winter. Changes in average annual temperature are already shifting the length of seasons in Maine. Studies for the Maine Climate Council show the statewide "warm season" (when the average daily temperature is above freezing) increased by two weeks over the past century. According to global climate models, the warm season will likely increase by two more weeks by 2050.[5]

Falmouth also will see more days of extreme heat in which temperatures exceed 90° F. In 2019, the National Weather Service recorded four days in the region during which temperatures reached or exceeded 90˚ F.[6] In 2021, seven high heat days were recorded, with a recorded peak temperature of 97˚ F in June. Between 2050 and 2100, the region will experience 20 to 30 more high heat days.

Impacts

Human

- Increased heat-related illnesses
- Increased vector-borne diseases (i.e. Lyme)
- Strain on the health care system
- Worsening air pollution
- Changing tourism seasons

Infrastructure

- Increased buckling, softening, and cracking of roadways
- Increased energy consumption

Ecosystem

- Agricultural shifts
- Increased frequency of pest outbreaks
- Shifting ecosystems (i.e. invasive species)

Temperatures have risen over 3˚ F since 1895

Average Annual Temperature in Maine (1895 - 2022)

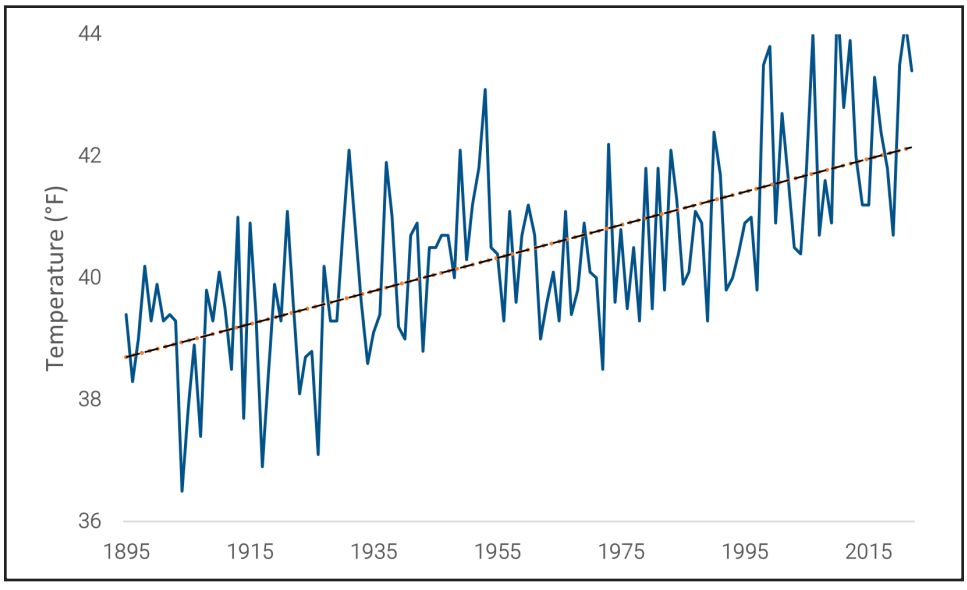


Figure 2: Average Annual Temperature in Maine from 1895 to 2022. The linear trend (dashed line) indicates temperature have risen approximately 3˚ F over this time period. Source: Maine Climate Change Institute

Changing Precipitation Patterns

Rainfall Totals

Warm air holds more moisture. As temperatures warm this will lead to an increase in the intensity and possibly the frequency of precipitation events. As a result, Falmouth will see more inches of rainfall annually, but it will likely be concentrated in more intense storms with periods of increased drought in between. According to studies for the Maine Climate Council, the average amount of precipitation Maine sees in a year has increased by 6 inches since 1895. This trend is expected to continue, with precipitation in the region projected to increase by 5% by 2050.[7] What is more striking is that between 1958 and 2010, the northeastern United States has seen a 70% increase in the amount of precipitation occurring in very heavy rain events.

Type of Precipitation

As temperatures rise, precipitation in Maine is increasingly falling as rain instead of snow. Since 1895, the average annual snowfall in Maine has decreased by about one inch, and the snowpack duration has decreased by two weeks. Even under the IPCC medium emission climate scenario (RPC4.5), southern Maine's snowpack is expected to be reduced by 50%, or one-third fewer snow days.[8]

Changing average temperatures and humidity also will increase the likelihood of weather events considered uncommon in the state. Assessments from the University of Maine found that Nor'easters, ice storms and/or bomb cyclones – a rotating system of clouds that grows into a rapidly intense storm due to a sudden drop in atmospheric pressure – are likely to be far more common.[9] Maine has been hit by nine hurricanes, with five of those making landfall. All five have been either category 1 or 2.[10]

Drought

Although average annual precipitation is expected to increase, warmer temperatures and reduced snowpack will result in increased periods of drought. Warmer temperatures mean higher evaporation rates in lakes, rivers, and other waterways. Maine has experienced 35 statewide droughts since 1900.[11] Projections suggest that Maine could see a 70% increase in risk from widespread summer drought by 2050.[12]

Impacts

Human

- Changes in property and municipal tax base
- Decline in water quality

Ecosystem

- Agriculture damage
- Decline in ecosystem health
- Wildfires

Infrastructure

- Coastal and inland flooding
- Coastal and inland erosion
- Overburdened wastewater systems
- Building and roadway damage

Average Annual Precipitation in Maine (1895 - 2022)

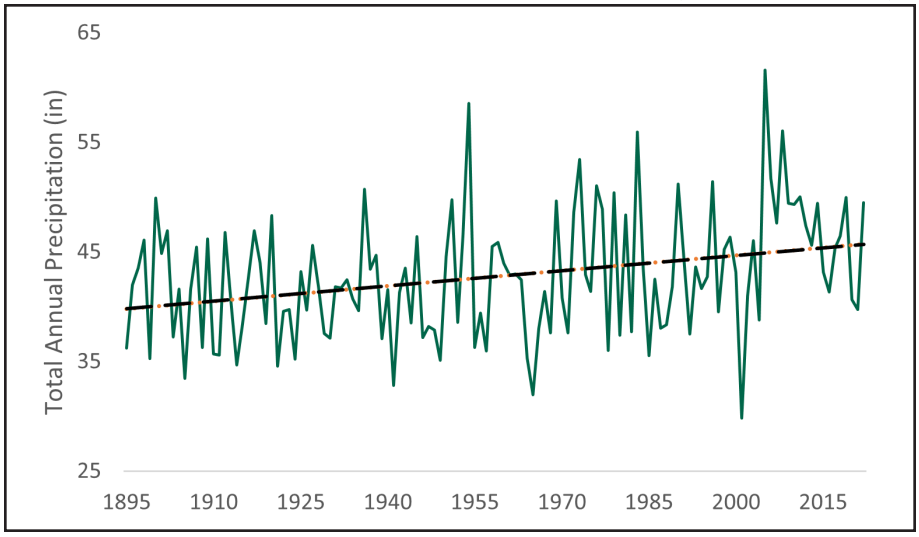


Figure 3: Average Annual Precipitation in Maine from 1895 to 2022. The linear trend (dashed line) indicates total precipitation has increased approximately 6 inches over this time period. Source: Maine Climate Change Institute

Sea Level Rise

Global average sea level has increased by roughly 7-8 inches since the early 1900s, with almost half of that rise occurring since 1993.[13]

The State of Maine recommends that communities commit to managing 1.5 feet of relative sea level rise by 2050 and 3.9 feet by 2100,[14] and be prepared to manage 3 feet of rise by 2050 and 8.8 feet by 2100, recognizing the high emission scenario.[15] In the high emissions scenario, no mitigation techniques are employed, and the average temperature of the Gulf of Maine would be 7˚ F higher than pre-industrial levels.[16]

The water levels in Casco Bay have risen by 7.5 inches since record-keeping began in 1912. While sea levels had been rising at a rate of 0.07 inches per year, that rate has accelerated to 0.12 inches since 1990.[17] This rate equates to about 1 foot of sea level rise per century but is predicted to accelerate further, as climate change worsens.

Higher sea levels mean higher tides reach further inland, causing more frequent "sunny day" or "nuisance" flooding, defined as when coastal water levels reach or exceed 2 feet above the long-term average daily high tide. In Greater Portland, nuisance floods historically happened about five times per year, but lately have occurred 12 or more times a year, especially during winter Nor'easters.[18]

Impacts

Human

- Changes in property and municipal tax base
- Contaminated groundwater

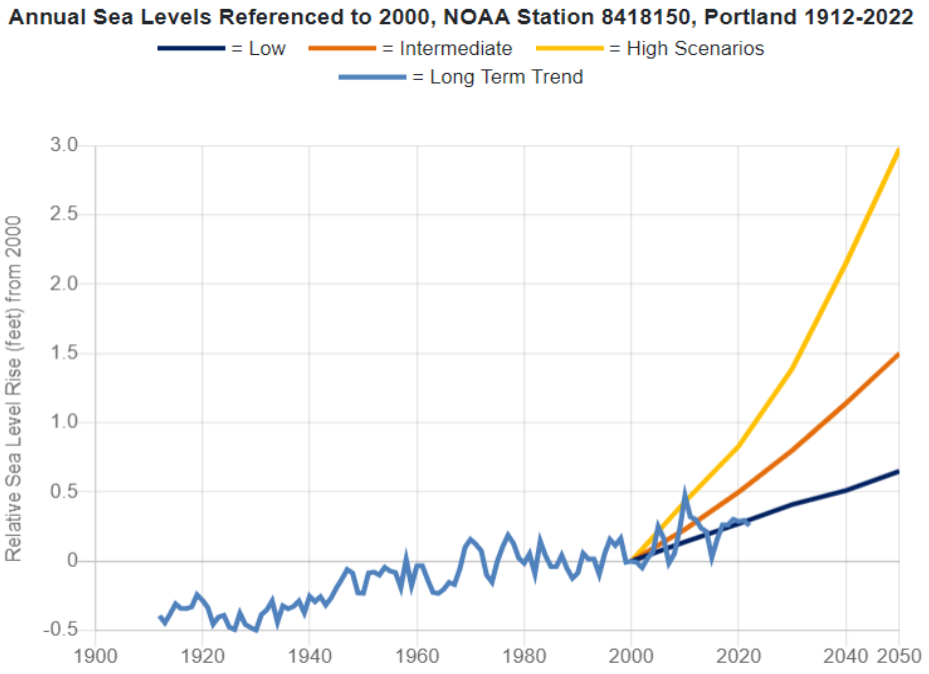
Infrastructure

- Coastal and inland flooding
- Coastal erosion
- Strain on stormwater systems

Ecosystem

- Shifting ecosystems (i.e. invasive species)
- Changing groundwater levels and salt accumulation in soil

Water levels in Casco Bay have risen 7.5 inches since 1912



NOTE: The intermediate scenario is the "commit to manage" and the high scenario is the "plan to prepare" level in the Maine Won't Wait Climate Plan. Low, Intermediate, and High scenarios are based on Sweet et al., 2017.

Figure 4: Annual sea level rise at the Portland tide gauge from 1912 to 2022. The trend lines so potential rise based on low (blue), intermediate (orange), or high (yellow) sea level rise scenarios. Source: Maine Sea Level Rise Dashboard

Rising Ocean Temperatures and Acidification

Ocean temperatures in the Gulf of Maine have been rising at an accelerating rate, warming three times as fast as the global average over the past three decades, and seven times as fast in just the past 15 years.[19] Between 2004 and 2013, the Gulf of Maine warmed by 0.41°F (0.23°C) per year, a rate faster than 99% of the world's oceans. Bodies of water along the Maine coast are expected to continue warming at an above average rate; water temperatures in Casco Bay have increased by about 2.5°F (1.4°C) between 1993 and 2018.

Oceans act as a "carbon sink," absorbing atmospheric carbon dioxide, thus helping to alleviate the impacts of climate change. As the atmospheric concentration of carbon dioxide rises, the ocean absorbs more carbon dioxide, causing the water to become increasingly acidic. Acidification is further increased by stormwater runoff with prominent levels of nutrients such as nitrogen, creating algal blooms. Acidification impacts the health of the ocean and harms marine life.

Globally, oceans have become 30% more acidic in the past 100 years.[20] The Gulf of Maine may have a higher susceptibility to ocean acidification because of its relatively low pH and colder waters, which more readily absorb carbon dioxide. Research predicts that the acidity of the Gulf of Maine will continue to increase rapidly in the coming decades and at a faster pace than the global average.[21]

Impacts

Human

- Changes in food supply

Ecosystem

- Decline in marine species health, particularly shellfish
- Harm to fishing industry

Casco Bay is warming faster than 99% of the world's oceans

Average water temperatures in Casco Bay have risen 3˚ F since 1993

Warming Temperatures in Casco Bay (1993-2018)

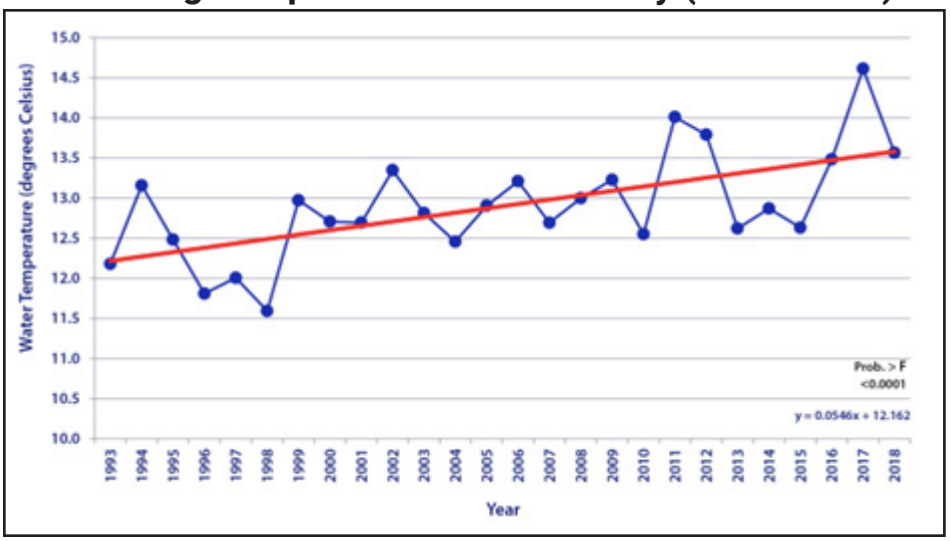


Figure 5: Average annual water temperature in Casco Bay from 1993 to 2019. Data is taken from Friends of Casco Bay's three Sentinel Sites, which are located offshore in Broad Sound, nearshore by Clapboard Island, and at the mouth of Portland Harbor. Source: Friends of Casco Bay

A Note on Flooding

The greatest climate change risk to Falmouth are impacts from flooding. However, flooding is not a climate hazard but rather a result of increased precipitation, infrastructure deficiencies, sea level rise and storm surge. Storm surge is a temporary increase in water levels above predicted astronomical tides due to weather events. Climate change is likely to amplify the risk of coastal and inland flooding by increasing the level of the tide, as well as increasing the likelihood of severe weather events capable of causing 100- and 500-year floods.

Flooding from significant weather events can damage infrastructure and private property, inundate stormwater systems and cause road closures that can strand residents and cut off emergency vehicle access. River flooding also may exacerbate erosion along riverbeds, which would degrade inland wetland ecosystems and threaten the stability of the ground beneath nearby structures.

This report uses flood modeling to assess the vulnerability of assets in Falmouth. These predictive models show higher potential for flooding along Mill Creek, Presumpscot River, Piscataqua River and other waterways, which would further impact Falmouth's infrastructure, community, and natural resources.

Flood Data Used in this Report

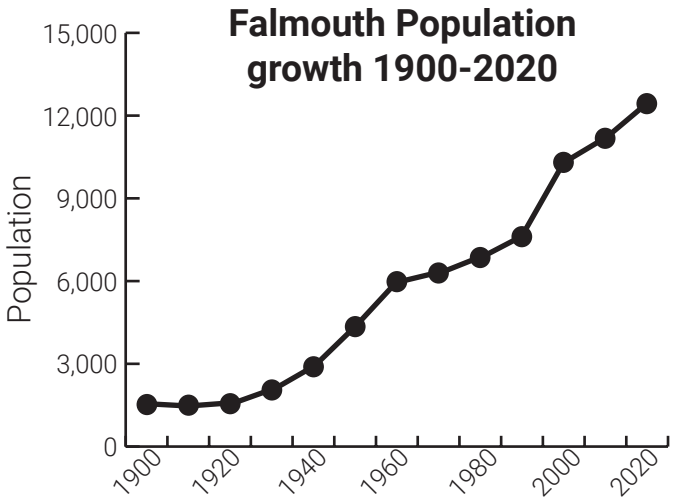
To assess the vulnerability of Falmouth's assets to coastal sea level rise and high astronomical tide (HAT), this report uses geospatial data from the Maine Geological Survey, which shows relative levels of inundation from sea level rise or storm surge for the Maine coast for the years 2050 and 2100 under six scenarios. The scenarios selected for this analysis include 1.6 and 3.9 feet of sea level rise on top of the highest astronomical tide, to visualize the intermediate climate scenarios for both 2050 and 2100.

To determine the impacts of 100-year floods, particularly along inland waterways, this report uses data from First Street Foundation's Flood Factor[22] rather than FEMA Floodplain Management. While FEMA floodplain information reflects current estimates and historic flood risk, it does not project future risk under a changing climate, and projected changes to floodplains are not available across the state. Flood Factor includes flooding from all types in its application – rain, river, tidal and storm surge. However, Flood Factor uses a single methodology on a national scale, which may create questionable accuracy at a local level. Currently this is the best available data, this data should be checked frequently and updated as new and better data is created.

The assets and areas identified as at risk by Flood Factor will require further study in the future as data sources are improved. If the Town wishes to calculate more localized projections, it can explore developing site-specific flood modeling to account for factors such as local topography and elevation.

Existing Social Vulnerabilities

Overall, Falmouth has low social vulnerability. However, the burden climate change hazards bring will not be shared equally within the community. Social vulnerabilities amplify the impacts of climate hazards for specific populations. Communities with higher social vulnerability will be less resilient to climate hazards. Identifying the populations most vulnerable to climate hazards allows the Town of Falmouth to better direct planning and resources when preparing for future climate impacts.



Social Vulnerability refers to factors that may weaken a community's ability to adapt to or recover from a disaster and is an indicator of community resilience.

