

City of Biddeford
Mayor's Sustainability Committee
May 14, 2024 5:30 PM Second Floor Conference Room & Zoom
<https://biddeford.zoom.us/j/91217104066>
Webinar ID #912 1710 4066

1. INTRODUCTIONS

2. DISCUSSIONS

- 2.1. Pollinator Festival-May 18, 2024, Rotary Park Noon-4:00 PM
[1. BCG Pollinator Festival 2024.png](#)
- 2.2. Bike to Work Week-May 13-17, 2024
[2. National Bike Month - PROCLAMATION.pdf](#)
- 2.3. Commission Ordinance-Review for recommendation to Mayor & Council
[3. Sustainability Commission Ordinance - May 2024 DRAFT.pdf](#)
- 2.4. Climate Action Plan Review
[4. Biddeford_CAP_OCT23_with_Appendices_FINAL APPROVED 11_21_2023.pdf](#)

3. ADJOURN



SAVE THE DATE!

Sat., May 18, 2024

Noon to 4:00 p.m.

Rotary Park

550 Main Street, Biddeford



City of Biddeford



PROCLAMATION

Whereas, National Bike Month was established in 1956 by the League of American Bicyclists as a chance to showcase the many benefits of bicycling and to encourage Americans to try biking; and

Whereas, As an avid cyclist, I encourage residents across the City to recognize National Bike to Work Week, May 13-17, 2024; and

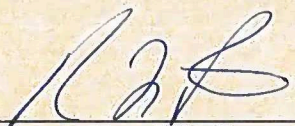
Whereas, Biddeford residents are encouraged to bike to work at least one day during the week of May 13 to May 17; and,

Whereas, Employers throughout the City are encouraged to promote biking to work during the week of May 13 to May 17; and,

Whereas, Biking to work has many proven benefits for both employees and employers such as reduced health care costs, decreased absenteeism, reduced stress, saves at the gas pump, and reduces parking costs; and,

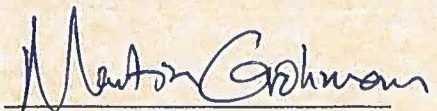
Now, Therefore I, Martin Grohman, Mayor of Biddeford, Maine do hereby proclaim National Bike Month in the City of Biddeford for the month of May and I look forward to seeing fellow residents out on their bikes either commuting or for fun and family time.

*In Witness Whereof, We the undersigned have herewith affixed
our signatures this 7th day of May 2024.*



City Clerk





Mayor

Chapter 2. Administration

Article IV. Boards, Committees, and Commissions

Division 14. Sustainability Commission

Sec. 2-340. Established

The Biddeford Sustainability Commission is hereby established.

Sec. 2-341. "Commission" Defined

Unless otherwise indicated, the term "Commission," as used in this division, shall mean the Biddeford Sustainability Commission.

Sec. 2-342. Composition; Appointment of Commissioners; Terms of Office

- a. The Commission shall consist of seven members, referred to in this division as "Commissioners." Such Commissioners shall be nominated by the Mayor and confirmed by the City Council.
- b. Commissioners shall serve for three-year terms. The terms of each Commissioner shall be staggered so that no more than three Commissioners' terms shall expire in the same year. Any Commissioner appointed to fill a vacancy for which more than half of the unexpired term remains shall be deemed to have served one full term.
- c. A Commissioner shall automatically be removed from office in the event that he or she no longer is a resident of the City of Biddeford or is absent for three consecutive regular meetings without being excused by the Chair.

Sec. 2-343. Functions and Purposes

It shall be the function and purpose of the Sustainability Commission to:

- a. Develop and recommend policies to City Council for the implementation of climate actions as outlined in the 2023 Biddeford Climate Action Plan, to both mitigate greenhouse gas emissions and adapt to impacts of changing climate;
- b. Investigate and study policies and best practices for adoption in Biddeford, as appropriate to implement said actions;
- c. Promote sustainable development that supports nature-based solutions to climate change;
- d. Work in an advisory capacity to City Council, Planning Board, and other committees, commissions, and boards as deemed necessary;
- e. Undertake an updated Greenhouse Gas Emission Inventory as needed to track emission reductions (every 2 to 3 years beginning in 2024);
- f. Report progress made in implementing the Biddeford Climate Action Plan annually to City Council, Mayor, and the City Manager.

Sec. 2-344. Quorum at Meetings

A simple majority of commissioners shall constitute a quorum.

Sec. 2-345. Required Vote

The Commission shall act by majority vote of those present and voting.

Sec. 2-346. Annual Election of Officers

The Commission shall hold a meeting at the beginning of each calendar year for the purpose of electing officers:

- a. Chair - The Chair shall preside over meetings. The Chair shall not vote except to break a tie.
- b. Vice Chair – The Vice Chair shall preside in the event the Chair is absent from any meeting.
- c. Secretary – The Secretary shall record all proceedings of the Commission.

Sec. 2-347. Management of Commission

The management of the commission shall be vested in the commissioners appointed and confirmed in accordance with Section 2-332. The commission shall be staffed by a designee of the Planning and Development Director. The commission shall be staffed by the Sustainability Coordinator as such a position, or similar, is created.

Sec. 2-348. Chair to Submit Budget, Reports

The Commission Chair shall at the beginning of each year, submit a budget for the ensuing year and report to Council regarding progress made in meeting goals as outlined in the 2023 Climate Action Plan, or, as requested by Council.

Sec. 2-349. Authority to Establish Subcommittees

The Commission may from time to time establish subcommittees composed of such persons as the Commission shall desire to provide advice and counsel on sustainability and matters of climate change.