Examples: Age, race, households with no vehicle, financial burden

Total Population
12,316

Total Households
5,134

Occupied Households
4,875

Census Data

Demographic data in this report relies primarily on ***American Community Survey (ACS) 5-year estimates (2017-2021)*** from the U.S. Census Bureau. To understand variability across Falmouth, data was analyzed at the block group level. Unfortunately, all data is inherently flawed and has limitations. For example, typically people who respond to the census survey have higher average incomes, education levels, and homeownership rates than those who do not. This means that census data historically undercounts already underrepresented populations. Although the data is flawed, it still provides the Town with baseline information and the ability to compare shifts in demographics. Falmouth recognizes the limitations in this data will endeavor to further refine its understanding of at-risk populations by working with emergency management staff and local community organizations.

Social Vulnerability Index

To develop a better understanding of populations at risk, GPCOG and the Town of Falmouth used U.S. Census data to identify populations with the potential for high social vulnerability. The Maine Social Vulnerability Index (SVI) developed for the Maine Climate Council identifies 17 social demographic characteristics that contribute to an individual's or household's vulnerability to climate impacts.[23] This vulnerability assessment looked at each SVI factor, but based on Falmouth's demographics, certain factors discussed further below will have a larger impact on the Town's overall vulnerability.

Definitions

People of Color are individuals who identify as Black or African American; American Indian or Alaska Native; Asian; Native Hawaiian or Other Pacific Islander; and/or Hispanic or Latino

Multi-Unit Structure is housing structure with 3 or more units.

Natural Resource Industry is defined as those working in agriculture, forestry, fishing and hunting, and mining.

Crowding is a household with more people than rooms. This includes owner-occupied and renters.

DEMOGRAPHIC		HOUSING		SOCIOECONOMIC	
Age 65 or over	**2,413** (19.6%)	Multi-unit structure	**429** (8.4%)	Below poverty level	**246** (2.0%)
Age 65 or over and living alone	**537** (4.4%)	Mobile homes	**31** (0.4%)	Self-employed	**580** (9.7%)
Age 18 or Younger	**3,171** (25.7%)	Crowding	**70** (1.4%)	No high school diploma	**96** (1.1%)
People of Color	**1074** (8.7%)	Single parent household	**335** (6.9%)	Unemployed	**167** (1.7%)
Speaks English less than well	**84** (0.7%)	Households with no vehicle	**205** (4.2%)	Natural resource occupation	**121** (2.0%)
Living with a disability	**783** (6.4%)			Median household income	**$132,817**

Notes: Calculations for each factor is based off different populations. For example, age and race or ethnicity factors are calculated based on total population while linguistics is determined for total population 5-years-old and older. Housing factors are calculated based on total households or housing units. Please see A lifeline and social vulnerability analysis of sea level rise impacts on rural coastal communities (2018) by Johnson, et. al. for a full description.. Data Source: U.S. Census Bureau

Compounding Social Vulnerability

Each individual factor increases a person's vulnerability to climate change; however, many people and households experience multiple factors. The more simultaneous factors someone experiences, the harder it will be to adapt to climate change. Climate impacts will be felt the most by those who have the highest social vulnerability. For example, an elderly resident living alone may also live in poverty and lack access to a vehicle. Evacuating during a severe storm could be difficult due to decreased mobility, reliance on public transportation, decreased communication, and limited financial means.

The Maine Coastal Risk Explorer aggregated the 17 Maine Social Vulnerability Index factors to assess compounding social vulnerabilities in Maine communities.[24] The data show the greatest amount of overlapping social vulnerability in neighborhoods bordering the river. Otherwise, findings do not show significant compounding vulnerabilities in Falmouth.

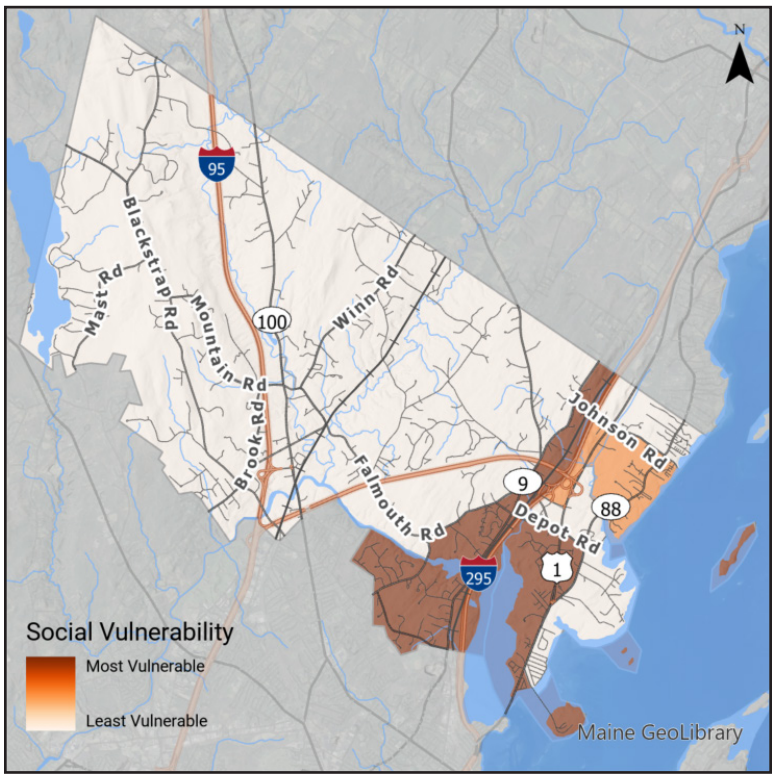


Figure 6: Social Vulnerability Index (SVI), aggregate measure of 17 factors of social vulnerability, by Census Block. Data developed by Johnson, et. al. (2018) and Maine Coastal Risk Explorer.

Notes on Social Vulnerability

This section discusses the historic impacts of climate change on social vulnerabilities. However, there is still variability within each factor. This means that someone classified within a social vulnerable group may not have the same risks as the broader group. Similarly, it is not assumed that people of one factor are automatically at risk for additional factors.

For example, on average someone who is 65 or over is at a higher risk of climate impacts due to greater health concerns or limited mobility. However, an older adult also may have greater financial means and better be able to respond to a disaster, or have strong social connections to help move around. It is not assumed that someone in Falmouth is vulnerable only because of their demographic or socioeconomic characteristics.

Age

WHY THIS MATTERS

Older adults are more susceptible to climate change due to increased likelihood of pre-existing conditions – such as chronic disease or reduced mobility, decreased physical or cognitive capacity, and an increased reliance on external support. These stressors mean older adults experience disproportionate rates of heat-related ailments. Heatstroke occurs at rates 12 to 23 times higher for individuals 65 years old and older, compared with other age groups.[25] Adults over age 65 also have a greater sensitivity to air pollution – such as particulate matter, dust, and ground-level ozone – all of which are expected to increase with climate change due to more frequent wildfires and increased annual temperatures.

Along with higher susceptibility to extreme temperatures, worsening air quality and vector-borne disease, elderly populations may have less capacity to respond to climate hazards, be it a lack of physical capability to drive to health care facilities or increased financial burdens from living on a fixed income.[26]

These risks are even greater for elderly residents who live alone. In the event of heatstroke, individuals living alone are less likely to receive necessary help accessing health care resources. In the event of a severe storm, impacts such as flooded roads or wind-damaged power lines may leave elderly residents living alone stranded and unable to evacuate to safety or request emergency assistance.

IN FALMOUTH

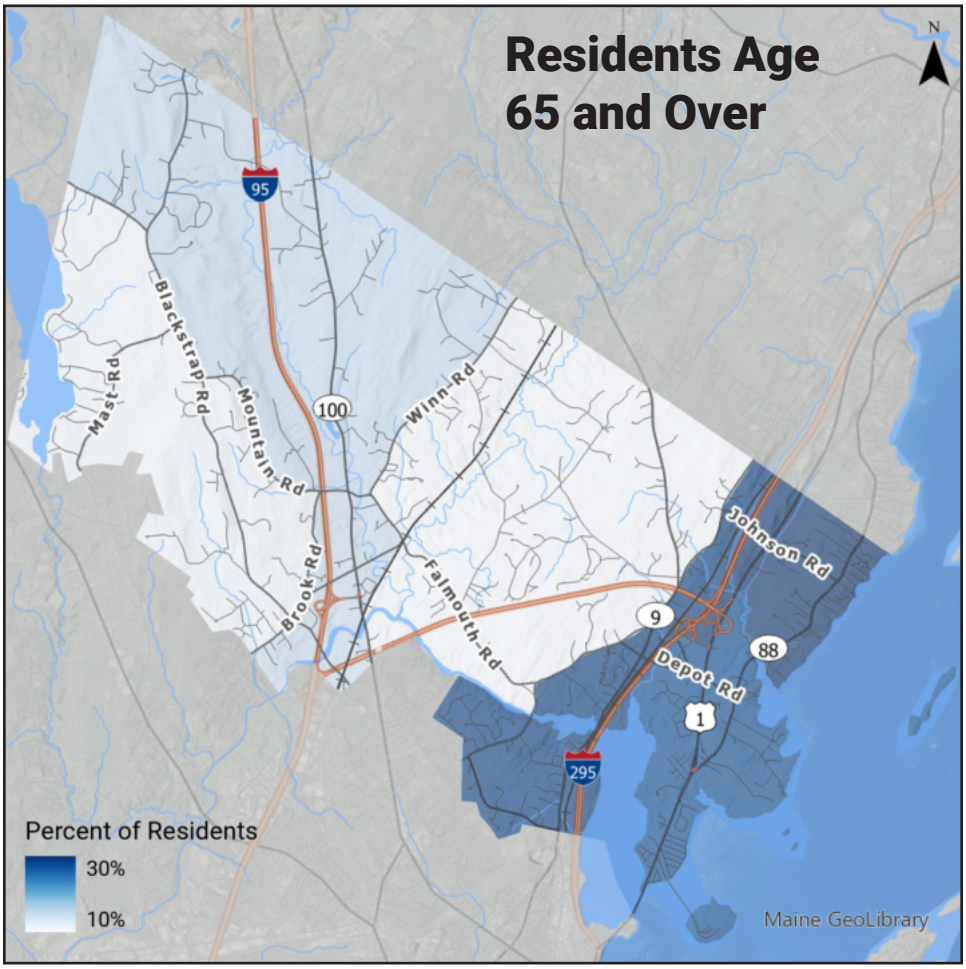


Figure 7: Percentage of residents in Falmouth age 65 or older by Census Block. Data source: U.S. Census Bureau, American Community Survey (2017-2021)

20% of Falmouth's population is **over the age of 65.**

Over **22%** of adults **65 and over live alone**. That is over 4% of the total population

Falmouth is home to numerous assisted living and retirement communities that represent high-density vulnerable populations with limited assistance in an emergency.

Health

WHY THIS MATTERS

Residents with poor health or a lack of access to health care will be inherently more susceptible to dangers such as high heat, worsening air quality, and power outages caused by intense storms.

The social marginalization of people with disabilities further increases the threat of isolation during a climate-related event. Studies show that emergency relief often excludes people living with disabilities due to lack of accessible shelters, inaccessible information, or failing to include people with disabilities in the initial planning and adaptation efforts.[27] Physical and social barriers that limit residents' ability to access resources on a day-to-day basis ultimately play a significant role in creating or increasing climate vulnerability.

IN FALMOUTH

6% of residents **live with a disability**

8% of the population is in **poor health**

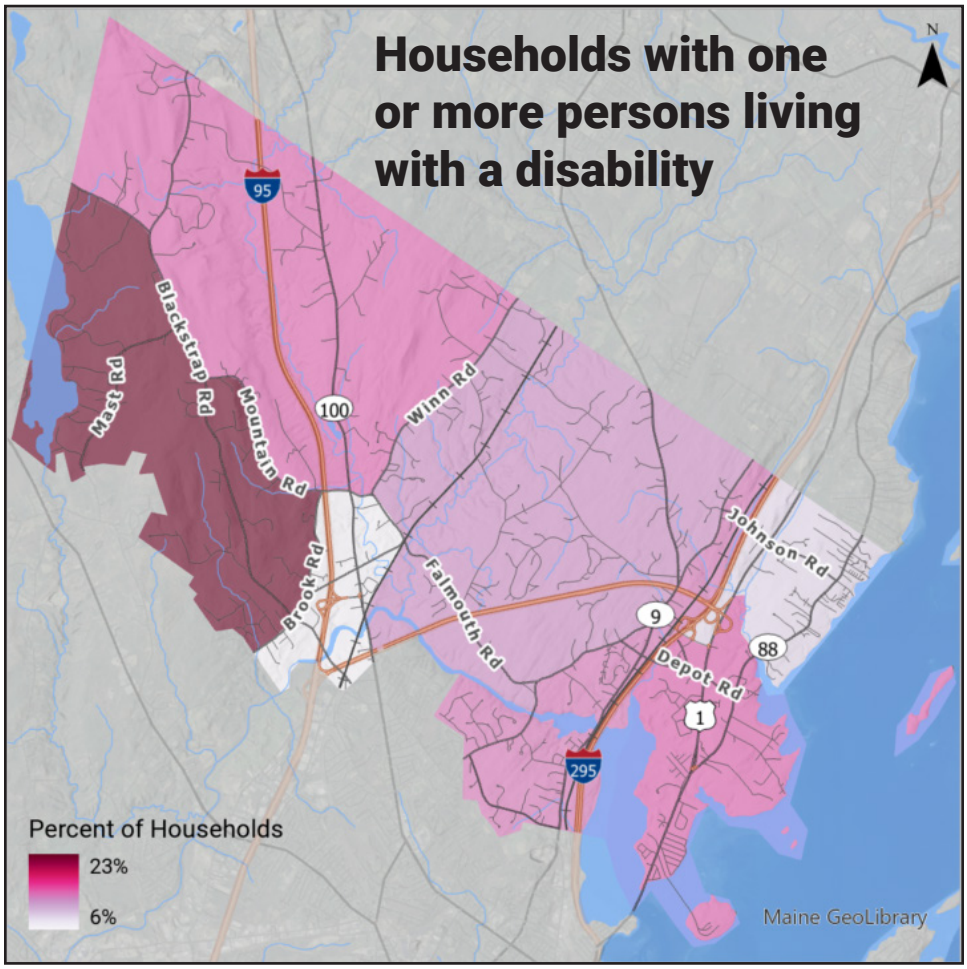


Figure 8: Percentage of households in Falmouth with one or more persons living with a disability by Census Block. Data source: U.S. Census Bureau, American Community Survey (2017-2021)

Poverty and Unemployment

WHY THIS MATTERS

Climate change disproportionately impacts people with lower incomes due to higher exposure to health risks, limited financial safety nets, and emotional stress from the harm and financial burdens posed by climate hazards. Residents facing poverty tend to live in poorer-quality housing and in areas with greater air pollution. The CDC found that low-quality living environments, high levels of stress, and poor physical and mental health are all highly correlated for people with lower incomes.[28] Households with incomes at or below the poverty line are also less likely to have property insurance or savings for added or unexpected expenses such as higher energy or food costs, costs to repair building or property damage, and/or lodging or transportation costs to evacuate if needed.

These added expenses are particularly detrimental for those who are unemployed and living on fixed or no personal income. Residents with lower incomes tend to work hourly jobs without paid time off. Consequently, disruptions in transportation or business continuity that restrict being able to work can lead to significant loss of income. Residents with limited disposable income can spend fewer dollars on mitigating the impacts of climate hazards. For example, to reduce extra expenses, people tend to avoid purchasing or running air conditioners in the summer, making the increasing severity of high heat more dangerous for cost-burdened households.

IN FALMOUTH

2%
unemployment rate

2% of residents, **are living below the poverty line**

71% of households who are below the poverty level are not receiving SNAP benefits

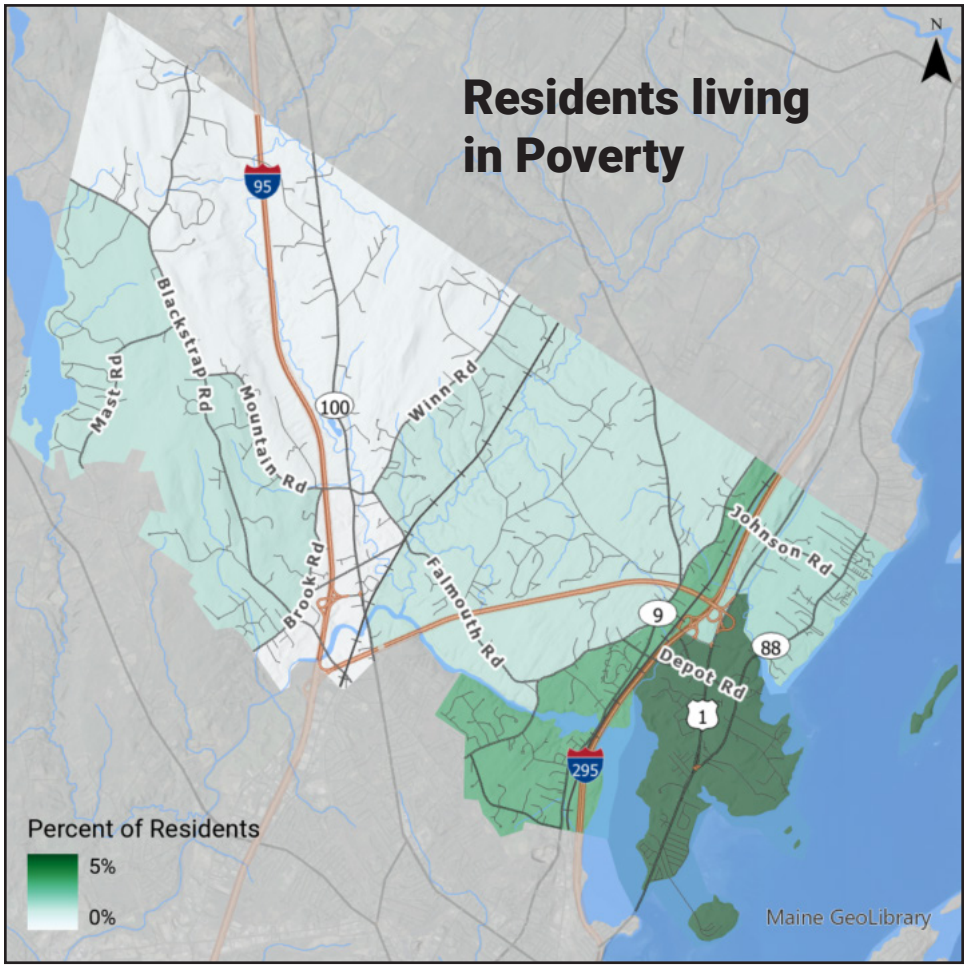


Figure 9: Percentage of residents in Falmouth living in poverty by Census Block. Data source: U.S. Census Bureau, American Community Survey (2017-2021)

Housing Affordability

WHY THIS MATTERS

For all homes, the impacts of climate hazards increase the cost of maintaining properties, repairing damage, and paying for major renovations, but southern Maine's housing crisis further impairs community resilience from climate stressors. A household is considered cost-burdened if at least 30% of monthly income goes towards housing costs. Cost-burdened households are less likely able to repair property damage from flooding or severe storms, purchase air conditioning, upgrade to energy efficient appliances (i.e., rooftop solar panels or heat pumps), or evacuate or relocate in case of a disaster.