Sec. 2-350. Expenditures

All Commission expenditures shall comply with the City procurement policies established in the City Code of Ordinances, Procurement, Sec. 2-341 et seq.



BIDDEFORD: CLIMATE ACTION PLAN

OCTOBER 2023



TABLE OF CONTENTS

03 Preface

04 *Acknowledgements*

05 *Letter from the Mayor*

06 *Executive Summary*

10 Introduction and Background

11 *What is a Climate Action Plan?*

12 *Our Climate Action Planning Timeline*

14 *Biddeford's Visions, Goals, & Targets*

16 *Community Engagement*

17 *What We Heard*

18 *Planning for Equitable Climate Action*

19 Climate Change in Biddeford

20 *How Climate Change is Affecting Biddeford*

26 *Biddeford's Greenhouse Gas Emissions*

27 *Greenhouse Gas (GHG) Inventory Key Takeaways*

28 Climate Actions

30 *Buildings and Energy*

34 *Transportation and Infrastructure*

38 *Land Use and Natural Resources*

43 *Health, Safety, and Well Being*

47 *Leadership and Support*

51 Conclusion

52 *What's Next*

53 *Looking Ahead*

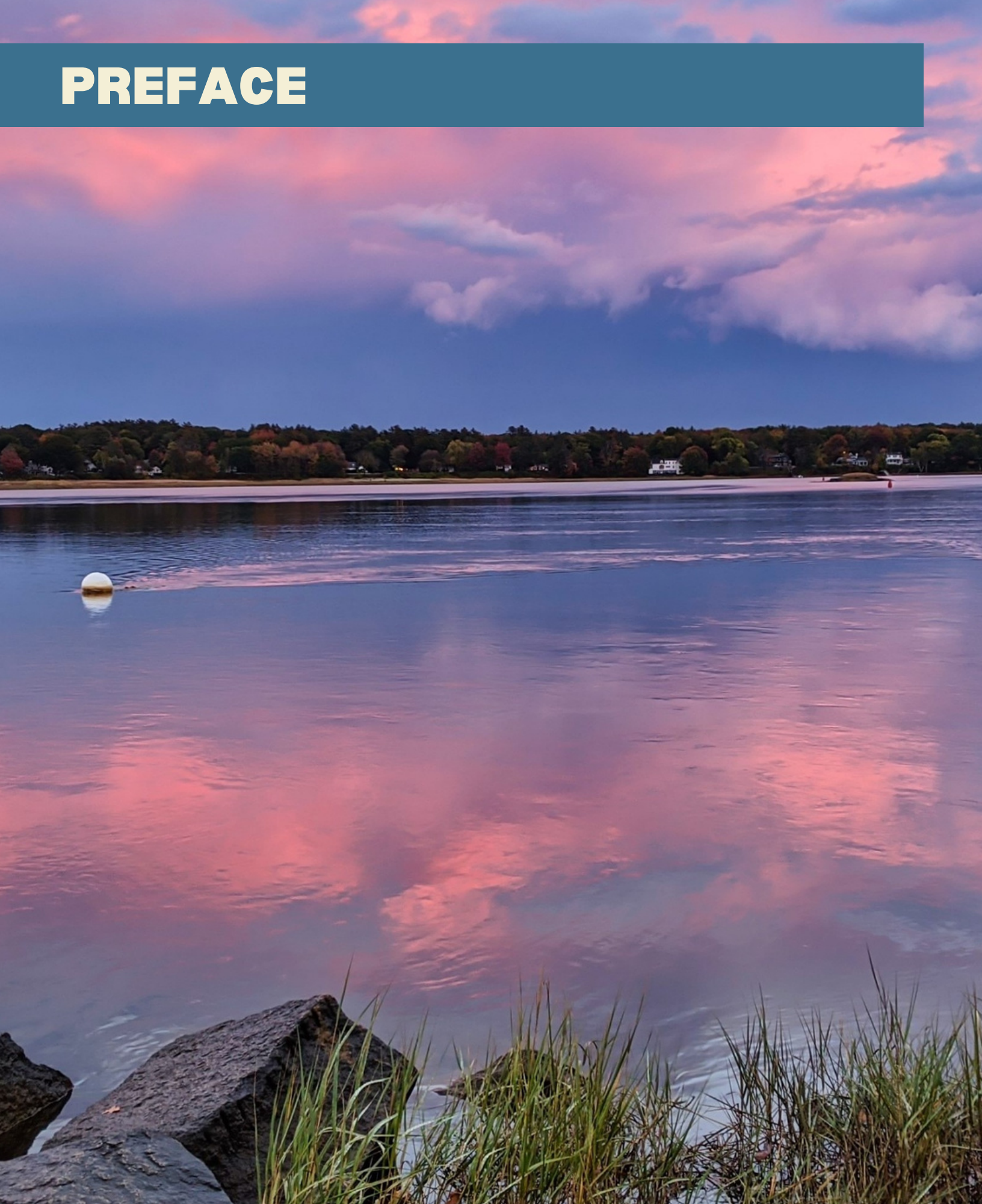
54 Appendices

55 *Climate Change Vulnerability Assessment*

142 *Greenhouse Gas Inventory Summary and Forecast*

153 *Complete Strategy Matrix*

PREFACE



ACKNOWLEDGMENTS

Biddeford City Council

Alan Casavant, Mayor
Bill Emhiser, Ward 1
Scott Whiting, Ward 2
Martin Grohman, Ward 3
Bobby Mills, Ward 4
Julian Schlaver, Ward 5
Norman Belanger, Ward 6
Laim LaFountain, Ward 7
Marc Lessard, Councilor-At-Large
Doris Ortiz, Councilor-At-Large