Renters have far less freedom in preparing for climate hazards than homeowners, as major renovations or upgrades are ultimately decided by the property owner. For significantly burdened families, even smaller efforts to improve resilience, such as purchasing new air conditioning units for warmer summers, may be too expensive.

Cost burdened: households who spend 30% or more of their income on housing expenses. Significantly cost-burdened households spend more than half of their income on housing costs.

IN FALMOUTH

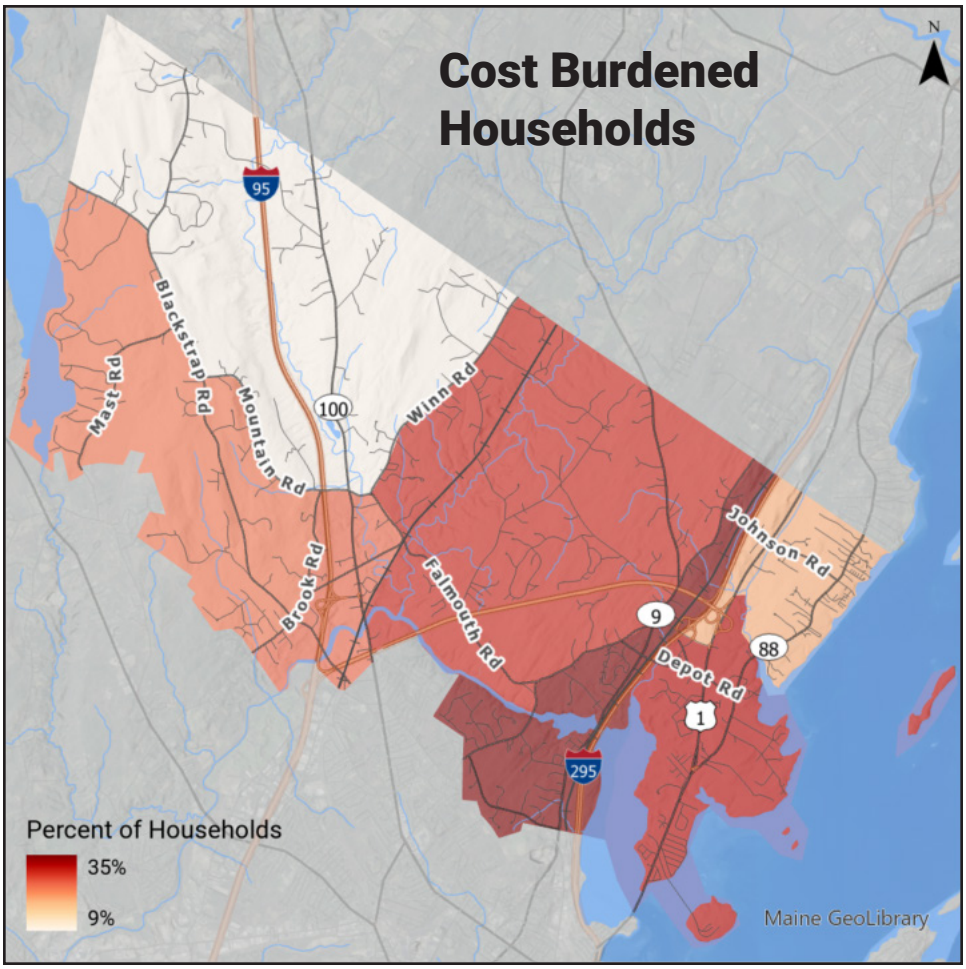


Figure 10: Percentage of households in Falmouth who are cost burdened by Census Block. Data source: U.S. Census Bureau, American Community Survey (2017-2021) Data source:

24% of Homeowners are **cost-burdened**

14% of residents are renters, **almost half are cost-burdened**

23% of rented households spend at least half of their monthly income on rent, classifying them as **significantly cost-burdened**.

Language, Race, and Ethnicity

WHY THIS MATTERS

The term "people of color" refers to all residents of Falmouth who do not identify as white non-Hispanic. National and regional studies show that because of historical and persistent patterns of structural racism, people of color are more likely to have fewer financial resources, reduced access to health care, and less protection from environmental hazards than white residents.

IN FALMOUTH

People of Color
make up **8%**
of the population

Only **1%** of households speak English less than well

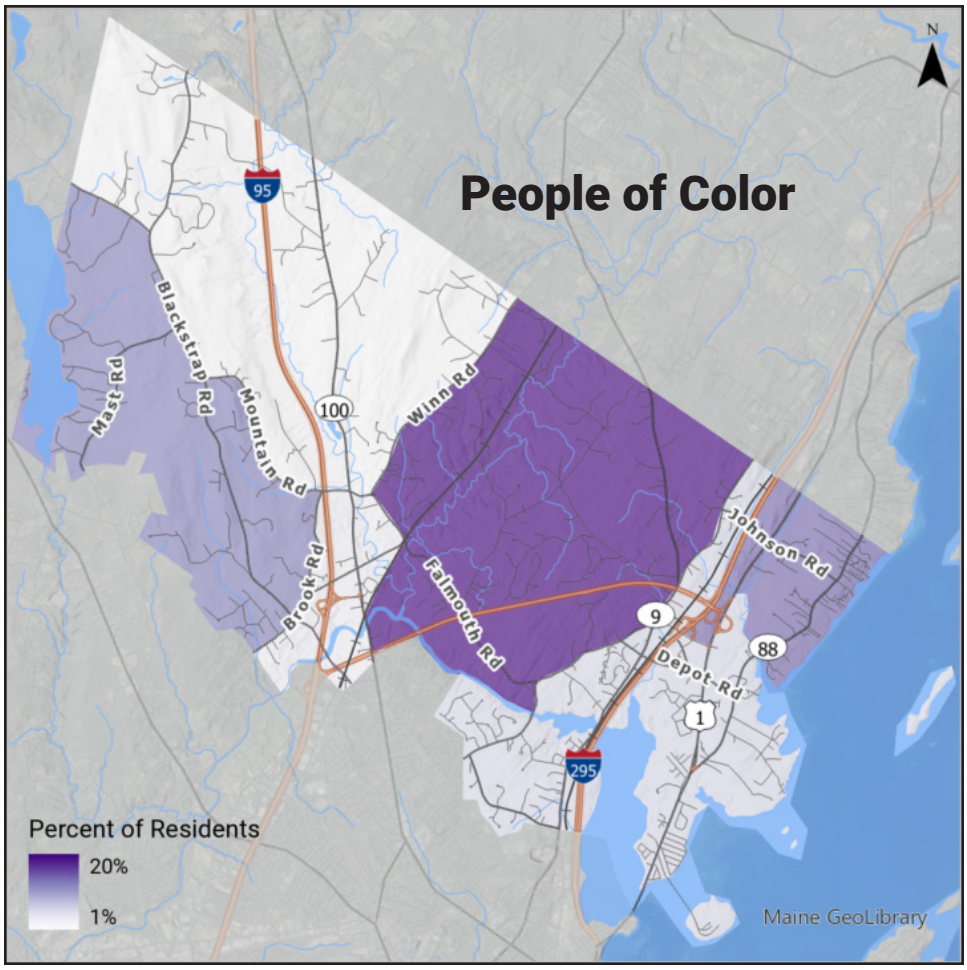


Figure 9: Percentage of residents in Falmouth who are people of color by Census Block. People of color represent everyone except white, non-Hispanic individuals. Data source: U.S. Census Bureau, American Community Survey (2017-2021)

Vulnerable Assets

Infrastructure, Communities, and Natural Resources

The vulnerability assessment focuses on climate hazards that will have the greatest impact on infrastructure, people, and natural resources in the Town of Falmouth. Vulnerability is determined by analyzing exposure, resilience, and capacity to adapt to future climate hazards.

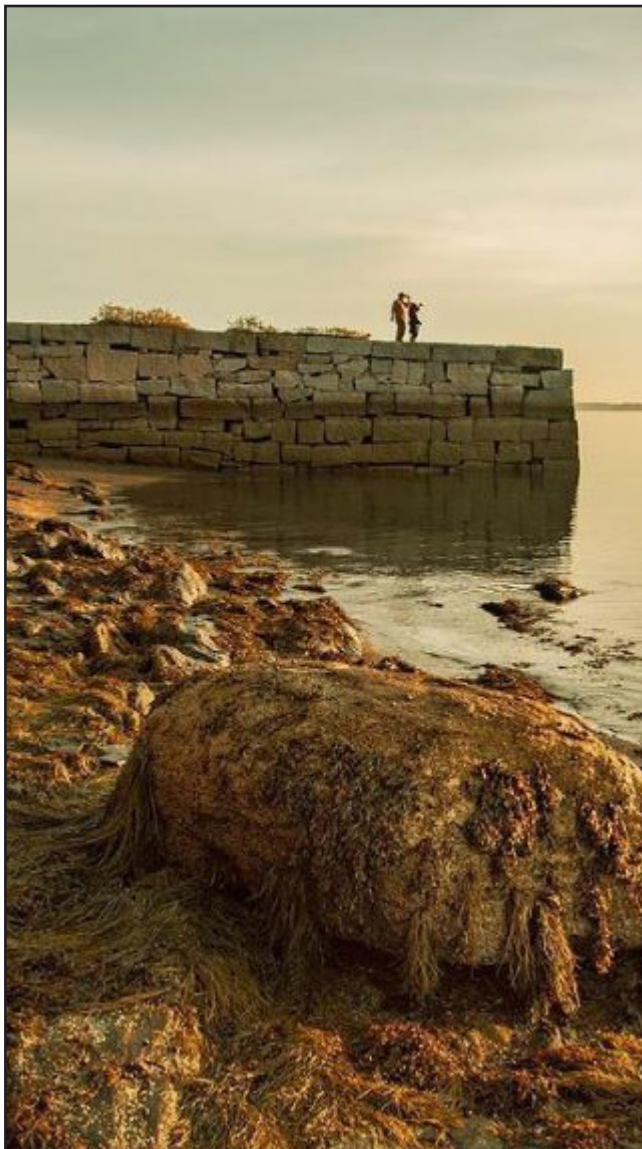
Key Terms

Exposure
Whether the asset or system is located in an area experiencing direct effects of climate variables

Vulnerability
A measure of risk to a threat, incorporating the likelihood of the threat occurring and the severity of the impact if it occurs

Adaptation
The process of adjusting to or preparing for changing conditions to reduce the vulnerability of impacted assets

Resilience
The capacity of communities or natural environments to adapt and/or recover quickly from impacts



Risks to Critical Infrastructure

Climate hazards cause damage to critical infrastructure such as roads, buildings, and utilities (water, sewer, energy, communications). Much of the country's infrastructure was not built to withstand the types of extremes our climate now delivers. Below is a summary of the potential climate hazards and resulting impacts on Falmouth's existing critical infrastructure.

Resource	Hazard	Possible Impacts
Wastewater		
Treatment Plant	• Sea level rise	• Groundwater infiltration/reduced effective capacity • Loss of effluent discharge due to flooded coastal outfall pipe
Pump Stations	• Sea level rise • Increased precipitation and severe storms • Inland flooding	• Permanent loss of coastal pump station due to flooding • Inundation during intense rain events • Damage from severe storms
Manholes	• Sea level rise • Increased precipitation • Inland flooding	• Excess flooding and inundation from stormwater runoff overflow • Temporary loss of access to sewer lines • Permanent loss of access to pipelines along coastal sewage systems
Pipelines	• Sea level rise • Inland flooding	• Increased chance of erosion and contamination risk along older pipelines • Inability to access or repair flooded pipes • Strained capacity from increased precipitation
Transportation		
Roads and Railroads	• Increased temperature • Sea level rise • Increased precipitation and severe storms • Inland flooding	• Buckling, cracking, softening of road pavement due to warmer, more variable temperatures • Temporary inundation due to flash flooding • Permanent loss of critical roadways due to sea level rise • Increased degradation and erosion of infrastructure from increased precipitation • Risk of significant damage from intense storms

Resource	Hazard	Possible Impacts
Bridges	• Sea level rise • Inland flooding • Increases precipitation and severe storms	• Permanent loss of low-lying bridges • Permanent loss of access to islands • Increased likelihood of inundation during storms • Increased chance of damage from intense storms
Stream Crossings and Culverts	• Sea level rise • Inland flooding • Increased precipitation	• Chance of inundation from increased precipitation • Higher stormwater runoff/sediment overflow from increased precipitation
Marinas	• Inland flooding • Sea level rise • Increased Precipitation	• Permanent inundation from sea level rise • Temporary loss of access due to high tides • Chance of stranding boats during severe storms • Damage from severe storms and higher wind speeds
Information and Communications Technology (ICT) and Power Networks		
Data Centers and Communication Towers	• Increased temperature • Increased precipitation and severe storms • Sea level rise	• Increased demand for electricity for cooling • Damaged infrastructure from flooding and extreme weather • Damage to towers due to erosion • Loss of access to radio towers due to sea level rise • Damage to backup centers outside of Town lines
Power Lines and Substations		• Erosion of coastal and low-lying power lines due to flooding • Damage from increased wind speed and debris • Flooding of underground lines and low-lying substations • Lower generation/solar panel efficiency on high heat days • Reduced carrying capacity and transmission efficiency on high heat days • Increased electricity demand on high heat days for cooling
Buildings		
Residential and Commercial Buildings	• Increased precipitation and severe storms • Sea level rise	• Damage from flooding and extreme weather • Temporary inundation and loss of access due to flooding or high tides • Permanent loss due to sea level rise

Table 1: List of infrastructure in Falmouth that are vulnerable to climate change and how they may be impacted.

Wastewater Infrastructure

The Town of Falmouth maintains water, sewage, and stormwater infrastructure within town lines. This includes 31 pump stations, roughly 60 miles of pipeline running through private and public ground, and a wastewater treatment plant located along the Presumpscot River. In addition to servicing all the sewer connections and emptying out septic tanks for the Town of Falmouth, the wastewater treatment plant "imports" sewage from roughly 1,000 households from the neighboring Town of Cumberland.

Sea level rise, increased precipitation and increased flooding severity pose new risks to the daily operation and structural integrity of wastewater systems. The Wastewater Department of Falmouth does not believe increased precipitation and storm surges will affect the capacity of pipelines or the wastewater treatment plant. However, increased stormwater can still inundate pump stations thereby reducing hydraulic capacity.

Vulnerable Assets

Asset	HAT + 1.6 feet	HAT + 3.9 feet	100-year flood
Wastewater Treatment Plant*	No	No	No
Pump Stations	0	2	7
Pipeline in flooded areas	2.4%	3.3%	8%
Sewage Covers in flooded areas	2.1%	3%	6.8%

* The treatment outflow pipe may be inundated by sea level rise, however, flood levels are not expected to rise above the hydraulic profile of the Treatment Plant where it would impact operations.

Table 2: .Wastewater infrastructure in Falmouth that is vulnerable to flooding based on projected 2050 100-year flood, 1.6 ft of sea level rise, and 3.9 feet of sea level rise. Inundation is determined by sea level plus highest astronomical tide (HAT).

Note on Drinking Water:

Drinking water is separate from wastewater for both infrastructure and service. Falmouth receives drinking water from Sebago Lake. Keeping the land surrounding Sebago Lake forested protects the high water quality. Climate hazards and development pressures pose challenges to maintaining healthy water quality. Drinking water infrastructure in Falmouth is serviced and maintained by the Portland Water District. Data on drinking water networks is protected for safety. Therefore, the vulnerability of specific drinking water assets has not been assessed for this study. However, similar to wastewater infrastructure, climate hazards can strain the capacity of the system, increase pipe damage, and impede access in flooded areas.

Vulnerable Assets

Wastewater Treatment Facility:
The wastewater treatment plant is elevated high enough where it won't be directly impacted by sea level rise or flooding. However, sea-level rise threatens the facility's outfall system.

Pump Stations:
Up to 7 of Falmouth's pump stations are vulnerable to flooding, 5 along the coast and 2 inland. The high cost and lack of suitable replacement locations (especially in residential areas) makes relocating pump stations challenging.

Pipelines and Sewage Covers:
Many miles of existing pipeline are old and degrading in quality. Storm surges and higher annual precipitation may strain the piping system by increasing the likelihood of pipe damage and breaks. Increased groundwater salinity due to sea level rise or coastal flooding can lead to pipe corrosion. In addition, inland and coastal flooding will limit access to pipes and sewage covers for repair. Based on Flood Factor model data and Maine sea level rise estimates, over 24,000 ft of pipeline and 82 sewage covers are in flooded areas.

Impacts

Since each pump station requires electricity to operate, strong storms that damage power lines could render stations ineffective. In the case of a power outage, 15 of 31 pump stations have access to independent generators, and the Wastewater Department has a series of portable generators. However, flash flooding or debris from intense storms could cut off access to stations that need generators or further repair.

Pump stations in low elevation areas may become increasingly inundated during high precipitation storm events that flood an area faster than a station can pump out. This will temporarily flood nearby roadways and risk wastewater contaminating streams and waterways. Once the storm is over, a pump station will be able to pump any remaining overflow water without threatening the capacity of the Town's treatment piping network.

Increasing strain on pipelines may increase leaks and create overflows into waterways, directly contaminating waterways with untreated sewage.

Manholes, piping networks and other sewage access points inundated by water will be inaccessible to service workers. Inundated infrastructure will have reduced capacity to convey wastewater flows, creating the possibility of overflows and threats to water quality.

Failure and/or damage to wastewater systems could degrade water quality and impact public health.

Any of these disruptions to wastewater systems could further impact residents and business owners.

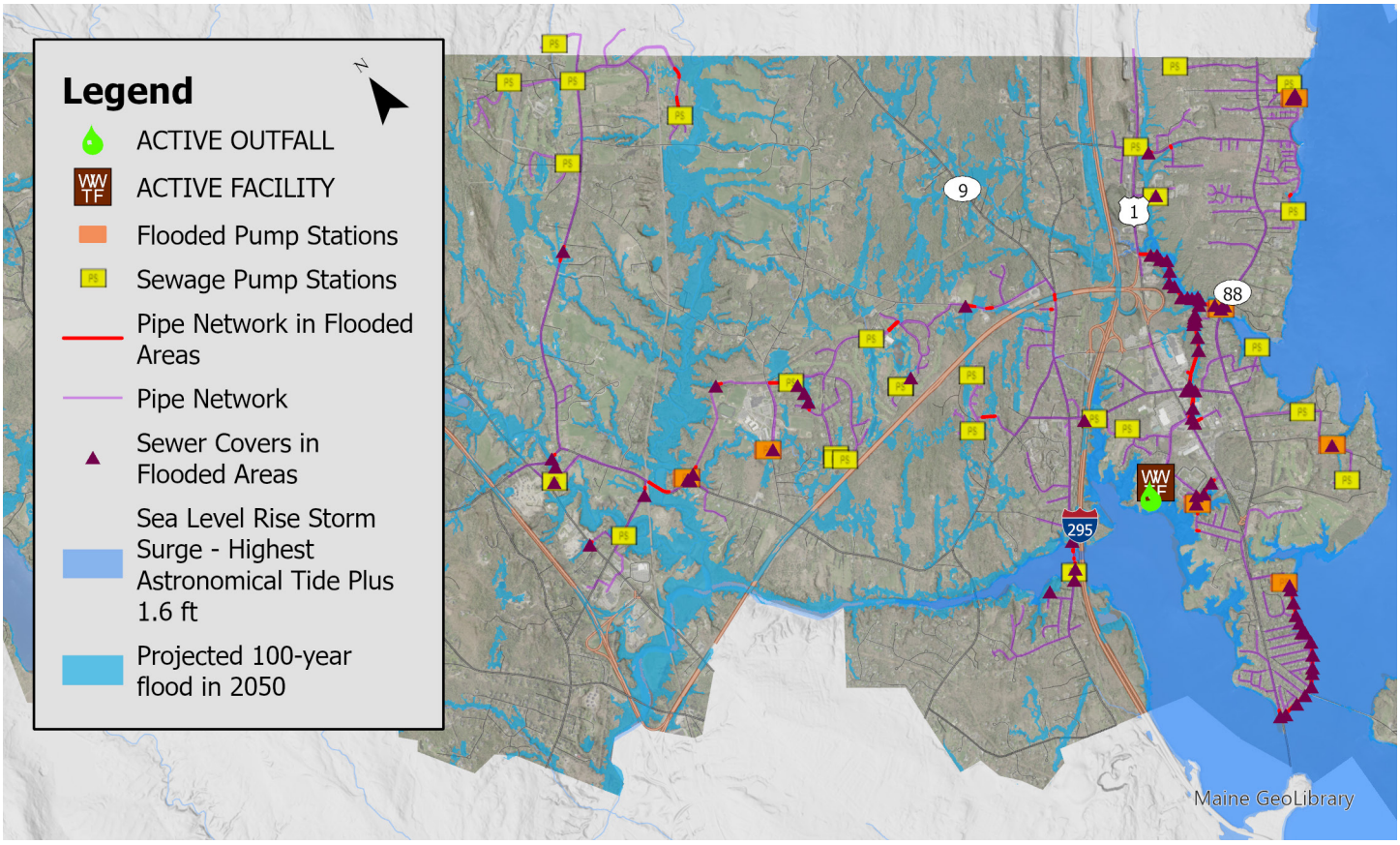


Figure 10: .Wastewater infrastructure in Falmouth that is vulnerable to flooding based on projected 2050 100-year flood and 1.6 ft of sea level rise.. Data Source: Town of Falmouth, Flood Factor

Transportation Infrastructure

Transportation infrastructure in Falmouth is at risk of flooding from a combination of sea level rise, increased frequency of storm surge and increased precipitation. It is not just coastal roadways and bridges that are at risk. Inland infrastructure will be impacted by increased precipitation, storms and surge from coastal waterways. Flooding will lead to erosion and damage to all infrastructure.

Maine's roads are designed to accommodate the consistent precipitation and longer-lasting storms (24 hours or longer) that have traditionally been common in the region. As both annual average precipitation rates and the intensity of weather events increase, roadways and bridges will be damaged by flooding if the hydraulic capacity of the storm drain is exceeded. During a severe weather event, lack of proper drainage capacity can cut off emergency vehicle access to neighborhoods and leave passenger vehicles stranded along flooded roads.

Below is a list of vulnerable infrastructure in Falmouth that is likely be impacted by flooding in the future, based on projected sea level rise and impacts of a 100-year storm.

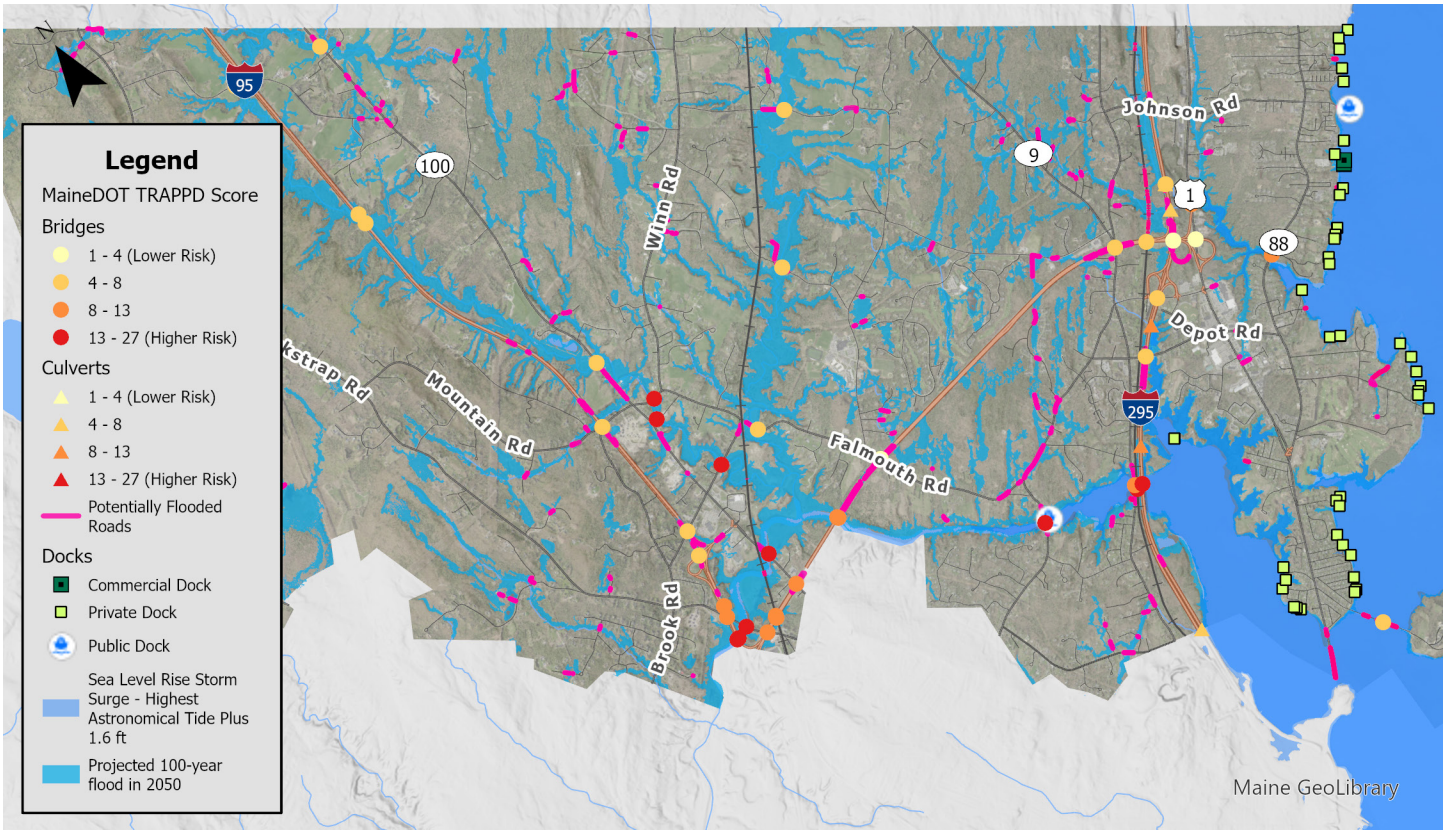


Figure 11: .Transportation infrastructure in Falmouth that is vulnerable to flooding based on projected 2050 100-year flood and 1.6 ft of sea level rise.. Data Source: Town of Falmouth, Flood Factor

Vulnerable Assets

Roads and Bridges

By 2050, sea level rise and storm surge threaten to impact major local and state roadways and bridges within Falmouth, including Foreside Road, Interstate 95, and Interstate 295. In addition, key inland highway corridors leading in and out of Falmouth are vulnerable to flooding due to increased precipitation and severity of storms, including Exit 52 and the end of the Falmouth Spur highway connector near the town's largest shopping center. All major interstate roads and the majority of bridges in the Town of Falmouth are maintained by the Maine DOT.

Neighborhood roadways along the Presumpscot Estuary are the most vulnerable to sea level rise, particularly roads along the Flats neighborhoods. Increased precipitation also threatens to erode critical bridge infrastructure at faster rates.

The Martin's Point bridge connecting the Flats to Martin's Point in Portland, and the Andrews Avenue bridge to access Mackworth Island are vulnerable at 1.6 feet of sea level rise, projected to occur by 2050 or sooner. While Martin's Point would still be accessible through Portland, Mackworth Island would be completely inaccessible without its bridge access. Additionally, I-295 across the Presumpscot River is at risk of being lost under 3.9 feet of sea level rise. While this road is managed by the State, the impact to Falmouth residents will be considered and planned for, as residents will be cut off from major services.

Railways

Both commercial rail lines through Falmouth (a Grand Trunk Line run by the Maine Department of Transportation, and a CSX freight railway owned by the Maine Central Railway Co) are vulnerable to flooding at several locations. The Grand Trunk Line bridge across the Presumpscot River is also vulnerable to flooding. Although there are no passenger rail stations in Falmouth, the Amtrak Downeaster uses the Pan Am railway to transport passengers from Brunswick to Boston.

Impacts

Impacts from flooded or damaged transportation infrastructure include the following.

Increased costs for maintenance and repair. Falmouth will need to budget for more emergency repairs, retrofitting culverts to appropriate sizing, and more frequent paving as roadway and bridge lifespans shorten and degrade faster.

Disruptions to supply chains caused by flooded roadways and bridges will harm the local economy.

Businesses and neighborhoods will be cut off from access to services. This can strand residents and prevent emergency vehicle access, thus increasing the public health impacts and limited ability to recover from a disaster.

Access to local and regional transit will be disrupted.

Access to key community assets is cut off. The Martin's Point bridge services a health care center in Portland, and Mackworth Island houses the Maine Educational Center for the Deaf and Hard of Hearing and the Governor Baxter School for the Deaf, both of which would be inaccessible in an extreme weather event.

Creates barriers for habitat migration, specifically around undersized or degraded culverts.

Marinas and Harbors

All of Falmouth's private marinas as well as its Town Landing, are vulnerable to flooding, these areas have approximately 1,200 moorings and provide access to commercial fishing and recreational boaters. While the Town Landing already sees flooding during high tides, sea level rise could permanently cut off ramp access for boats to enter and exit the water from that point.

Harbor floats can withstand winds of 45 mph, but faster wind speeds from increased severity of storms could overwhelm harbor infrastructure, temporarily flood boat launch areas, and cut off access for marine vessels to return to shore, possibly stranding them in the water during a storm.

Stream Crossings and Culverts

Increased precipitation and increased flooding severity threaten to overwhelm existing culverts. When culverts are undersized, water can back up and cause localized flooding, which can washout roadways, increase erosion, limit habitat access, and degrade water quality. MaineDOT maintains culverts along state-owned roadways through Falmouth. Four smaller state-maintained cross-culverts along I-295 are at risk of being flooded during a projected 100-year flood.

However, due to lack of information we do not know whether any of these culverts are sized appropriately to handle the potential increase in precipitation. While these culverts may be large enough to handle future flooding, Falmouth should be aware where potential impacts could occur. Four additional large culverts across I-295, while not in the flood zone, are listed by MaineDOT as not large enough to pass unexpected flow when the channel is full.

Asset	HAT + 1.6 feet	HAT + 3.9 feet	100-year flood
Roadways	Interstate 95 U.S. Route 1 Foreside Road		Interstate 95 U.S. Route 1 Foreside Road Falmouth Road
Bridges	Mackworth Causeway Martin's Point Bridge Presumpscot Falls Bridge	I-295 Bridge along Presumpscot River Grand Trunk Line Presumpscot Bridge	Lunt Road Bridge Falmouth/Winn Road Bridge
Railroads			Grand Trunk Railway CSX (Downeaster)
Marinas and Harbors	Town Landing Portland Yacht Club Handy Boat Marina		Town Landing Portland Yacht Club Handy Boat Marina
Stream Crossings and Culverts			I-295 NB Mill Creek Crossing I-295 SB Mill Creek Crossing Falmouth Spur to I-295 NB entrance ramp I-295 SB south of Lunt Road

Table 3: .Transportation infrastructure in Falmouth that is vulnerable to flooding based on projected 2050 100-year flood, 1.6 ft of sea level rise, and 3.9 feet of sea level rise. Inundation is determined by sea level plus highest astronomical tide (HAT).

Power and Information Systems

Energy and information systems, including radio towers, data centers, substations, transmission and cable lines, are growing increasingly vulnerable to climate change, with both direct and indirect impacts threatening the efficiency of the system and the reliability of supply. Faster wind speeds, heavier precipitation events and storm surges, and flooding will increasingly disrupt transmission lines, inundate substations and data centers, and erode communications systems.

Indirectly, the projected temperature changes may shift patterns in energy use, causing strains on both system reliability and capacity. The energy and communications systems that service Falmouth are interconnected within broader regional systems, and most assets are serviced by private utilities which have ultimate jurisdiction over any infrastructure systems. Understanding local infrastructure connections in the context of both the regional systems and climate hazards is necessary to determine potential actions for risk mitigation. These plans should be included in local emergency management plans.

Impacts

Impacts to power and information systems will include.

Increased costs for users. Strain on the energy grid from increased demand or disruptions in equipment due to climate change could create financial burdens on residents, businesses, and the Town.

Increased repair and maintenance costs for the Town.

Reduced ability to provide help in case of a disaster. Disruptions to communications systems will make it challenging to reach residents, especially those who are most vulnerable.

Significant economic losses for the Town and businesses may result due to power disruptions.

Vulnerable Assets

Transmission Lines and Grid Reliability

Electricity is provided to the Town of Falmouth by the utility Central Maine Power, with Town department buildings using Spectrum as their broadband carrier. Power transmission lines and fiber-optic cables run along the same poles throughout the Town, which are vulnerable to impacts from increasing severity of storms. Higher wind speeds knock down poles and leave debris, which obstructs road access for repair crews.

This leaves every Falmouth department vulnerable to losing its data connection if enough cables are damaged or destroyed, and every facility without an independent generator vulnerable to losing power. In a major weather event, because carriers run service on poles, if the pole at the end of a road is taken out by severe wind, there is nothing the Town can do until after the event is over.

As the intensity and prevalence of heat waves increase, higher demand for air conditioning increases the strain on power lines, increasing the chance of partial power outages and brownouts on high heat days. The police department has already purchased electric cruisers; as more departments electrify their buildings and vehicle fleets, power failure threatens to prevent critical services and even emergency vehicles from operating. Avangrid Inc., the parent company of Central Maine Power, has acknowledged the need for investment in southern Maine's energy grid to meet the capacity of increasing demand and minimize the vulnerability of critical transmission lines to severe storms.

Communications Systems

Falmouth maintains radio towers within the Town itself. Emergency services use radio stations located on Foreside Road and Mackworth Island. As discussed in the previous section, the bridge connecting Mackworth Island to the mainland is vulnerable to permanent inundation from sea level rise, which would cut off access for the Town to maintain and repair the system.

The Town also uses cell towers to communicate and control remote pump stations. Damage or disruption to these systems could also impact wastewater assets.

Interconnectedness of Private Information Systems

Data carrier infrastructure is so interconnected across the country that data centers located within Falmouth act as backup and redundancy points for external communities, and vice versa. This means Falmouth is vulnerable to severe weather events that affect distant communities. There is little the Town can do to protect privately run data centers from vulnerability due to rising temperatures and increased flooding, but there is even less it can do to improve the resiliency of external backup data centers the Town itself is directly dependent on.

Major carriers are always looking at redundancies and safety measures, but outages across the region and country could lead to internal failures. Further collaboration with private utilities may be useful in coordinating attempts to protect power and ICT assets from the impacts of climate change. At a minimum, planning for potential disruptions can at least minimize impacts.

Solar Array

The Town of Falmouth implemented a solar array on a 4.2-acre capped landfill along Woods Road. The array produces enough renewable energy to offset roughly 70% of municipal electric use. The solar array is not currently expected to be impacted by flooding during sxtreme events, but high intensity storms and winds could damage the solar panels.

Buildings

Homes, businesses, and town buildings are directly impacted by increasing precipitation and heavy storms. Those along the coast risk further flooding from sea level rise and storm surges. Older housing stock are especially susceptible to damage and higher energy costs if they have not been properly maintained or retrofitted with more resilient building materials. As climate change increases, residents in the Town of Falmouth could see increased property damage.

Vulnerable Assets

Overall, there is minimal flooding projected for Falmouth infrastructure. Some neighborhoods, particularly those adjacent to inland waterways, are likely to be inundated during extreme weather events that cause flooding. Flood Factor estimates that 27 homes in Falmouth have greater than a 26% chance of being flooded within the next 30 years.[29] However, most commercial and municipal buildings in Falmouth will not be directly impacted by flooding or sea level rise. Buildings with the potential to be impacted during extreme storm events include:

- The northwest buildings on the Falmouth Middle School campus.
- Parking lot in the Falmouth Shopping Center.
- The multi-unit commercial building on the Corner of U.S. 1 and Fundy Road.
- Commercial structures off Depot Road.

These are buildings subject to direct flooding during a 100-year flood event, but it is not possible to identify the number of buildings that may be damaged by strong storms and high winds.

Impacts

Flooded or damaged buildings will result in:

Millions of dollars of economic impact to residents, businesses, and the Town from property damages.

Decrease in property values and tax base from high-flood risk coastal properties and properties along degraded water bodies

Lack of access to neighborhoods or businesses due to flooded roads which impedes emergency services.