Municipal Staff

Jim Bennett, City Manager
Brian Phinney, Chief Operating Officer
Greg Mitchell, Former Planning and Development Director
Roby Fecteau, Code Enforcement Director
Greg Copeland, GIS Manager
Danica Lamontagne, Assistant to the City Manager

Partner Organizations

Heart of Biddeford
Engine
McArthur Library
Wells Reserve at Laudholm
Bike Biddeford Saco
Biddeford Adult Education
Learning Works
Biddeford Community Gardens
Governors Office of Policy, Innovation, and the Future
Biddeford Housing Authority

Biddeford Climate Task Force

Steve Reiter, Chair
Jake Aman
Tim Boston
Dr. Meaghan Daly
Ally Demeule
Bill Emhiser
Brad Favreau
Kiara Frischkorn
Junelle Soucy
Beverly Thorpe
Max Zakian

Consultants

Southern Maine Planning and Development Commission
Zoe Miller Strategies, Portland, Maine
Morris Communications, Kennebunkport, Maine
ICLEI – Local Governments for Sustainability, Denver, Colorado

Cohort Communities

Town of Kennebunkport
Town of Kennebunk
Town of Kittery

Special thanks go to **Southern Maine Planning and Development Commission**. Without the leadership of SMPDC this effort would not have been possible.



This work was supported by a Community Action Grant from the Maine Community Resilience Partnership. The work by SMPDC was also partially supported by award CZM NA21NOS4190082 to the Maine Coastal Program from the National Oceanic and Atmospheric Administration, U.S. Department of Commerce. The statements, findings, conclusions, and recommendations are those of the author(s) and do not necessarily reflect the views of the National Oceanic and Atmospheric Administration or the Department of Commerce.

LETTER FROM THE MAYOR



City of Biddeford, Maine

205 Main St • P.O. Box 586 • Biddeford, Maine 04005

(207) 286-9385

acasavant@biddefordmaine.org



Alan M. Casavant

The City of Biddeford is pleased to release our first Climate Action Plan. This plan will help guide Biddeford in our efforts to lower our carbon emissions in the coming years and to adapt to climate-related events as they occur. This plan gives us a broad roadmap to guide us over the next few years as we pursue our climate-related targets.

In 2022, the Biddeford City Council adopted aggressive goals for carbon emissions reductions for Biddeford: a reduction of 62.6% by 2030 and net zero emissions by 2050. To achieve these goals, we need a strong plan that will help us reduce our reliance on fossil fuels and strengthen our community's assets against the threats of climate change, without compromising Biddeford's quality of life.

Our plan presents 48 strategies spread over five categories: Buildings and Energy; Transportation and Infrastructure; Land Use and Natural Environment; Health, Safety, and Wellbeing; and Leadership and Support. These strategies will help us reduce energy use, protect the vulnerable areas of our city, manage risk, and educate Biddeford residents about the many ways to participate in reaching our goals. It will also help Biddeford do its part to help manage this global crisis.

This plan is the result of listening to Biddeford residents. It is the culmination of a three- years' effort by the Biddeford Climate Task Force, in collaboration with regional, state, and national partners. We are especially grateful for the leadership of the Southern Maine Planning and Development Commission (SMPDC), who directed and managed our planning efforts. Our first priority in the process has been to ensure that the plan reflects the voices of everyone who lives, works, and plays in Biddeford. We want to be sure that everyone will benefit equally from the progress we make. Through all of the work done to prepare this plan, we made public engagement the center of the process.

But now the real work begins. Now we have to make every effort to implement these strategies and adopt the policies outlined here that. Together, we can make Biddeford become a stronger, more resilient community.

We all want to live a healthy, prosperous life. With Biddeford's Climate Action Plan in place, we can live more sustainably, as well.

Sincerely,

A blue ink signature of Alan M. Casavant, written in a cursive style.

Alan Casavant
Mayor

EXECUTIVE SUMMARY

The Need for Action

We live in a rapidly changing world. Climate change is causing global disruptions: wildfires, flooding, record high temperatures, extreme storms, and rising seas. In Maine, the statewide annual temperature has increased by 3.2°F since 1895, and annual rain and snowfall have increased by more than 6 inches. These changes are bringing extreme heat and storms that impact community health and threaten essential community infrastructure. On top of that, they are threatening native fish, wildlife, and our unique natural areas.

Biddeford is already experiencing climate change. In just the last two years, we have seen extreme rain cause the collapse of a portion of the RiverWalk and the collapse of culverts at the Biddeford Connector, both disrupting the community and requiring expensive emergency repairs. Biddeford has been a hotspot for wildfire occurrences in recent years, and droughts have threatened farms and private wells. **The need for action is here.**

Biddeford is among seven municipalities in Maine that have declared a Climate Emergency and 1,136 cities worldwide that have joined the Race to Zero initiative to halve global greenhouse gas emissions by 2030. By taking action on climate change at the local level, Biddeford is joining cities in Maine and around the world in working toward a future that is not only livable, but resilient, innovative, and prosperous. **The time for action is now.**