Vulnerable Community Assets

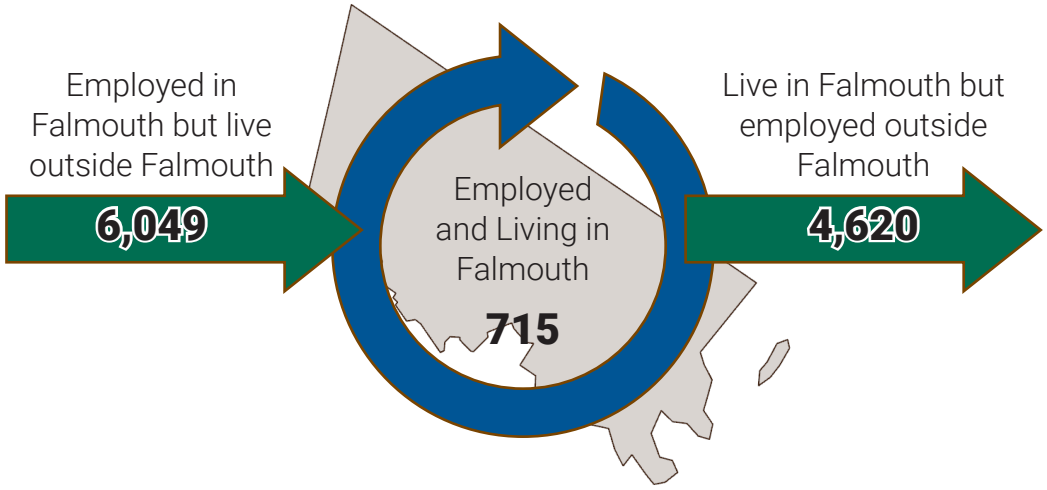
Climate hazards will have direct impact Falmouth's social and economic health. Impacts on housing security, food security and public health also will bring economic shocks as well. Overall, the Town of Falmouth is considered low in social vulnerability ranking according to the State.[30] However, it is still important to assess how people will experience the impacts of climate change, especially across underrepresented communities. Below is a summary of community assets that will be impacted by hazards.

Resource	Hazard	Possible Impacts
Local Economy and Livelihoods	• Increased temperature • Sea level rise • Increased precipitation and severe storms • Inland flooding	• Economic losses from changes to natural resource and tourism industries • Damage to properties and marine structures • Temporary loss of access to businesses
Housing	• Increased temperature • Sea level rise • Increased precipitation and severe storms • Inland flooding	• Increased property damage and resulting repair costs • Higher energy costs from increased temperatures • Decrease of property values
Community Service	• Increased temperature • Sea level rise • Increased precipitation and severe storms • Inland flooding	• Temporary and permanent loss of access from flooding and sea level rise • Changes in food systems and supply • Disruptions to transit
Health	• Sea level rise • Changing precipitation patterns • Ocean acidification	• Increased heat-related illnesses • Increased vector-borne diseases • Lack of emergency services access • Strain on healthcare system from flooded infrastructure
Social Equity	• Increased temperature • Sea level rise • Increased precipitation and severe storms • Inland flooding	• Increase of existing social vulnerabilities • Increased financial, physical, and mental stress • Increased social isolation

Table 4: List of community resources in Falmouth that are vulnerable to climate change and how they may be impacted.

Local Economy and Livelihoods

Major employers in Falmouth are in health care, retail, and education. A vast majority of Falmouth's labor force (including Town staff) live in neighboring communities, while most employed Falmouth residents commute out of town to work, primarily by car.[31] In a region reliant mainly on private vehicle transportation, this makes both workers and businesses vulnerable to temporary flooding and long-lasting damage to roads, which may significantly impact the Town's economy. The Maine Climate Council estimates the impact to jobs and local industries in Falmouth represents a potential loss of 130 jobs and GDP of up to $14 million.



Essential Services

Access to supermarkets, health care, emergency services, schools and municipal buildings may be cut off due to flooding of roads and bridges. This prevents people from getting to their jobs or receiving those services. For example, due to sea level rise, the bridge to Mackworth Island, which includes the Maine Educational Center for the Deaf, would be inundated.

Most municipal staff, including first responders, also commute to work in Falmouth. During a severe or even catastrophic weather event that affects the region, first responders will face difficulty, even danger, coming to the Town to provide support. In each town, mutual aid partners may also be faced with the choice between traveling to the town they work in or staying in their home communities to support their neighbors and families.

Tourism and Recreation

The tourism and recreation industry makes up 70% of the gross regional product of the ocean economy in Casco Bay.[32] In Falmouth, the retail; arts, entertainment, and recreation; and accommodation and food services industries provide 23% of the Town's jobs.[33]

Sea level rise threatens waterfront restaurants and businesses. The loss of docks limits recreational sailing and marine tourism. Further inland storefronts within Falmouth Shopping Center are vulnerable to flooding, which may damage facilities and force essential businesses to close during emergency events. Flooding of roads and commercial areas will impact revenue.

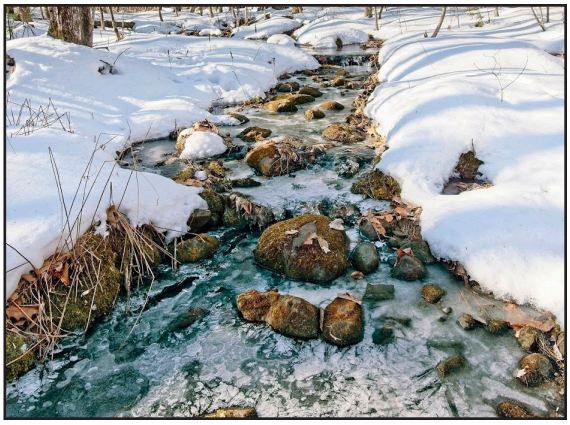
Natural Resource Industry

Roughly 2.0% of Falmouth's labor force is employed in the natural resource sector, primarily in agriculture, aquaculture, or fishing.[34] Though this is a small percentage, the impact could be significantly broader to the economy. Additionally, as climate change impacts existing natural resources (for example, fishing), other natural resource economies may replace them and this total may expand.

The fishing industry will be at risk due to ocean acidification and warming temperatures causing marine species populations to decline or shift to new waters, lowering potential yields for fisheries. In addition, the loss of docks such as the Town Landing threatens commercial fishing industries access to the waterfront, which is already limited in Falmouth.

Although Maine's agricultural sector could benefit from a longer growing season, these benefits could be offset by more crop-destroying pests brought on by warmer temperatures, and a cycle of prolonged periods of drought followed by heavy storms from changing precipitation. Warmer temperatures bring new pests to Maine and allow current pests to reproduce more within a single growing season.[35] Heavier, more sporadic rain events damage crops, increase soil erosion and nutrient runoff, and prevent soil from retaining moisture. Increased temperature and evaporation rates mean that crops are more likely to experience drought conditions.

Temperature increases may also decrease yields for some of Maine's signature crops that grow best in cooler climates (such as potatoes), and unseasonably warm springs can cause fruit trees and other perennial crops to bloom before the last frost, leading to freeze damage. A lower capacity to retain water combined with warmer and drier summers can be particularly problematic for much of Maine's unirrigated cropland.



Housing Security

Rising sea levels and storm intensity threaten not only to directly damage houses, but also create lasting effects on property values, the Town's tax base and its real estate market. Any substantial loss or damage to the housing stock caused by storms or flooding will ultimately compound the region's ongoing stresses for housing security, affordability, and quality.

Access

A lack of available or affordable housing in Falmouth means a growing percentage of the labor force will have to commute to the Town for work. As housing prices also rise regionally, workers may commute from outside the Greater Portland area over time, leading to greater vulnerability for climate-related transportation interruptions. Similarly, since most Falmouth residents work outside of Town boundaries, residents run the risk of losing access to their homes in the case of a severe or catastrophic weather event while at work. Additionally, more commuting increases emissions which contributes to climate change.

Property Values and Tax Base

In addition to the economic costs of property damage, climate change is impacting property values. Property values are higher for land on higher elevations due to their lower risk of flooding. Similarly, as climate change degrades water quality, property values are lower on lakes with poor water clarity and increased algal blooms. Tidal flooding caused by sea level rise has been estimated to have eroded more than $70 million in Maine coastal real estate value, with most of that occurring in southern Maine.[36] Substantial loss or damage to housing will reduce a town's tax base, impacting municipal budgets.

Affordability

Falmouth's cost-burdened homeowners and renters already face financial insecurities. As climate hazards damage properties, force temporary or permanent evacuation, or require increased maintenance it will continue to increase housing costs. Investing in flood insurance, retrofitting buildings, or investing in flood-resistant properties are often unattainable for cost-burdened households. A lack of affordable housing will continue to push people out of town and place financial burdens on those who stay, making responding to climate change difficult.

Social Equity

As mentioned earlier, climate change will not affect everyone equally; it will be felt most by those most vulnerable. Climate change may even further amplify social inequity by amplifying many of the existing vulnerability factors. Falmouth does not have the same ease of access to various nonprofit and social service organizations as larger cities. In order to account for the most vulnerable populations, Falmouth will need to expand support to address heightened social vulnerability from climate change, and to ensure equitable processes and outcomes in future planning for climate resilience.

Community Services

The need for social services and community resources will likely increase due to the financial, physical, and emotional stressors created by climate change. If Southern Maine continues to become a settlement location for migration, both national and international, the region may eventually see an influx of "climate refugees" as people are displaced due to climate hazards. Tracking this phenomenon will be essential to preparing to deliver services to the community.

Social Services

Falmouth residents often commute to Portland for health and social services. As mentioned earlier, flooding along I-295 and U.S. 1 will limit residents' ability to access resources outside of the Town boundary. Flooded roads could also prevent access to childcare or schools, libraries, town services, and additional community support. Losing access to key social services, whether permanently or temporarily increases the overall vulnerability of the community.

Food Security

Climate change threatens to amplify food insecurity for households across Falmouth. Impacts will occur across the system from growing to distribution. Major grocery and retail stores are all identified as potentially vulnerable to inland flooding, posing a risk to residents' access to food and medicine during storms. On average, 90% of food consumed by Mainers comes from outside the state.[37] Reliance on non-domestic food increases households' vulnerability to climate-induced price shocks; shipments may be delayed or damaged due to severe weather and increasing fuel prices can cause higher overall food costs.

Falmouth's local agricultural industry is also at risk. While the longer growing season could benefit farmers, increasing drought conditions, pests, and intense storms that damage crops may offset any of the benefits and challenge the needed expansion of at-home food production and local agriculture.

Transit

In Falmouth, 4.2% of households do not own a vehicle, making those residents reliant on local bus services to commute to work or travel for services such as groceries and health care.[38] The Greater Portland METRO bus service may experience service interruptions during severe storms or a flooding event. While there are bus stops throughout the Town of Falmouth, most of them do not have shelters for residents to take cover in during a storm.

Health

Heat Risks

Many Maine homes and businesses lack air conditioning, making people more vulnerable to heat stroke in the summer. Elderly residents, children and people in poor health are at a higher risk of contracting heat stroke. Additionally, those with financial and mobility burdens are less able to afford air conditioning or access cooling centers.

Areas of town with more impervious surface (i.e., buildings, roads, parking lots, etc.) retain more heat and have higher surface temperatures while areas with more trees and vegetation remain cooler. Residents who live or work in high-impervious areas are at greater risk of heat-related illnesses. Historically, the most vulnerable populations within a community have the least access to open, green space. The Town's land cover map provides a proxy for understanding which areas of town may be most at risk during high heat days.

Air Quality

Climate change will likely exacerbate poor air quality over time, as rising temperatures speed up the chemical reactions that create smog, and changes in wind patterns may potentially reduce local air circulation, trapping pollution at the ground level.[39] Higher annual temperatures are likely to bring earlier flowering, more pollen production, and the potential for a longer pollen season. Additionally, Maine is susceptible to pollution from sources located hundreds of miles away. In the summer of 2021, fires in the western United States and Canada began impacting the air quality index in Maine, prompting warnings from the state Department of Environmental Protection.[40] Increasing severity and prevalence of wildfires, in Maine and beyond, increases particle pollution.

Higher levels of pollen, pollution, and particulate matter can cause irritation and infection; trigger allergic responses, asthma, and other respiratory stress; and even cause serious cardiovascular problems such as heart attacks and strokes or lead to chronic respiratory conditions. In 2020, 10.6% of adults in Maine had asthma.[41] Residents with existing conditions will be more vulnerable to poor air quality.

Vector-borne Disease

Warmer winters, higher humidity, and more precipitation impact the breeding and survival rates of ticks and mosquitoes, as well as the pathogens they carry. Nine vector-borne diseases (two mosquito-borne and seven tick-borne) have been identified in Maine. In 2019, Lyme disease, which is spread by black-legged ticks or deer ticks, was the most common vector-borne disease in Maine.[42] Rates of Lyme disease have increased significantly over the past decades from less than 250 reported cases in 2005 (70 in Cumberland County) to over 1,500 reported cases in 2021 (225 in Cumberland County).[43]

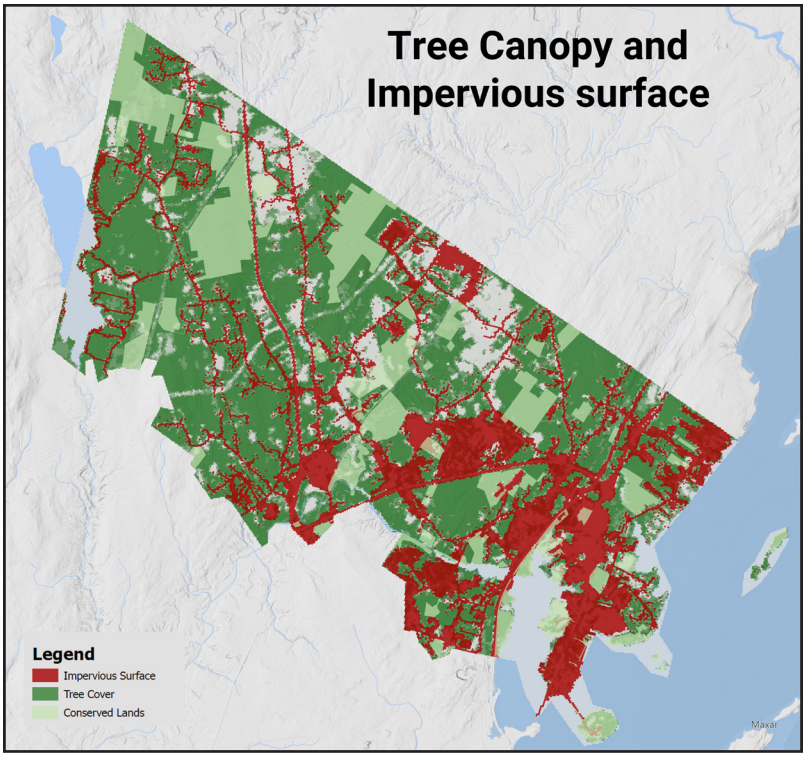


Figure 12: .Tree canopy and impervious surface in Falmouth. Areas with more impervious surface will feel hotter. Data source: National Land Cover Database

Natural Resources at Risk

Climate hazards strain the health of marine and terrestrial ecosystems. The Gulf of Maine and Casco Bay exchange nutrients and support marine species important to southern Maine's coastal economy and identity. The Presumpscot River running through Falmouth offers an important location for wetland ecosystems. Climate change has already begun to strain ecosystems and has the potential to lead to long-term impacts. Understanding how and where the environment is vulnerable can guide decision-making to conserve and protect Falmouth's natural resources.

Changes in temperature and precipitation are expected to increase stress and disturbances in forests. Disturbances such as flooding, ice storms and wildfires can open forest canopies, expose mineral soil, and reduce tree cover, providing greater opportunities for invasion.[44]

Resource	Hazard	Possible Impacts
Marsh land	• Sea level rise • Changing precipitation patterns • Ocean acidification	• Loss of marsh habit to inundation • Decline of water quality • Strain on vegetative health
Coastal Habitat	• Sea level rise • Changing precipitation patterns	• Shoreline destabilization • Decline of water quality • Loss of species
Forest and agriculture land	• Wildfire due to increased temperatures • Changing precipitation patterns	• Damage to lands • Loss of habitat and species • Reduction in productivity of soils
Natural Water Systems	• Sea level rise • Changing precipitation patterns • Ocean acidification	• Decline of water quality • Decline in health of ecosystem • Economic loss from natural resource industries
Native Species Ecosystems	• Invasive Species • Sea level rise • Increased temperature Changing precipitation patterns • Ocean acidification	• Decline of water quality • Economic loss from natural resource industries shifting • Strain on food systems • Increased human health impacts

Table 5: List of Natural Resources in Falmouth that are vulnerable to climate change and how they may be impacted.

Marsh Migration

Tidal areas such as marshes and wetlands are particularly sensitive to climate change. These ecosystems provide tremendous benefit to wildlife, plant species and the surrounding built environment by serving as habitat and a protective barrier against storm surge and rising sea levels. Marshes also have the natural ability to filter various types of pollution and slow the impacts of erosion. Preserving and protecting marsh and wetland areas improve the resiliency of surrounding coastal communities.

As sea levels rise, tidal marshes gradually shift inland onto formerly dry land or nontidal areas. This process, known as marsh migration, is possible only as long as there are no constraints from the built environment or steep slopes in the area. In areas where marshes are bordered by the built environment, migration may not be possible, resulting in the loss of marsh and wetland and in increase of risk to the developed area.