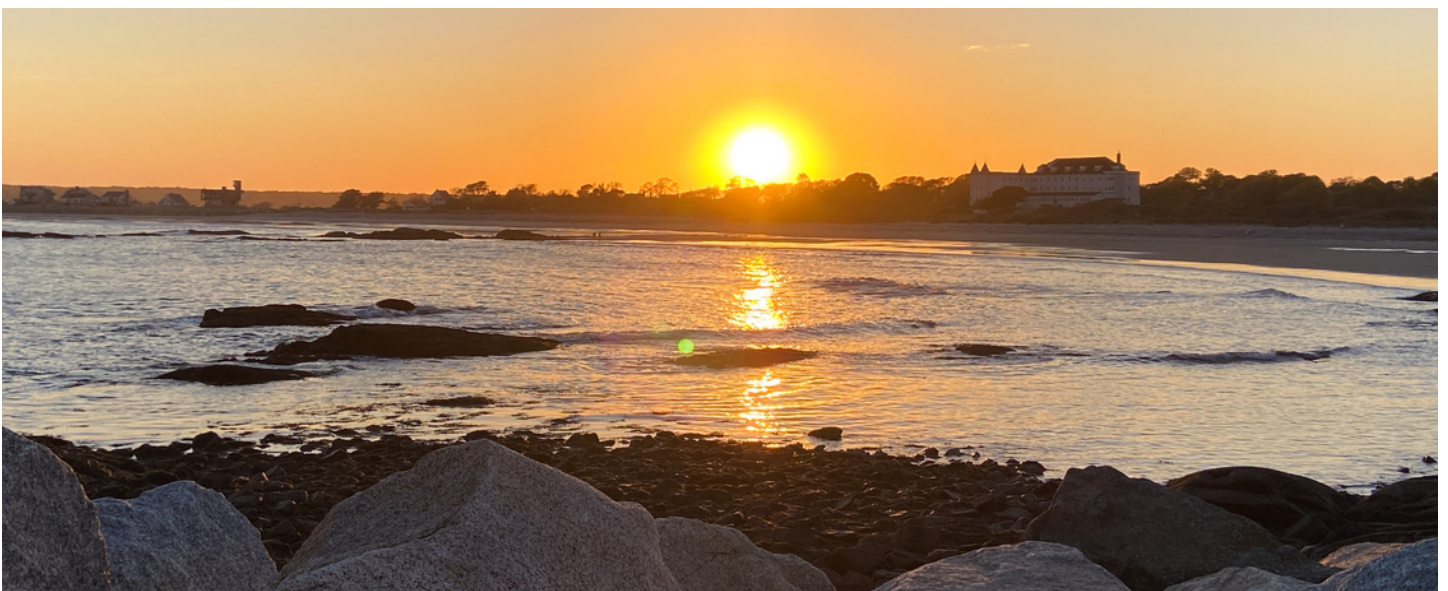
Beautiful Destruction. PhotoVoice Contest 2023 Entry

“

With a changing climate, how we receive our precipitation is now less predictable than in the past. Where we might once have expected snow, our wintry mixes are often more sleet, ice, and slush -- which can cause damage to power lines, trees, and our homes.

– PhotoVoice Contest 2023 Entry

”



Our Vision

Our vision is a resilient, zero-carbon Biddeford where clean energy powers accessible transportation and buildings and where inclusive communities can thrive. We believe that being good stewards of the natural world, and being responsible for the quality of the environment, will help ensure opportunities for everyone, now and in the years to come.

Biddeford's Climate Action Plan (CAP) will serve as a roadmap for our climate ready future, including:

- 1 Where we are now:** our city's climate change vulnerabilities (how we're impacted) and current greenhouse gas emissions (how we're contributing).
- 2 Where we are headed:** goals, targets, and actions to reduce our greenhouse gas emissions and adapt to the impacts of climate change.

The establishment of a new position of Sustainability Coordinator is a fundamental first step toward achieving the goals and targets outlined in this plan.

Our Goals, Actions and Targets

Our plan outlines the **48 comprehensive actions** across five categories that we will take to reduce our greenhouse gas emissions and adapt to the impacts of climate change. Seeking out input from our community was instrumental in learning what actions and goals our community values most, shaping the actions that appear in this plan. By taking these actions we will achieve the targets we set in the **Biddeford Race to Zero Resolution**:

Our Targets

62.6% absolute emissions reductions by 2030

Net-zero emissions by 2050



BCTF members and friends.

Our Goals and Priority Actions



Buildings and Energy

- Foster energy efficiency programs that reduce vulnerability to volatile fossil fuel prices.
- Reduce emissions by electrifying buildings and energy systems.
- Bolster the resilience of neighborhoods and critical facilities to natural disasters.

Renewable Energy (B1) - Encourage & incentivize small scale renewable energy, like rooftop solar.

Energy Efficiency (B3) - Increase efficiency of large buildings & rental properties.



Transportation and Infrastructure

- Enhance active mobility (walking and biking) and public transit as alternatives to single-occupancy vehicle use to improve health, safety, and accessibility.
- Reduce emissions by electrifying public and private vehicles.

Public Transit (T1) - Expand access to & use of public transit services.

Increase Walkability (T2) - Create a safe, comfortable, & convenient network of pedestrian walkways.

Increase Bikeability (T3) - Create a safe, comfortable, & convenient network of bikeways & infrastructure.

Transit-Oriented Development (T4) - Concentrate housing, business, & leisure activities within easy walking distance to public transit.

Encourage Transition to Electric Vehicles (T10) - Through efforts such as streamlined permitting, installation of public EV chargers, EV charging station requirements, & the municipal fleet.



More Information

Priority actions are included in this summary. To learn more about all the CAP actions, see the "Climate Actions" Section of this plan.

Our Goals and Priority Actions



Land Use and Natural Resources

- Implement land use policies that foster sustainable food production and reduce the impact of development on the natural world.
- Commit city ordinances and plans to limiting our carbon footprint and to protecting the natural environment.

Sustainable Landscaping (LN1) - Promote & practice climate resilient landscaping approaches on municipal landscapes.

Sustainable Food Systems (LN5) - Promote & expand local food systems.

Mixed-Use Zoning (LN6) - Allow a blend of residential & commercial uses to reduce sprawl.