Area of current tidal marshes	Area of tidal marsh migration		
	Under 1ft sea level rise	Under 2ft sea level rise	Under 3.3ft sea level rise
212.6 acres (0.33 sq miles)	34.7 acres (0.05 sq miles)	63.1 acres (0.1 sq miles)	91.7 acres (0.143 sq miles)

Table 6: Square miles of current tidal marshes and how many square miles are needed under different sea level rise scenarios to accommodate marsh migration. Data source: Maine DEP

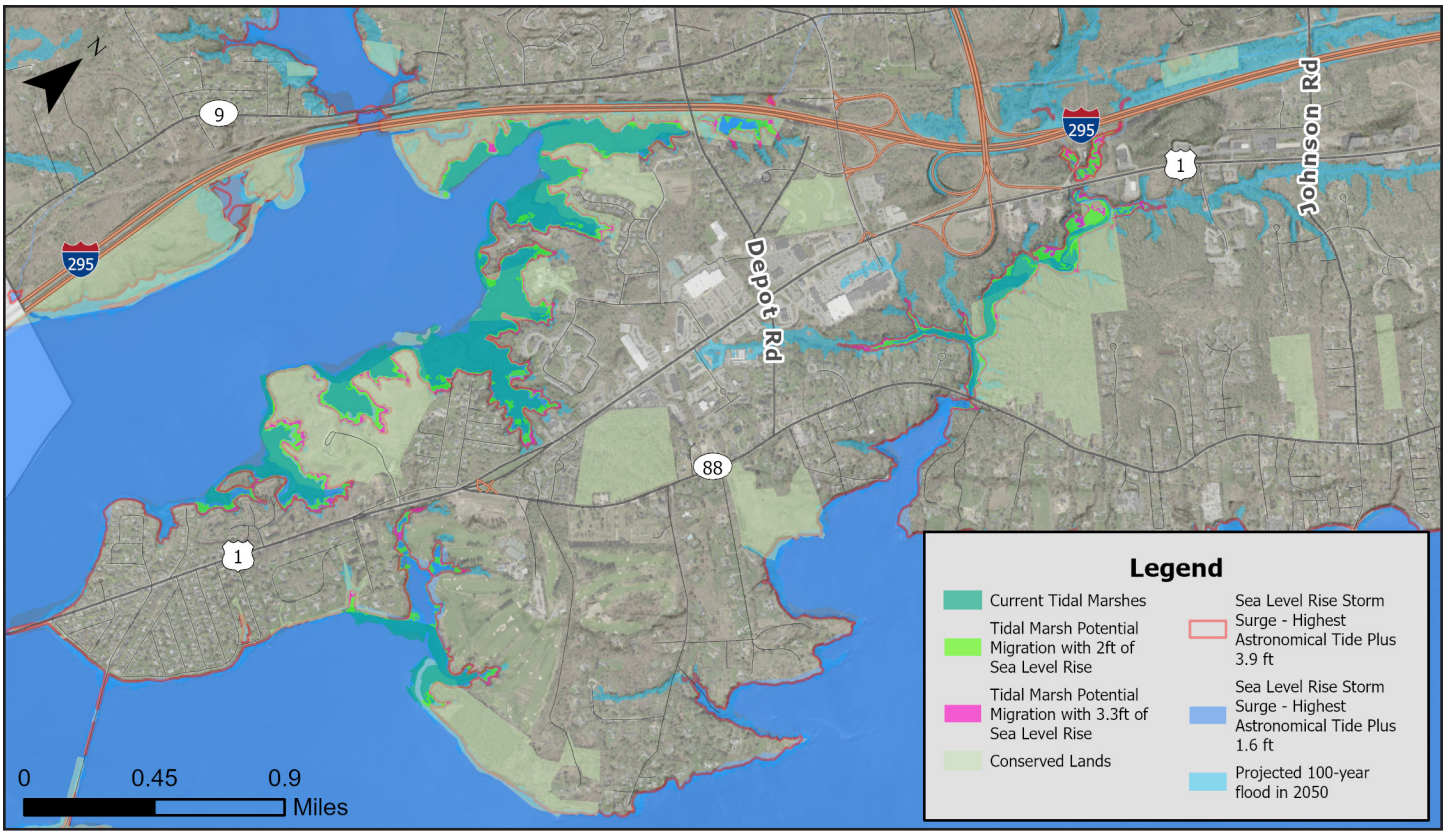
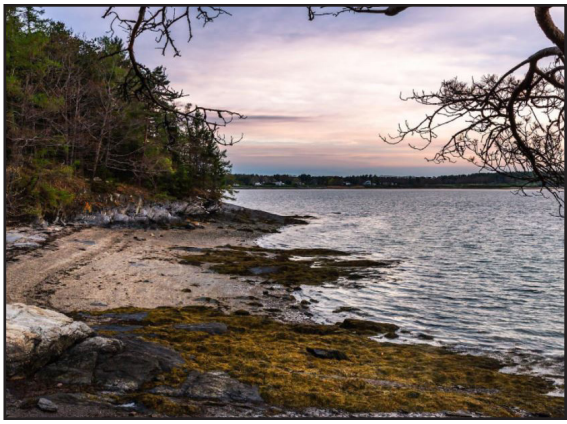


Figure 13: .Current tidal marshes in Falmouth and potential marsh migration under different sea level rise scenarios. Data source: Maine DEP

The Community Intertidal Data Portal[45], developed by Tidal Bay Consulting and the Greater Portland Council of Governments, identified two major regions in Falmouth likely to experience significant marsh migration:

Inland areas near Mussel Cove, including Foreside Road and U.S. 1

Most of the existing tidal marsh is surrounded by forested and conserved lands. As sea level rises, parts of these areas will be need to be converted to tidal marshes in order to maintain the health of the marsh. Elevations are suitable for substantial new pockets of wetland to form in the vicinity of U.S. 1 and I-295. However, migration could be complicated by the presence of road crossings that may restrict tidal exchange near Foreside Road and to a lesser degree U.S. 1. The effects of sea level rise will depend in part on the degree to which Foreside Road, and U.S. 1, restrict tidal exchange. Wetland degradation in Mill Creek will pose a flooding risk to critical commercial assets at the Falmouth Shopping Center, even potentially impeding U.S. 1 where it intersects on Foreside Road.



The Presumpscot Estuary, where the Presumpscot River meets Foreside Road and along the shores of the Flats neighborhood

Upper Presumpscot River: Elevations are suitable in several areas for the formation of new wetlands as marsh migrates inland. However, due to the significant amount of existing development around the estuary, several low-lying areas, such as the area between Foreside Estates, Providence Avenue and Route 88, are at risk from tidal inundation. The presence of several restrictions to tidal exchange, particularly where Lunt Road crosses a tidal creek, and along the old ice ponds, could inhibit new wetland formation in response to sea level rise.

Lower Presumpscot: Wetland migration driven by sea level rise will impact the area along the Flats and threatens neighborhoods off Route 1. Parts of the conserved land along this area could be able to convert to marsh if land in this area is continually protected from development. A dam along the eastern waterfront will limit migration of tidal wetlands into residential and recreational areas, potentially leading to this infrastructure being impacted by rising seas, in part due to the loss of existing wetlands along the immediate shoreline due to inundation.

Coastal and Inland Erosion

Coastal erosion is a process by which severe storms, flooding, sea level rise and human-related activities wear away beaches and dunes. Erosion of the shoreline increases coastal flooding, decreases habitat, and removes natural storm and flood barriers, making adjacent infrastructure more vulnerable. According to data from the Maine Geological Survey, most of the coastal bluffs in Falmouth are unstable and potentially vulnerable to erosion or landslides. The Maine Geological Survey has monitored the bluff erosion along Gisland Farm, and there is currently work being done to stabilize an eroding bluff along Shoreline Drive.

In addition to coastal erosion, higher tides and sea level rise threaten the integrity of inland waterways such as riverbeds. In the 2022 Cumberland County Hazard Mitigation Plan, erosion and coastal flooding were among the most prevalent hazards in the county.

Increased precipitation also heightens the threat of inland erosion and landslides. Inland flooding can change the composition of soil along riverbanks and compromise the integrity of pre-existing structures built along inland waterways. In 2020, the City of Westbrook declared a state of emergency after the Les Wilson & Sons material stockpile collapsed and fell into the Presumpscot River. While the landslide occurred in Westbrook, the landslide affected all communities along the Presumpscot River, blocking off Falmouth's River Point Conservation Area triggering a state of emergency for Cumberland County.[46] Whether natural or caused by artificial structures, future landslides threaten to damage complex wetland ecosystems along inland waterways and cause severe flooding across inland neighborhoods.[47]

Further studies may be necessary to better understand the risks of inland erosion, especially regarding the integrity of pre-existing structures that were considered safely distant from inland shorelines when they were originally constructed.

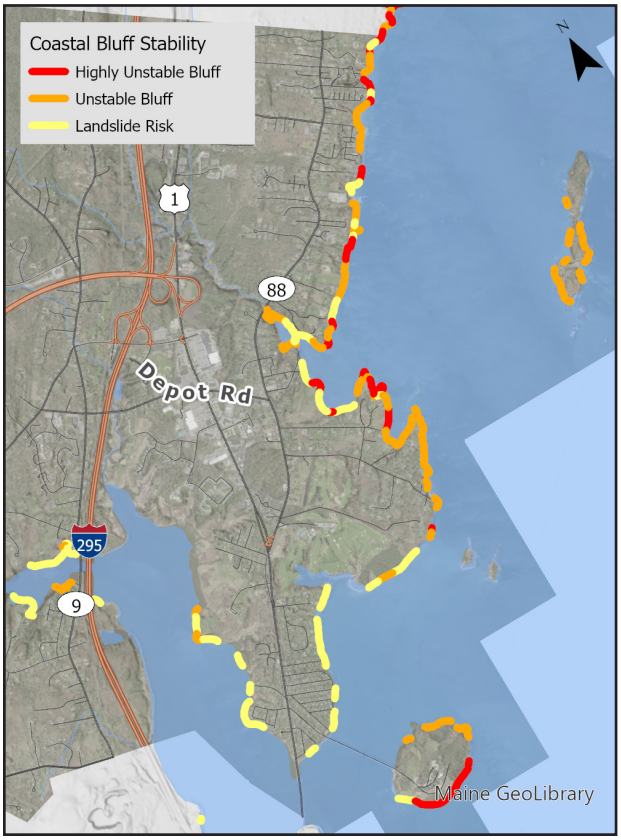


Photo above shows erosion at Maine Audobon Gisland Farms. Maine Geoglogical Survey has been monitoring this site to assess the change in erosion over several years. Photo Credit: GPCOG

Figure 14 (left): Map showing risk of costal bluff erosion and vulnerability to landslides. Orange indicates areas with coastal bluffs are observed to be potentially unstable, while red indicates coastal bluffs deemed highly unstable, and yellow lines indicate coastal edges that appear to be vulnerable to landslide hazards Data source: Maine Geological Survey

Compromised Natural Water Systems

Increased precipitation creates more stormwater runoff, which impairs water systems. Stormwater runoff delivers larger quantities of pollutants such as nutrients, sediment, bacteria, and trash into waterbodies. These pollutants, combined with higher temperatures, further degrade water quality by facilitating toxic algal blooms.

The shellfish industry in Casco Bay has seen repeated and continuous closures due to related water quality challenges. Waters around Casco Bay are often classified as prohibited by the Maine Department of Marine Resources and closed to shellfish harvesting due to either water quality testing showing elevated levels of fecal bacteria, or when an area is near a wastewater treatment plant outfall or other source of pathogens. This has not been an existing problem in Falmouth, but could be possible in the future.

Closures can also reach beyond Casco Bay. In the winter of 2017, a harvesting ban stretched from Portland to Harpswell when shellfish showed elevated domoic acid levels, a biotoxin produced by a large phytoplankton bloom.[48] These closures impact shellfish harvesting, fisheries operations, local jobs, and the economy.

Wildfires

Though wildfires occur naturally, usually from lightning strikes, human activity is the leading cause of wildfires in Maine. Falmouth hasn't experienced a significant wildfire in over 25 years but increasing temperatures and prevalence of drought make woodlands increasingly vulnerable to wildfires.

Drought was a significant factor in the last widespread wildfire in Maine, which occurred in 1947 and was one of the worst wildfires in Maine's recorded history.[51] In both 2020 and 2021, Maine saw more wildfires than the 2016-2019 annual average of 545. In 2020 alone, there were over 1,150 wildfires in Maine.[52]

The Town of Falmouth owns 1,800 acres of conserved land, roughly 80% of which is forested. As Maine's future gets warmer and drier, further study into the town's vulnerability to fires may be useful to ensure emergency services remain prepared for the potential of increased burn risk, especially during seasons with significant drought.

Acidification Impacts

Ocean acidification poses a severe threat to Maine's fisheries. Higher levels of carbon dioxide in the ocean make it difficult for marine species with hard protective shells; such as clams, lobsters, mussels, shrimp, oysters, and scallops; to grow healthy shells. As a result, these species have slower growth, thinner shells, and higher mortality rates. Over 87% of the statewide landings value of harvested or grown species comes from these types of species.[49]

Data from the Friends of Casco Bay indicates that Casco Bay does not have sufficient levels of calcium carbonate needed for organisms to build and maintain their shells. Under increasingly severe conditions, high acidity can dissolve calcium carbonate shells at a faster rate than they can be formed.[50]

Native Species Migration and Shifting Ecosystems

Warmer air and water temperatures cause shifts in species' geographic ranges, leading to declines in native marine and terrestrial life and increases in invasive species, pathogens, and pests. These shifts alter the local food web, making ecosystems more vulnerable to stressors such as invasive species and habitat destruction.

Maine's fishing industry is particularly susceptible to species migration due to warming water temperatures and ocean acidification. Scallops, shrimp and groundfish – all significant species in Maine – could shift northward to waters in Canada if ocean temperatures continue to rise.

Recent research predicts that lobster populations are likely to shift 200 miles further north because of climate change.[53] However, other research suggests that Gulf of Maine waters may remain resilient and suitable for lobster populations.[54] Atlantic Cod populations in the Gulf of Maine have been declining since before 1990, and recent research suggests that the remaining habitat for the species in the North Atlantic could shrink by over 90% by 2100 due to warming waters.[55] As native species move north, the Gulf of Maine is likely to see increases in other species that are more accustomed to warmer waters.

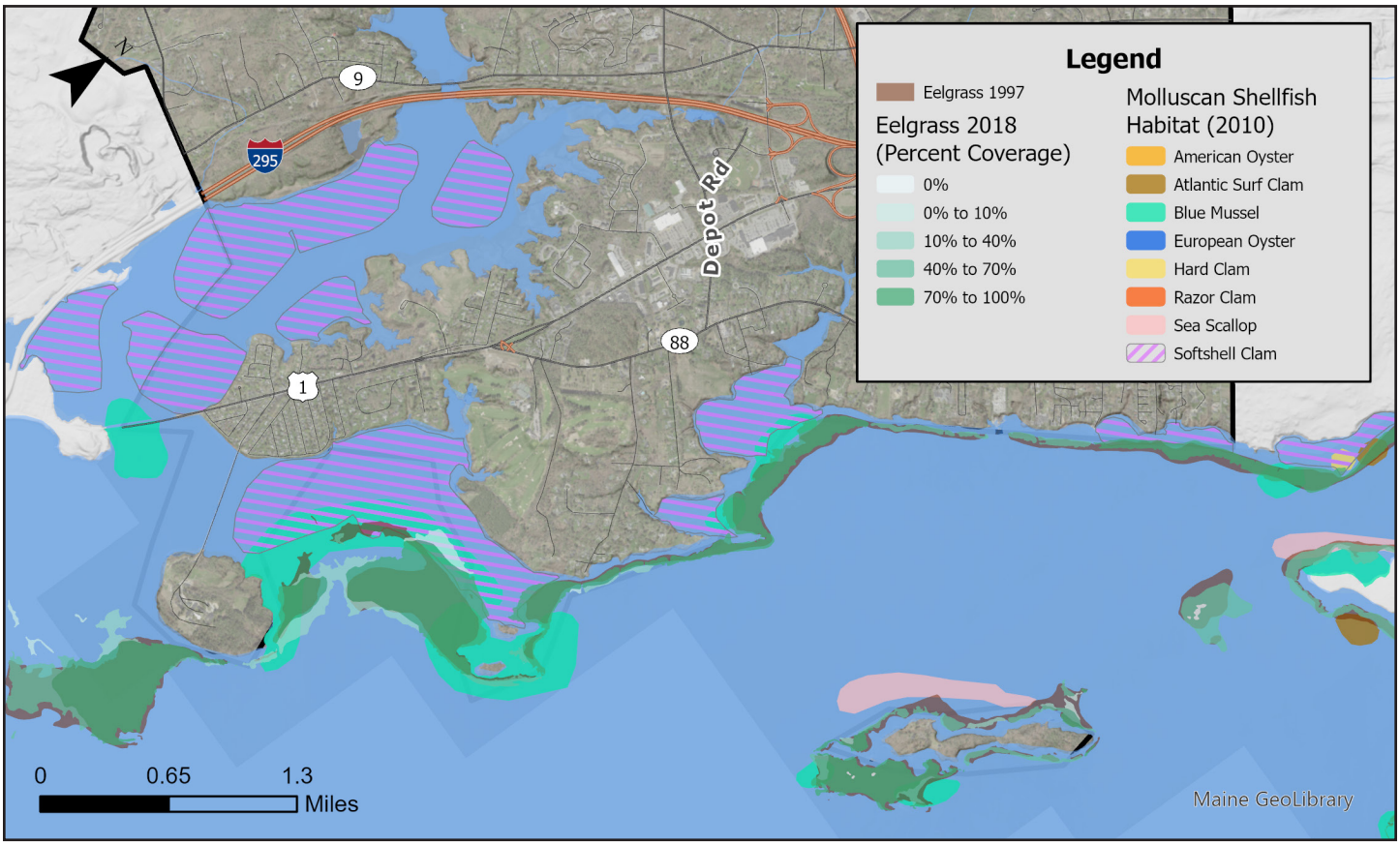


Figure 14: .Intertidal habitat along Falmouth's coast. Eelgrass and shellfish habitat are vulnerable to climate change. Data source: Maine DEP

Invasive Species

In addition to forcing native species to shift further north, new climate-induced conditions in marine and terrestrial ecosystems are causing non-native species to migrate into southern Maine. Invasive species are plants and wildlife that spread to the point that they can cause harm to ecosystems, usually out-competing local species for resources or hunting prey down to dangerously low populations.

Invasive Marine Species

Research by Casco Bay Estuary Partnership found that at two sample locations in Casco Bay, between one-fifth and one-third of all identified marine species were not native.[56] One example is the European green crab, which greatly impacts the local shellfish population and habitat. The green crab disturbs the sediment and uproots beds while foraging.[57] Eelgrass is a native seagrass that provides critical habitat and food for other marine species, supports healthy water quality by managing nutrients in the water and stabilizing sediment, and can sequester carbon. According to the Casco Bay Estuary Partnership, the Casco Bay region lost more than half of its eelgrass beds between 2001 and 2003 due to warming waters and invasive species like the European green crab.[58] Since 2003, eelgrass beds have begun to recover, but coverage is still lower than pre-2001 levels.[59]

Invasive Plant Life

Invasive plant species disrupt ecosystems in Maine by developing self-sustaining populations that are dominant or disruptive to native species by outcompeting them for water, light and nutrients. The aggressive growth of invasive plants can affect forest regeneration and reduce the value of habitat for other species. Once introduced, invasive species can be hard to control or remove from an area. After habitat loss, invasive species are the second most critical threat to ecosystem diversity.

Invasive Pest Species

Throughout New England, pests have caused significant damage to native tree species, as well as forest ecosystems. Climate change has the potential to amplify this impact by expanding the range and the intensity of pest infestation. Warmer winters are likely to provide population blooms for species that decimate local tree populations. Falmouth is already a generally infested area for the Emerald Ash Borer, for example.[60] Favorable conditions will only increase the vulnerability of local forested areas.

Priority Areas of Risk

Throughout the vulnerability assessment process, geographic areas that are at highest risk from a combination of hazards were identified within Falmouth. Identification and assessment of these areas included the following factors:

- Number of climate hazards threatening the area
- Number of assets in a specific area that are vulnerable to identified climate hazards
- Time before a hazard will significantly impact a geographic area's community, infrastructure, and natural resources
- Chance of natural system degradation
- Overlapping social vulnerability in observed neighborhoods

This assessment can guide prioritization of areas for future climate adaptation planning strategies.

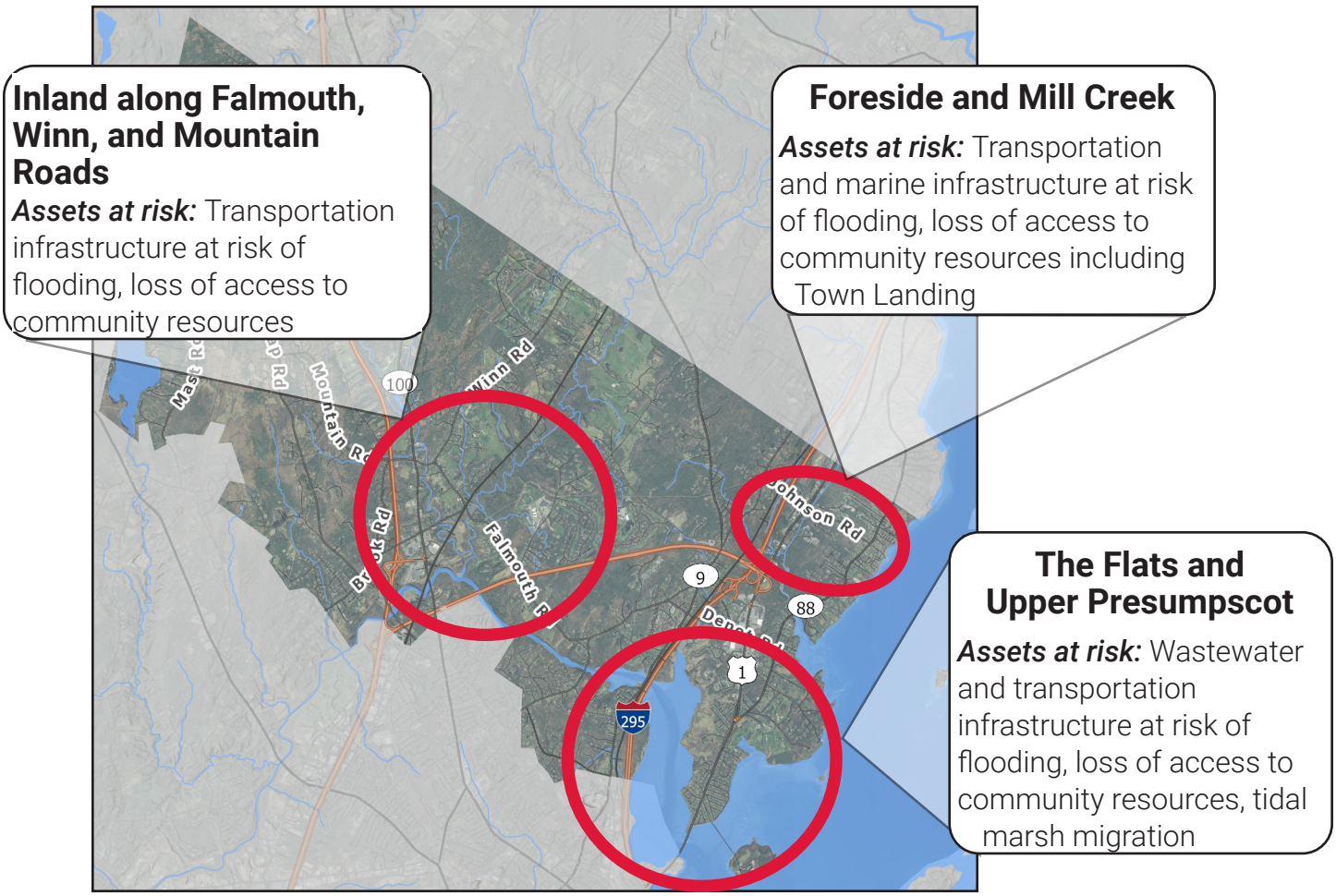


Figure 15: Priority areas at risk in Falmouth identified based on vulnerable assets and social vulnerability discussed in this report.

The Flats and Upper Presumpscot

The neighborhoods built along the Flats and further up the Presumpscot Estuary are significantly vulnerable to future flooding, both coastal and inland. Coastal properties are at risk of being damaged or inundated by rising sea levels. Sea level rise also threatens the coastal piping network running along Shoreline Drive, as well as the peninsula's only wastewater pump station on Brown Street. The most significant impact to wetlands is projected to occur along the Presumpscot Estuary as well. The impact on current tidal marshes threatens to remove natural barriers that might otherwise protect low-lying neighborhoods in the area from storms and floods, impact essential habitats on conserved lands in the area, such as Gilsland Farm, and cause marsh migration that will encroach upon pre-existing structures and businesses, including those along I-295.

The Mackworth Island and Martin's Point bridges are both identified as vulnerable to flooding. Flooding on Martin's Point bridge, which provides access into Portland and directly connects Falmouth to medical service buildings at Martin's Point, threatens to impact the workforce, public health, and supply chain system for the Town of Falmouth. Mackworth Island houses a state park, a school for the deaf and communications infrastructure for the Falmouth Fire-EMS Department, all of which are only accessible by a single low-lying bridge.

The Flats neighborhood is also one of the areas with the most built surfaces identified. As the frequency of high heat days increases and maximum average temperature rises, these communities will be more vulnerable to rising heat and flooding due to its higher prevalence of impervious surfaces.

Social vulnerability from the U.S. Census show compounding social vulnerabilities in the Flats neighborhood, where a higher concentration of residents that are housing cost-burdened, below the poverty line, and above the age of 65. While this area and other neighborhoods nearby along the Upper Presumpscot Estuary are all vulnerable to flooding and sea level inundation, the population within the Flats has a higher concentration of socially vulnerable residents. This community has fewer resources and less resilience to hotter days, temporary loss of road access and damage to their households due to flooding or storms.

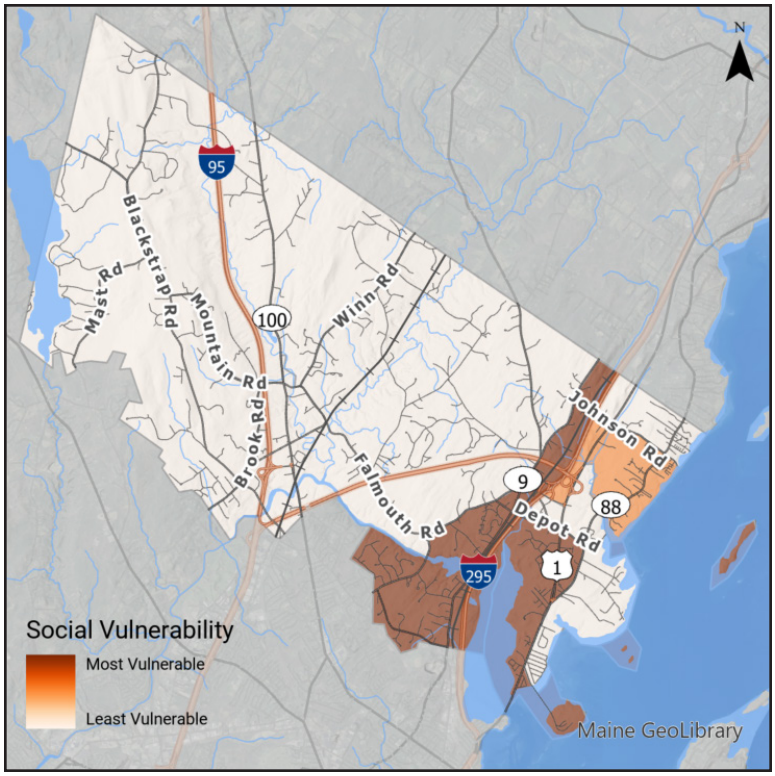


Figure 16: Social Vulnerability Index (SVI), aggregate measure of 17 factors of social vulnerability, by Census Block. Data developed by Johnson, et. al. (2018) and Maine Coastal Risk Explorer.

Foreside and Mill Creek

Along the coast by Foreside Road are several marinas, docks, and wastewater assets, many of which are vulnerable to sea level rise. The Town Landing, which provides a mooring station for thousands of recreational and commercial vessels, already suffers consistent inundation during storms and astronomical high tides, which damages structures and threatens the access point for vessels to safely enter and exit the water. Sea level rise and storm surges do not appear to pose a significant risk beyond immediate coastal assets, but further inland, flooding due to increased precipitation in Mill Creek, as shown above in the Risks to Critical Infrastructure Section, is likely to significantly damage built infrastructure and render a pump station and significant pipeline network inaccessible under extreme weather. Flooding may impact businesses along U.S. 1, even encroaching on I-295.

Inland flooding along the Foreside's coast can impact the highway area. Households, docks, and marinas along Foreside are all vulnerable to sea level rise and higher astronomical tides, including the Town Landing. Wastewater infrastructure in the Mill Creek valley is also likely to be lost as well. Most supermarkets and resource centers are along U.S. 1, and flooding during severe storms will prevent access. Flooding along Mill Creek threatens to impact major roadways and significant shopping and resource centers, including U.S. 1 and I-295, which have the most supermarkets and pharmacies as well as the Town's only primary care facility through Northern Light. Stretches of I-295 are also vulnerable to future flooding, especially with the loss of nearby wetlands and marshes to act as natural flood barriers.

Inland Assets Along Falmouth, Winn, and Mountain Roads

Falmouth Road, Winn Road, and Mountain Road have several stretches identified as more vulnerable to flooding, particularly along the Presumpscot River. This threatens to cut emergency vehicle access to neighborhoods in those areas during severe weather events. Inland flooding threatens agriculture further inland, potentially including Hurricane Valley Farm.

Low-lying roads further from town present a greater threat to access. Several winding roads have higher potential to flood during storms or high flooding events, stranding neighborhoods from accessing escape routes or resources further into Town, and also preventing emergency vehicle access. Along the Presumpscot River, flooding presents a significant risk to stretches of low-lying road, bridges crossing the river and public buildings. Flooding along Falmouth Road can cut off access to Town Hall, as well as the food pantry there.

The bridge directly adjacent to the Winn Road fire station is potentially vulnerable to flooding, as are stretches of Gray Road following tributaries of the Presumpscot, which threatens to cut emergency vehicle access further west into Falmouth. Adjacent areas further inland, such as those around Mountain Road, are less susceptible to flooding due to their higher elevation and further proximity from shoreline or riverbeds. But if emergency vehicles can't access inland regions due to flooded roads along the Presumpscot, regions such as the Mountain Road area are still indirectly vulnerable to flooding.

As discussed above in the Social Vulnerabilities Section, the neighborhoods around this area are also identified as having a higher percentage of cost burdened households. These groups are less able to afford the resources needed to prepare for or respond to significant weather events.

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Appendix E

Public Outreach

The Town of Falmouth collaborated directly with community members and relevant organizations to ensure discussions and decision-making included representation from all interested communities. Throughout the climate action planning (CAP) process, the following strategies were utilized to facilitate collaborative planning with the People of Falmouth:

- Development of a Climate Action Planning Committee, to provide an organized group of stakeholders to directly represent their communities' interests in conversation regarding the CAP.
- Internal coordination meetings between the Town of Falmouth's Department heads and the Climate Action Planning Committee to share information and collaborate on key decisions.
- Surveys and workshops for Falmouth residents to solicit input on technical components at key points in the process.
- Partnerships with internal and external institutions to involve the community in directly monitoring the impacts of climate change.

Climate Action Planning Committee

Falmouth's ad hoc Climate Action Planning Committee (CAPC) was established for the duration of the CAP process. The involvement of the CAPC in the planning process ensured that the final plan reflects the vision and values of Falmouth residents. The CAPC reviewed the CAP, Vulnerability Assessment, and Greenhouse Gas Inventory, and was also responsible for:

- Ensure community engagement to guide creation of CAP targets and actions
- Identify vulnerable populations and develop strategies that encourage their participation in public events
- Collaborate with stakeholders to help hold Climate lectures, Workshops, and other town events
- Establish a new vision for climate action and prioritize targets
- Pursue opportunities to enable development through community resilience grants

Municipal Outreach

Falmouth's Climate Action Plan (CAP) outreach began with engagement of municipal staff, elected officials, and committee members. The initial kick-off meeting with municipal staff was primarily aimed at describing likely hazards for Maine and discussing potential impacts in the Greater Portland region. Municipal staff were also asked if they had identified any risk areas in their department already in order to jump-start prioritization of risk areas in the town. The Falmouth Town Council members were presented with updates throughout the CAP process.

After the primary meeting with municipal staff, GPCOG conducted 1-on-1 interviews with department heads in order to get an in-depth view on primary concerns and priorities for each department. Department head interviews also provided information on current challenges faced within each department and considerations into future challenges.

Workshops

The Town of Falmouth opted to host two public workshops to contribute to the CAP process. A baseline setting workshop and a priority setting workshop engaged Falmouth residents with support from GPCOG and the CAPC.

The baseline setting workshop was held virtually on March 9th, 2022. The purpose of the workshop was to provide information on climate hazards and impacts in the region and for Falmouth residents to identify specific vulnerabilities in the community. Residents discussed changes they have seen and their concerns for the future of the town. The knowledge provided by workshop attendees helped to inform the Vulnerability Assessment. The workshop also provided an overview of the CAP process and provided an overview of the Community Resilience Grant.

The priority setting workshop was hosted in person on September 22nd, 2022, with an option for virtual attendance. Attendees were presented with a summary of the findings from the greenhouse gas emissions inventory and vulnerability assessment. The presentation also included examples of potential key actions for stationary energy, transportation, community resilience, and municipal operations. The goal of the workshop was for residents to discuss potential climate actions and identify priority strategies for mitigating emissions and improving community resilience.

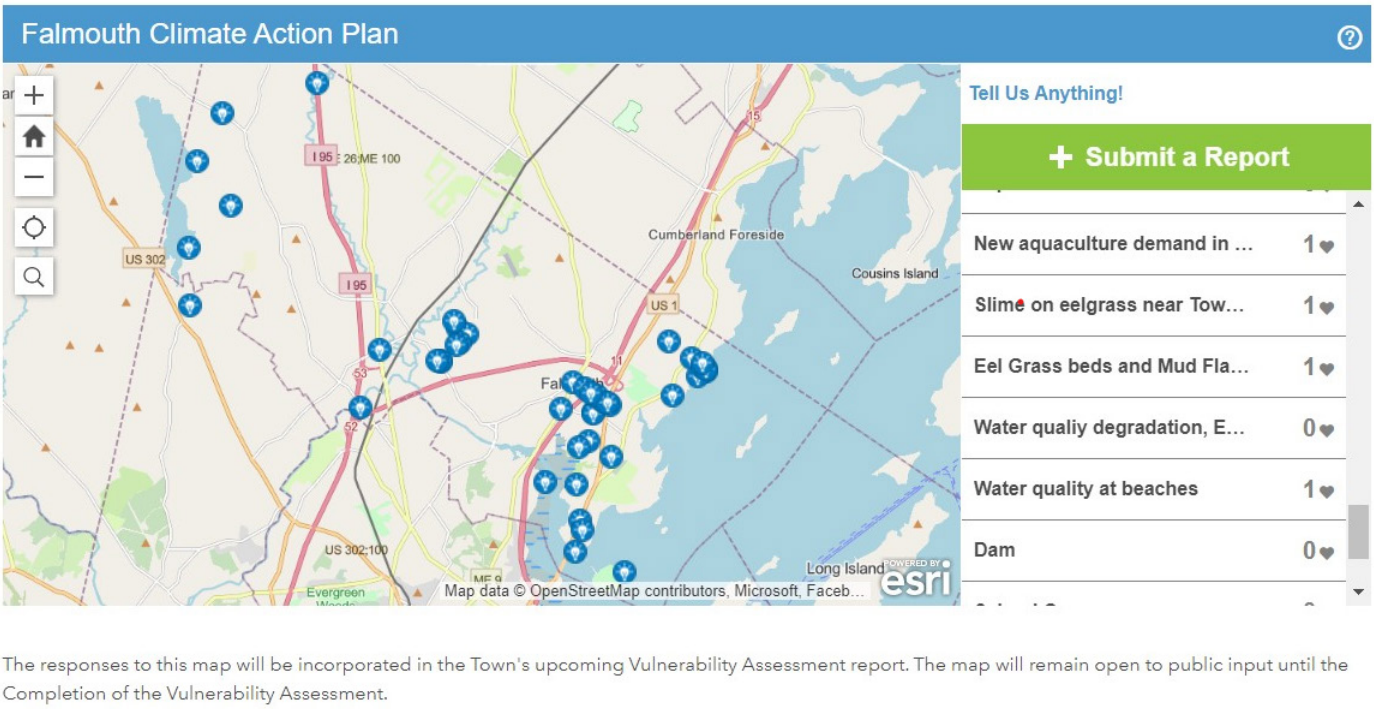


Figure 1. *The interactive Falmouth Community Input Map from the CAP website. Areas of concern are indicated by the blue circles with lightbulbs.*

Website

To simplify community outreach and sharing information, Falmouth opted to have a CAP website created to centralize data and updates for Falmouth residents. Public events and surveys were highlighted on the website, as well as vulnerability data for the town.