Health, Safety, and Well Being

- Ensure the health and safety of everyone in the Biddeford community to climate change hazards, especially those who are most vulnerable.
- Ensure community resilience to climate change through the expansion of public resources and affordable housing.

Affordable Housing (H5) - Create resilient, energy-efficient & low-carbon affordable housing.

Ensure Safe Drinking Water Supply (H6) - Assess & manage drinking water, septic systems & wells.

Shade Structure Ordinance (H7) - Adopt an ordinance requiring shade structures on city-owned properties.

Tree Ordinance (H8) - Adopt an ordinance to increase tree canopy on city-owned & private property.



Leadership and Support

- Ensure Biddeford City government has the funding, dedicated staff, and skills to address climate change effectively, efficiently, and equitably.
- Engage community members and regional partners to broaden the impact of resiliency actions.

Create Climate Commission (LS1) - Create a commission to assist with implementing the CAP.

School Curricula (LS2) - Support local schools to include climate change and sustainability in school curricula.

Create a position of Sustainability Coordinator (LS4) - Create a municipal Office of Sustainability and a position of Sustainability Coordinator, whose mandate will be to implement the CAP.

INTRODUCTION AND BACKGROUND



WHAT IS A CLIMATE ACTION PLAN?

A Climate Action Plan (CAP) is a strategic plan that lays out policies and programs for reducing a community's greenhouse gas (GHG) emissions and adapting to the impacts of climate change. CAPs include an *inventory* of the municipality's current GHG emissions and existing vulnerabilities, *goals* for emissions reductions and climate adaptation, and *actions* to achieve those goals.

This CAP will serve as a roadmap to ensure Biddeford's climate ready future.



Birder on the Rocks, Photovoice Contest 2023 Entry.



Emissions reductions – Actions that help reduce the total amount of GHGs in the earth's atmosphere. These actions put the brakes on the speed at which climate change is happening.



Climate adaptation – Actions taken to strengthen a community's ability to adjust to climate change and thrive in spite of its impacts. Adaptation softens the blow of climate change.

“

The failure to act against the effects of climate change carries a great risk for Maine, as doing nothing will cause costly damage to Maine's buildings & infrastructure, vulnerable ecosystems, iconic species, & public health.

– *Maine Won't Wait, 2020*

”

OUR CLIMATE ACTION PLANNING TIMELINE

In October 2020, the City Council passed a Climate Emergency Resolution for the City of Biddeford. The resolution sparked a multi-year effort to create a Climate Action Plan (CAP). The Mayor established our group, the **Biddeford Climate Task Force (BCTF)**, to create an action plan that focuses on adaptation, emissions reduction and sustainability strategies.

Our climate action planning efforts were perfectly timed to coincide with efforts to plan for climate change by the State of Maine and by our neighboring communities. We decided to work with the Towns of Kennebunk, Kennebunkport, and Kittery as part of the Southern Maine Planning and Development Commission (SMPDC) Southern Maine CAP Cohort.

All four community task forces developed CAPs concurrently. While we each set our own priorities and actions, we learned from one another, sharing ideas for actions to include and ways to engage with our communities. We also discussed and agreed upon regional actions to include in our plans and work on together in the future.

State Actions

Pre-Plan Actions

CAP Planning Actions

Governor Janet Mills signs LD 1679 into law, creating the **Maine Climate Council**

June 2019

City Council adopts resolution declaring a **Climate Emergency**

October 2020



December 2020

Biddeford Mayor **establishes ad hoc Climate Task Force** to develop a Climate Action Plan

December 2020

Maine releases **4-year CAP** to confront climate change and its risks to the state

Biddeford joins the **State's Community Resilience Partnership**

March 2022

BCTF conducts **Greenhouse Gas emissions inventory**

February 2022

State launches the **Community Resilience Partnership** to support local climate action

Summer 2021

January 2021

January 2021

Mayor approves **Biddeford Climate Task Force** and meetings begin

September 2022

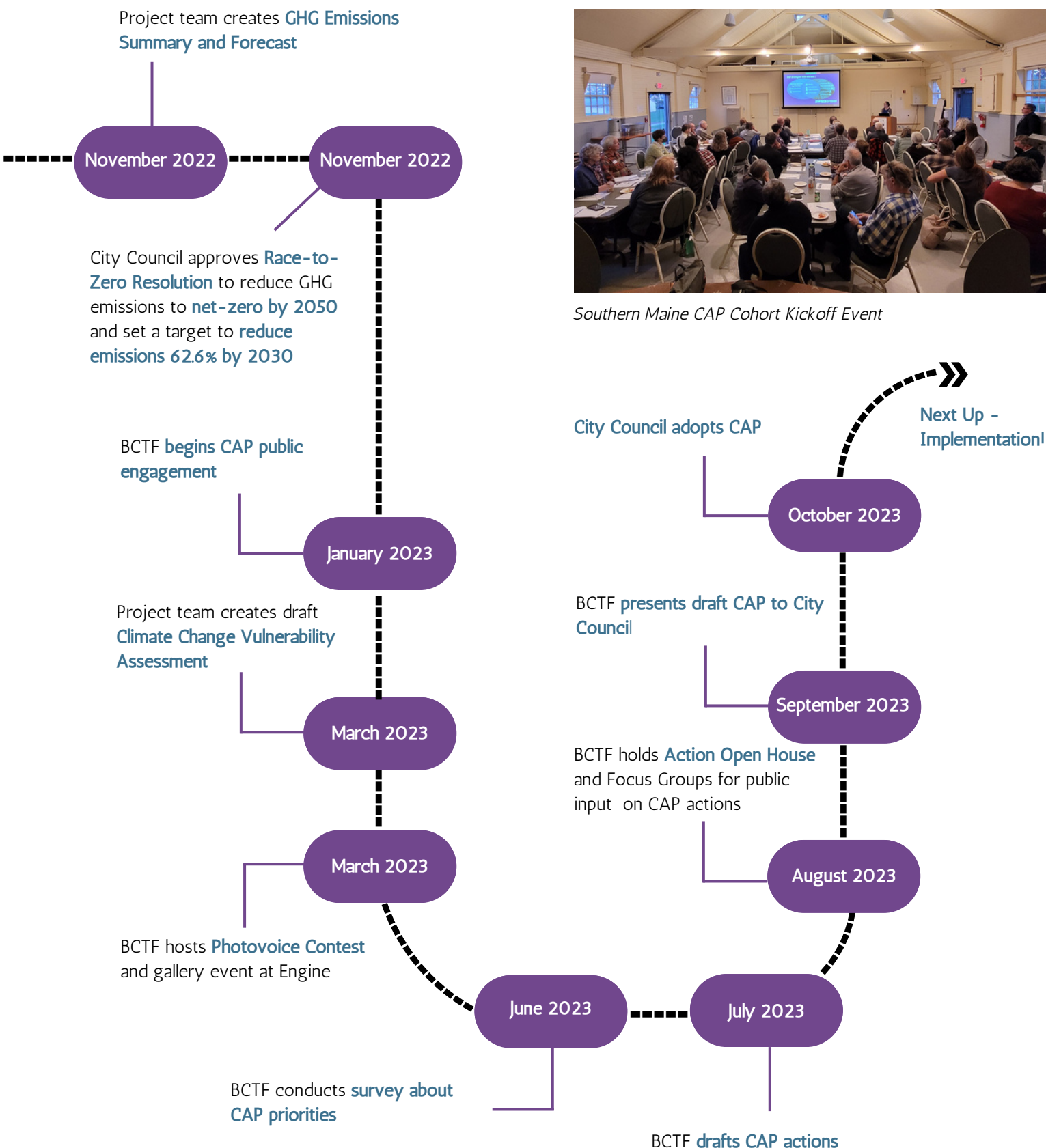
Project team hosts **Southern Maine CAP Cohort Kickoff event**

BCTF hosts **gallery event at Engine** with climate artist Jill Peltó



Biddeford Climate Task Force members.

Our Climate Action Planning Timeline



BIDDEFORD'S VISIONS, GOALS, & TARGETS

Our Vision

In the City of Biddeford, the future beckons us. We recognize that we are but one small part of our Earth and that living sustainably in the natural world reaps many benefits. We respect that the environment requires stewardship, not dominance, and so we strive to ensure that humanity coexists harmoniously with nature.

- Beyond our modern urbanized areas, there are wide verdant expanses accessible for all to enjoy; **the air is clean, the water is pure, and healthy food is abundant for everyone.**
- We rely on **renewable energy that does not add to our carbon footprint; green transportation is available to all** members of the community through many mass transit options using carbon neutral technology; and we continue to **develop affordable housing that uses renewable energy resources for heating, cooling and power.**
- Our community is **resilient, and with fairness and equity**, we ensure that **there is a place for everyone in Biddeford's future.**
- We create **thriving inclusive neighborhoods.**
- At its foundation, our community adapts to changes in our climate, providing **new opportunities for everyone, now and for future generations.** Biddeford is a center of **green development and job creation.**



Our Goals

Buildings and Energy

- Foster energy efficiency programs that reduce vulnerability to volatile fossil fuel prices.
- Reduce emissions by electrifying buildings and energy systems.
- Bolster the resilience of neighborhoods and critical facilities to natural disasters.

Transportation and Infrastructure

- Enhance active mobility (walking and biking) and public transit as alternatives to single-occupancy vehicle use to improve health, safety, and accessibility.
- Reduce emissions by electrifying public and private vehicles.

Land Use and Natural Resources

- Implement land use policies that foster sustainable food production and reduce the impact of development on the natural world.
- Commit city ordinances and plans to limiting our carbon footprint and to protecting the natural environment.

Health, Safety, and Well-Being

- Ensure the health and safety of everyone in the Biddeford community to climate change hazards, especially those who are most vulnerable.
- Ensure community resilience to climate change through the expansion of public resources and affordable housing.

Leadership and Support

- Ensure Biddeford City government has the funding, dedicated staff, and skills to address climate change effectively, efficiently, and equitably.
- Engage community members and regional partners to broaden the impact of resiliency actions.