Access the website: https://falmouth-cap-gpcog.hub.arcgis.com/

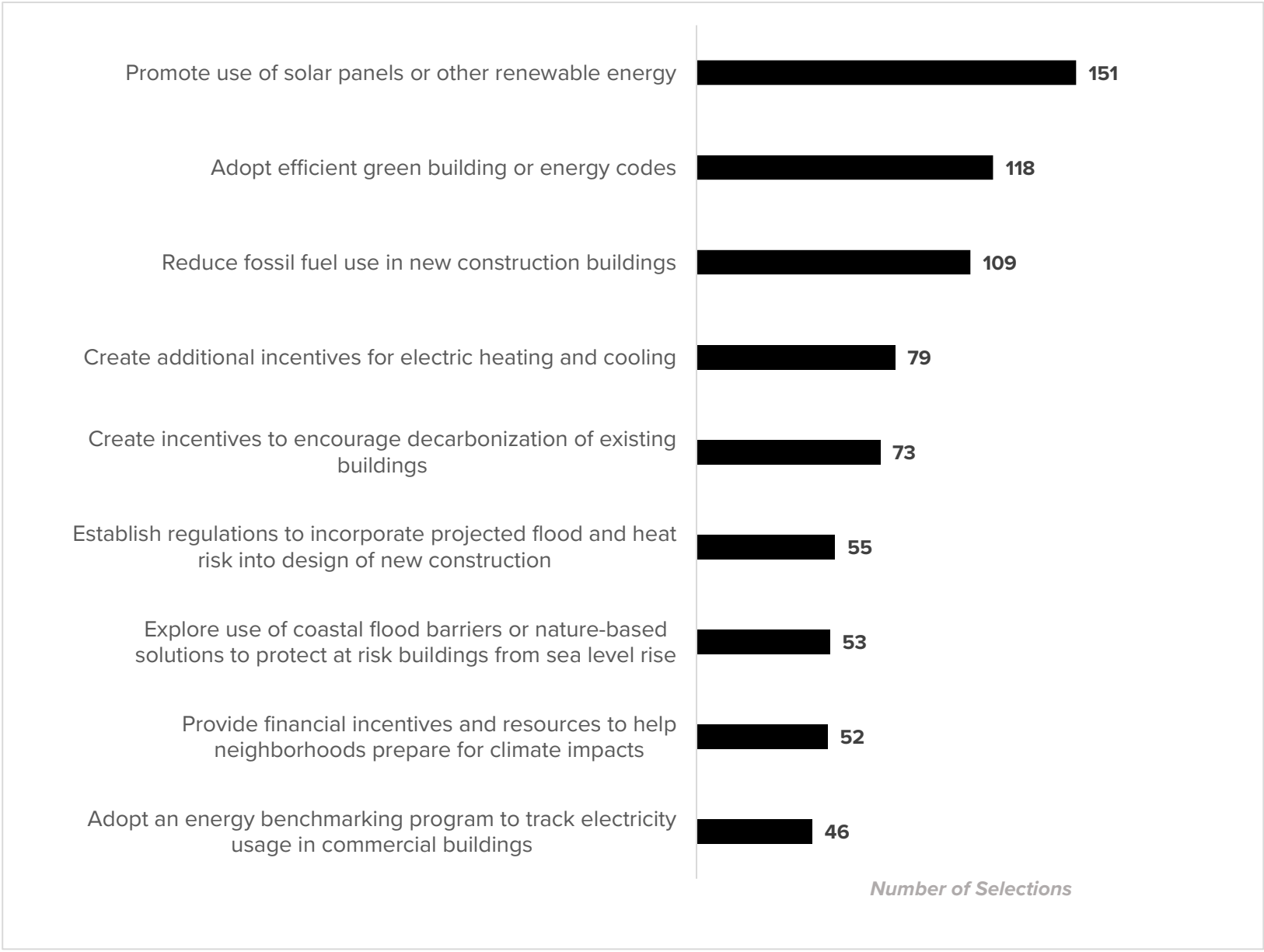
Survey

To fortify the conclusions of the priority setting workshop, Falmouth also created a publicly available survey. The purpose of the survey was to connect with a larger number of Falmouth residents in order to collect feedback on priority action areas. The survey was open to the public for two months from October to December, 2022, and received 226 responses.

For the survey questions, participants were asked to rank their top three to four priorities for each sector. The results of each question are included below, along with the information provided to participants in the survey:

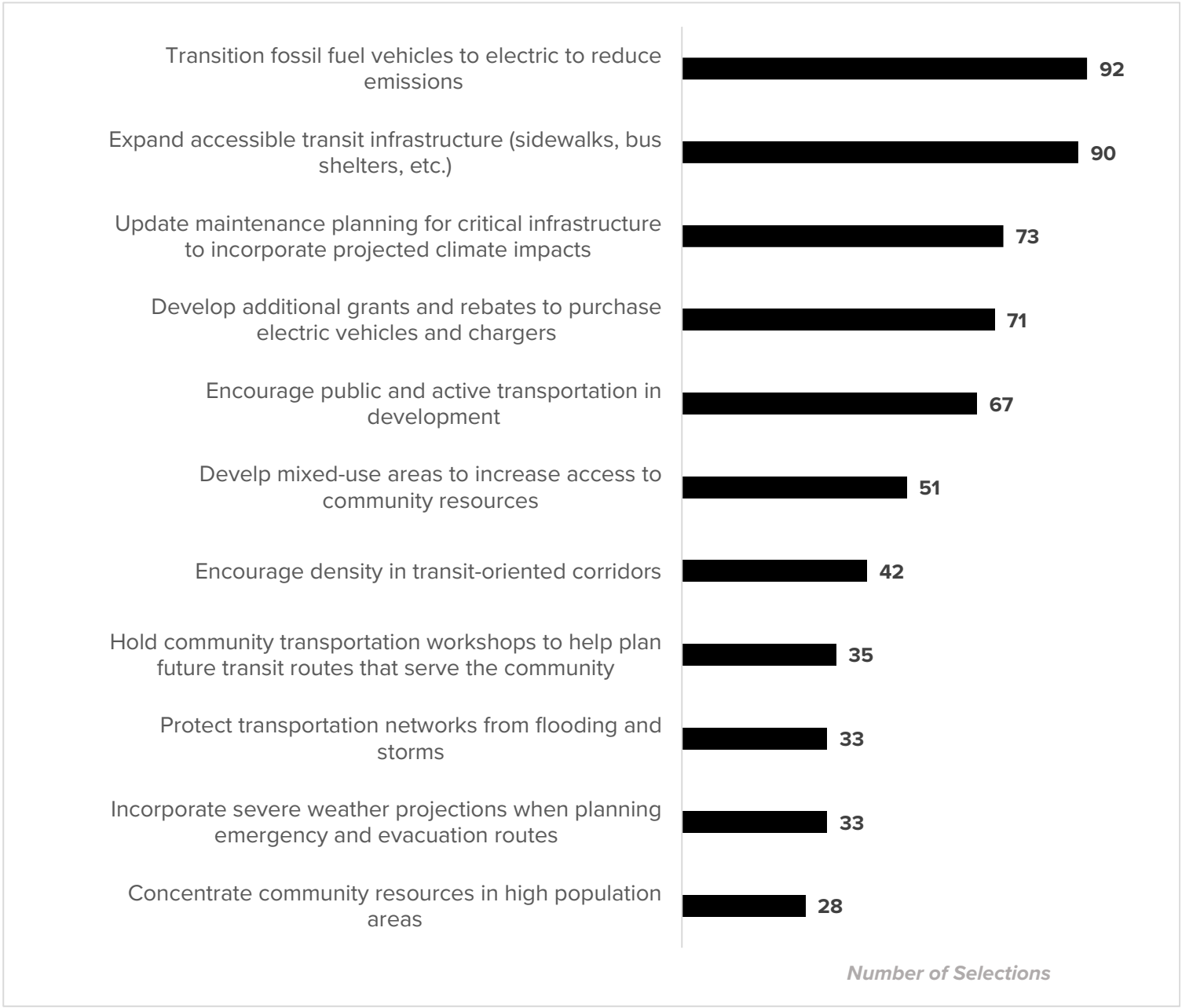
Question 1: Buildings and Energy Usage

Efforts pursued by the Town will involve both reducing community emissions and improving neighborhood resilience to climate change. Select the top 4 actions the Town should prioritize:



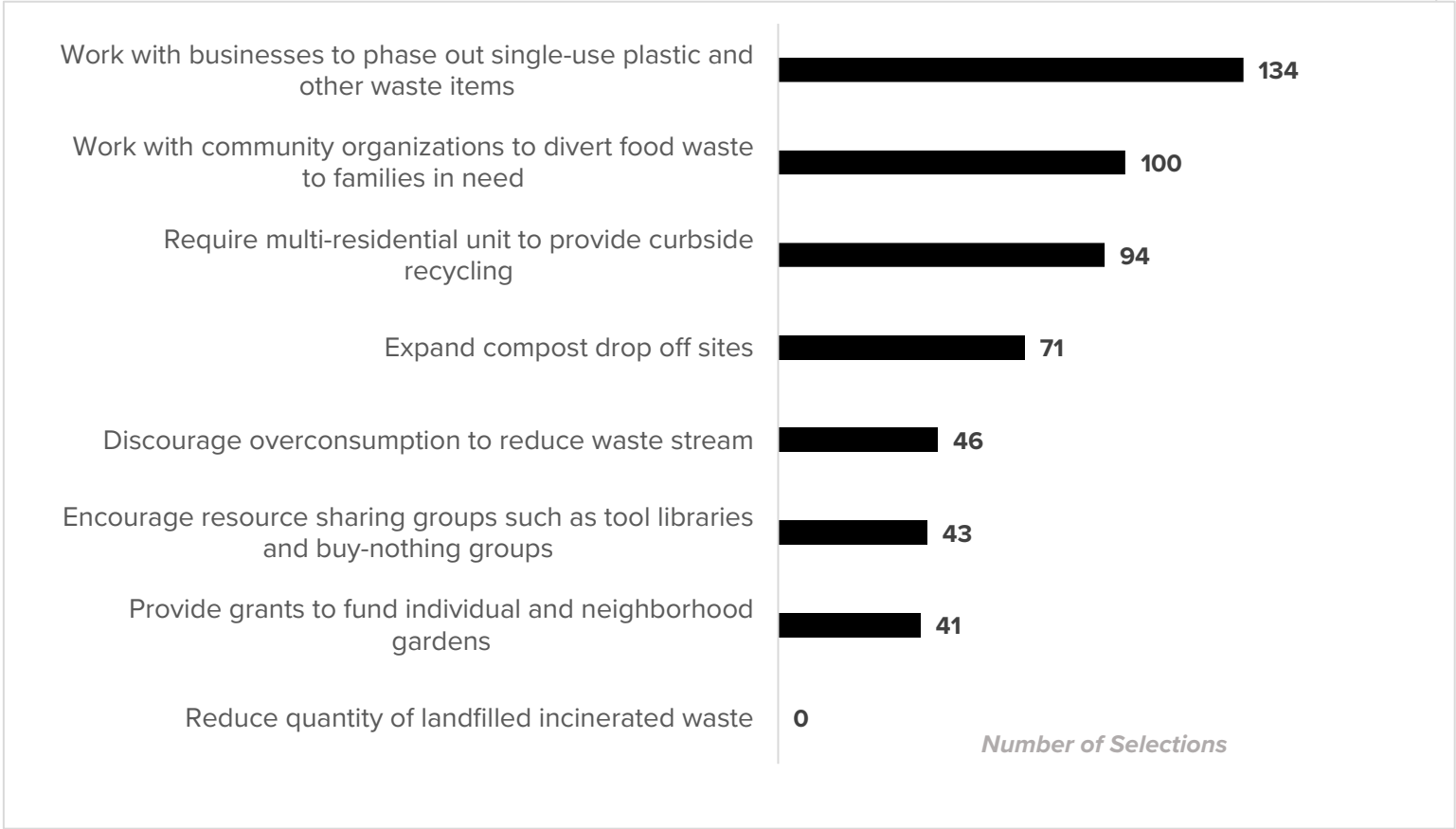
Question 2: Transportation and Land Use

More than half of Maine's greenhouse gas emissions come from transportation. In addition to reducing transportation-based emissions, efforts will also include protecting transportation networks from increased risk of damage and flooding. Select the top 3 actions the Town should prioritize:



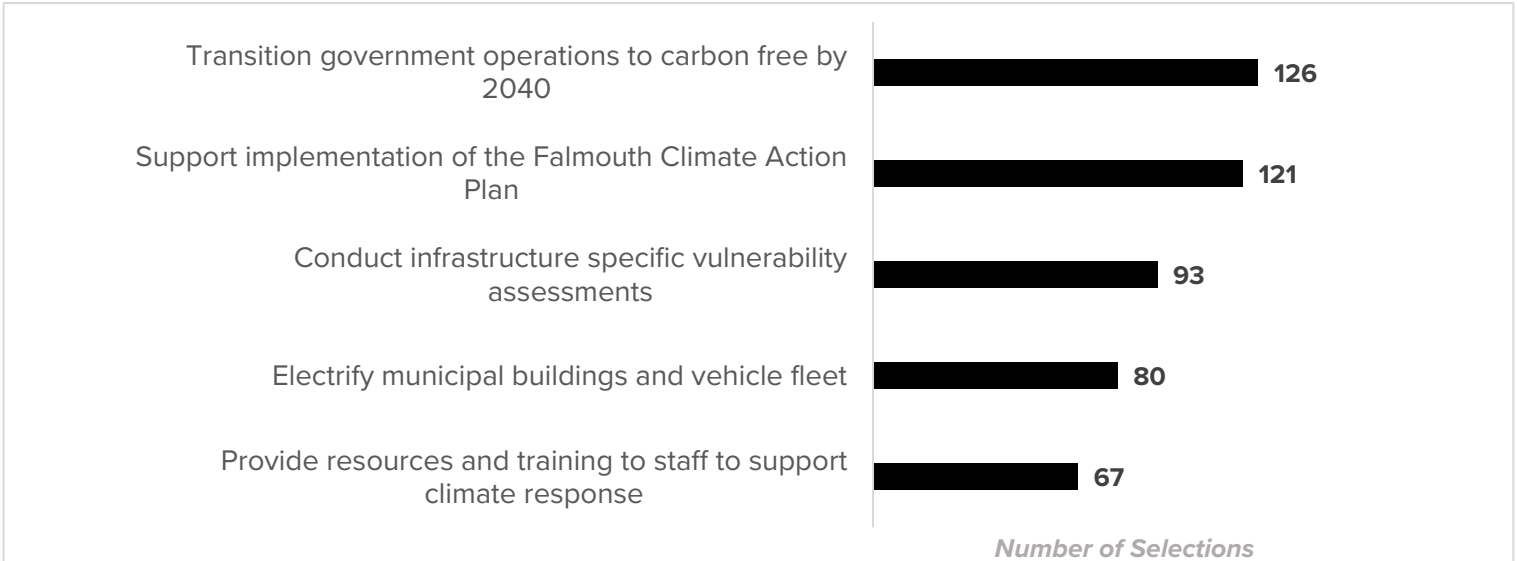
Question 3: Waste Reduction

We can reduce both emissions and vulnerability by changing how our community produces, consumes, and disposes of material goods. Key actions include utilizing local sourced food, developing community gardens and compost systems, and reducing consumption of single use items. Select the top 3 actions the Town should prioritize:



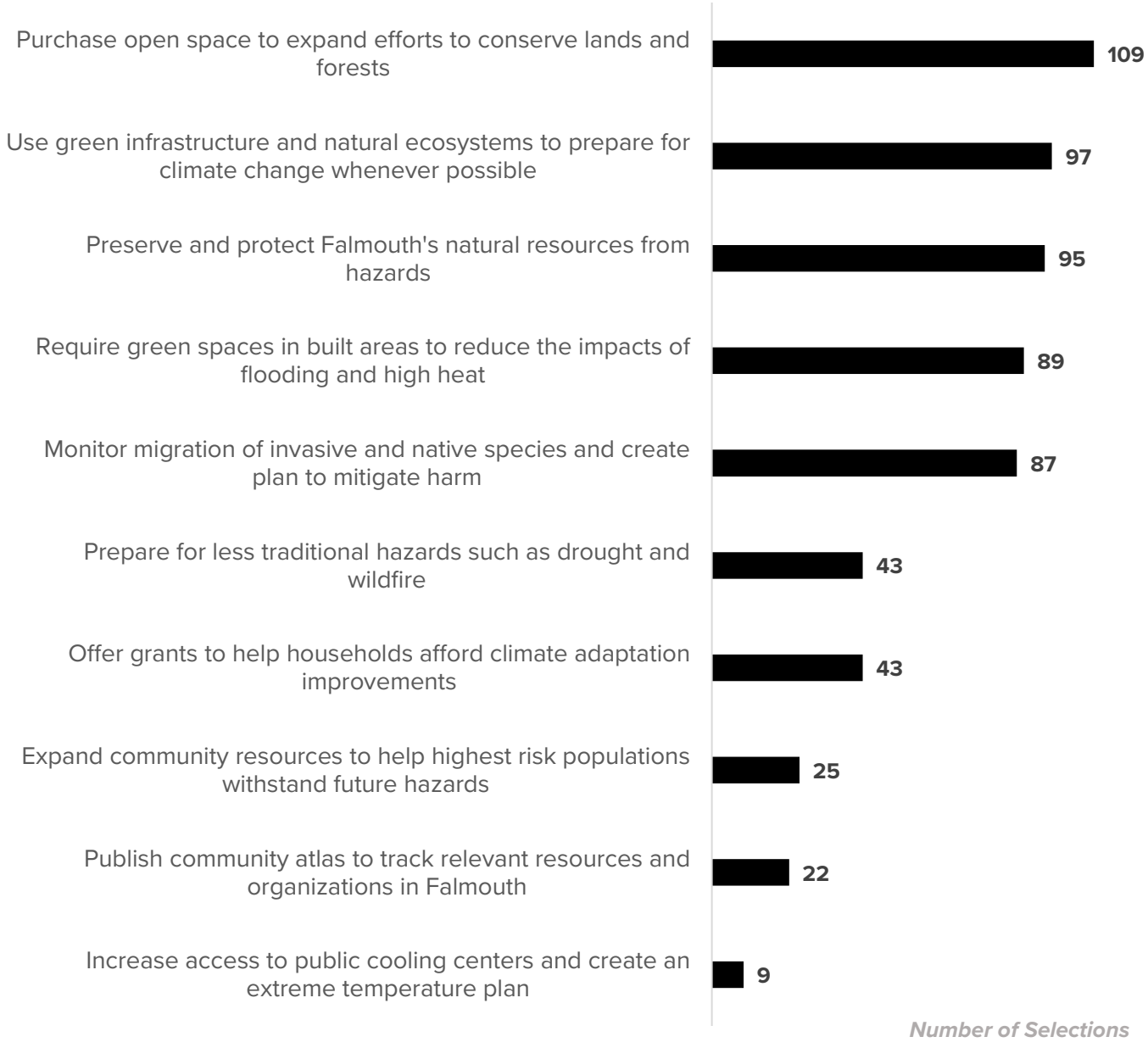
Question 4: Government Operations

Select the top 3 actions the Town should prioritize:



Question 5: Climate Resilience

In addition to adapting infrastructure to future climate impacts, the Town of Falmouth will also embark on efforts to improve the resilience of its community and natural resources to a changing climate. Select the top 3 actions the Town should prioritize:



Question 6: Are there other priority actions or strategies that you would like to add?

Of the 59 responses to this question, results included:

Additional priorities identified:

7	Identified enriching and expanding green spaces, including planting more trees and focusing on forest health as a priority.
5	Addressed waste management (e.g. increasing composting, improving recycling services, restructuring waste treatment facilities)
3	Wished for the deadline to move up to 2030 or 2035 from 2040
3	Identified increasing infrastructure for pedestrians, bicycling, and public transportation
3	Expressed interest in incorporating more solar power in the Town
3	Emphasized increasing electric vehicle infrastructure

Additional suggestions:

- Create "no idle" zones for vehicles and assess intersections to reduce vehicle emissions from idling
- Reduce noise and light pollution
- Fortify the energy grid with distributed energy storage and increased capacity for renewables
- Require new power lines to be buried, and begin burying existing power lines
- Ban toxic chemicals by use of the Town
- Assess environmental impacts of snow removal and salting/sanding
- Prioritize protecting the watershed