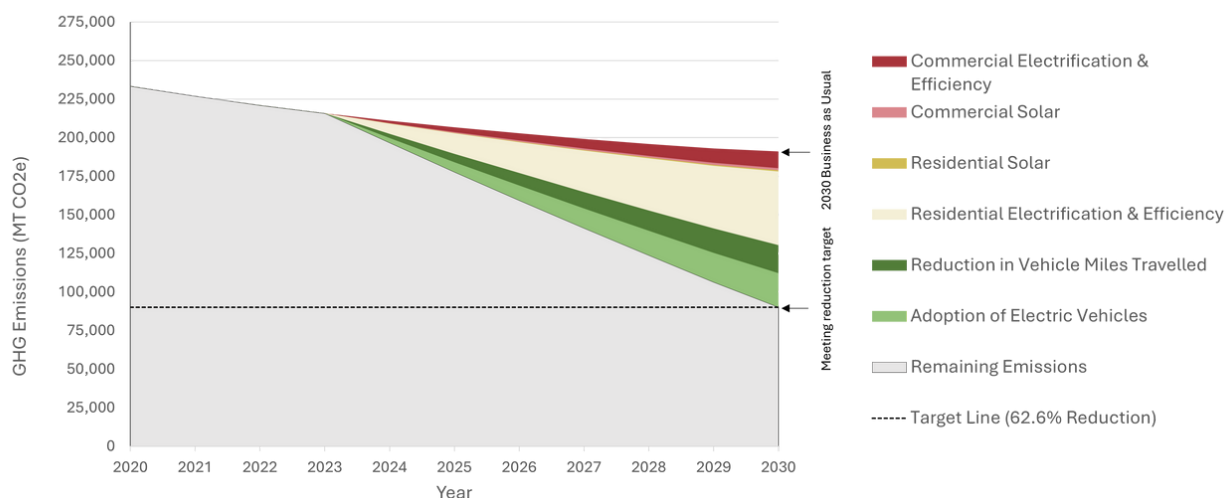
Our Targets

Biddeford is a member of [Race to Zero](#), a global campaign to avoid the worst impacts of climate change by limiting global warming to no more than 1.5°C. Biddeford's [Race to Zero](#) targets:

62.6% absolute emissions reductions by 2030

Net-zero emissions by 2050

Biddeford Emissions with Reductions for Climate Action



COMMUNITY ENGAGEMENT

Community engagement was critical to the development of this CAP. We employed various engagement tools and tactics to educate the community and seek out public input, informing the actions in this plan that will direct Biddeford's climate efforts for years to come.

Winter 2022

- Jill Peltó Gallery event at Engine

Summer 2022

- Music in the Park BCTF Table
- Pollinator Festival BCTF Table
- Earth Day Bike Ride
- Fringe Fest BCTF Table
- River Jam BCTF Table



Spring 2023

- Downtown Development Commission Presentation
- Chamber of Commerce Presentation
- Biddeford Pool Community Assn. Community Conversation
- Earth Day Event BCTF Table
- Pollinator Festival BCTF Table
- **PhotoVoice Contest & Exhibition:** BCTF encouraged community members to submit photos answering the question, "What does climate change look like to you?" The contest culminated in a display of the photos at the Engine art gallery on April 21, with winners selected in multiple categories.
- Climate Action Public Survey



PhotoVoice Contest Exhibition

Summer 2023

CAP development's public engagement chapter closes, but the implementation dialogue continues!



Climate Action Open House Event

- Heart of Biddeford Community Conversation
- BLAST Program K-4th graders Community Conversation
- Art Walks BCTF Table
- Adult Ed Focus Group
- LearningWorks Focus Group
- General Public Focus Group
- **Climate Action Open House:** BCTF hosted an open house at McArthur Public Library giving community members a chance to provide feedback on the proposed climate actions. This input shaped how the actions appear in the plan.
- Community Gardens Focus Group
- Biddeford City Council Workshop
- River Jam BCTF Table
- BLAST Focus Group
- Biddeford Community Gardens Focus Group



Biddeford Adult Ed Focus Group

WHAT WE HEARD

Climate Concerns

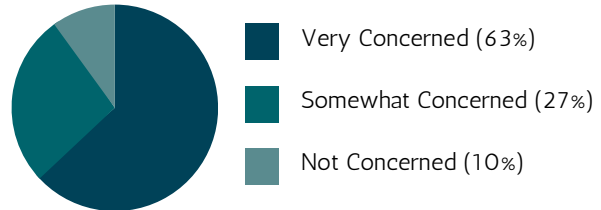
We listened to the climate concerns shared by our community members.

- 1 **Changes in natural environment including loss of wildlife/wildlife habitat and increase in invasive species**
- 2 **Risks to roads, water & sewage treatment from storms and sea level rise**
- 3 **Coastal, river, and flash flooding**



Worried about Nature, PhotoVoice Contest 2023 Entry.

Are you concerned that climate change will affect Biddeford over the coming decades?



Data source: Biddeford Climate Action Public Survey (387 responses)



Sea Level Rise and Erosion, PhotoVoice Contest 2023 Entry.

Climate Action Feedback

We heard your ideas for actions Biddeford can take to tackle climate change.



Preserve open space.



Many more EV charging stations.



Drought has been getting worse every year. I worry that our community is not ready for the threat of wildfire we face in a hotter, drier world.



Make Biddeford bikeable.



Retrofit our historic buildings to make them more energy efficient.



Accessible and affordable public transit.



More energy efficient building construction and housing.



We need to start making our shoreline more resilient ASAP.



Concerned about downtown heat, too many paved surfaces. We need more trees.



All neighboring towns/cities need to work together.



Our interdependent responsibility for Mother Earth is crucial. Without it, we forget how we created this catastrophe in the first place.



Affordable housing, active transportation and climate are all connected.

PLANNING FOR EQUITABLE CLIMATE ACTION

Social equity means all community members can participate, prosper, and reach their full potential. Climate change and social equity are closely intertwined. **Climate change affects some members and groups of our community differently**, some more severely than others. Equally, climate action has many benefits, and in some cases, negative impacts, that can be distributed unevenly and unfairly to different groups.

Biddeford's climate actions must address social equity every step of the way. We've embedded equity in the design and implementation of our CAP to ensure that actions respond to social inequities and the needs of those who are most vulnerable.

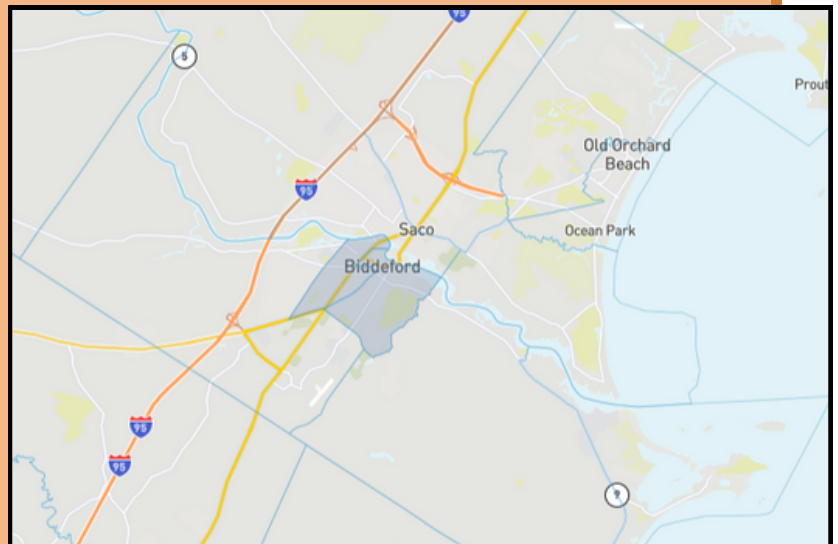
- Public engagement efforts such as the survey, focus groups, and Action Open House were designed to reach vulnerable community groups including immigrants and asylum seekers, youth, and unhoused community members.
- Equity was one of three priority criteria for the action evaluation process. In considering each potential action, we asked, *"Are the costs, benefits of this action distributed fairly? Does this action minimize harm to the most vulnerable groups?"*

As we look towards implementing our CAP, we will need to be flexible, adaptive, and reflexive to ensure the biggest benefit and least harm to our vulnerable community members.

Biddeford's Equity Considerations

Over Biddeford's long history, the city has seen many changes. Once an agricultural center for the indigenous tribes that thrived along the Saco River, Biddeford was incorporated as a town in 1653. From mill town, to trash town, to Maine's coolest city, Biddeford has grown into a thriving small city of more than 22,000 residents. Biddeford is **one of Maine's most diverse and young communities**, with a relatively high number of Black, Indigenous, and People of Color (BIPOC) residents and an influx of new residents from out-of-state.

But the city's growth is not without challenges. **13% of residents live below federal poverty levels and 41% earn less than \$50,000 annually.** Biddeford, along with the rest of Maine, is **experiencing a housing affordability crisis.** And while Downtown Biddeford is seeing rapid commercial and residential development, that growth is pushing out long-term Downtown residents, and it has led to an **increase in unhoused community members.** In the future, Biddeford could become a popular destination for people leaving regions of the country that have become more endangered by climate change, worsening the city's housing challenges.



Part of Biddeford's downtown has been designated disadvantaged due to low household income and health risks. The residents here are therefore more sensitive to climate hazards than other parts of the city.

CLIMATE CHANGE IN BIDDEFORD



HOW CLIMATE CHANGE IS AFFECTING BIDDEFORD



Biddeford Pool in 1930 (left) and in 2015 (right).



How did we determine these impacts?

We conducted a climate change vulnerability assessment to identify who, what, and where will be impacted by local climate hazards and what those impacts could be. The assessment used a combination of national, state, and local data sets, as well as input from the Task Force and community members, to assess local impacts of climate hazards (flooding from sea level rise and storm surge, precipitation and extreme storms, extreme temperatures, drought, and changing marine conditions) and Biddeford's vulnerability to those hazards. Find the full assessment in Appendix A.

Climate Impacts

We face major threats to the future of our community and the places we love. Increasing temperatures, changing precipitation, sea level rise, and shifting ecosystems are driving changes here in Biddeford.



Increasing Temperatures

Impacts of increasing air temperatures:

- Maine's statewide annual temperature has increased by 3.2 °F (≈ 1.8 °C) since 1895.
- There will be 4 times more extreme heat days (heat index $>95^{\circ}\text{F}$) in Southern Maine by 2050.



A Terrifying February Day in Maine. 65 degrees and no snow in the middle of a Maine winter. PhotoVoice Contest 2023 Entry.

How Climate Change is Affecting Biddeford

Changing Precipitation

Impacts of changing precipitation:

- Maine's annual precipitation (rain and snowfall) has increased by more than 6 inches since 1895, and extreme precipitation events are becoming more frequent.



In 2021, an intense downpour washed out a large portion of an embankment along the Saco River in Biddeford, with repair costs estimated over \$2 Million. Credit: A. Sherwin

Sea Level Rise

Impacts of sea level rise:

- By 2050, Maine will likely experience between 1.1 - 1.8 feet of sea level rise, and between 3.0 - 4.6 feet of sea level rise by 2100, with higher amounts possible.
- Increased likelihood and severity of coastal flooding, especially during storms.



Sea Level Rise Will Have Dramatic Impact on Biddeford. PhotoVoice Contest 2023 Entry.

Changing Ecosystems

Impacts of changing ecosystems:

- System-wide changes to marine and land ecosystems are decreasing biodiversity and giving a leg up to invasive species
- Of the State's 378 most at-risk fish and wildlife species, nearly one-third are predicted to be negatively affected by climate-change related threats, including habitat shifts and alterations, droughts, temperature extremes, and storms and flooding



Blue Invader. Blue Crabs are a recent invasive species in Maine. PhotoVoice Contest 2023 Entry.

Drought and Wildfires

Impacts of changing drought and wildfires:

- Warmer air temperatures and changing precipitation patterns are increasing the severity of droughts.
- York County has experienced three severe droughts in the last five years, which lasted between two to eight months.
- Wildfire frequency, particularly in the spring, is increasing due to drought, decreased snowpack, and windier conditions.



Over the last several decades, Biddeford has been a hotspot for wildfire occurrences compared to the rest of the county. In April 2020, high winds and dry conditions led to more than a dozen wildfires in Maine, including one in Biddeford that burned about 20 acres of forest.

Climate Vulnerabilities

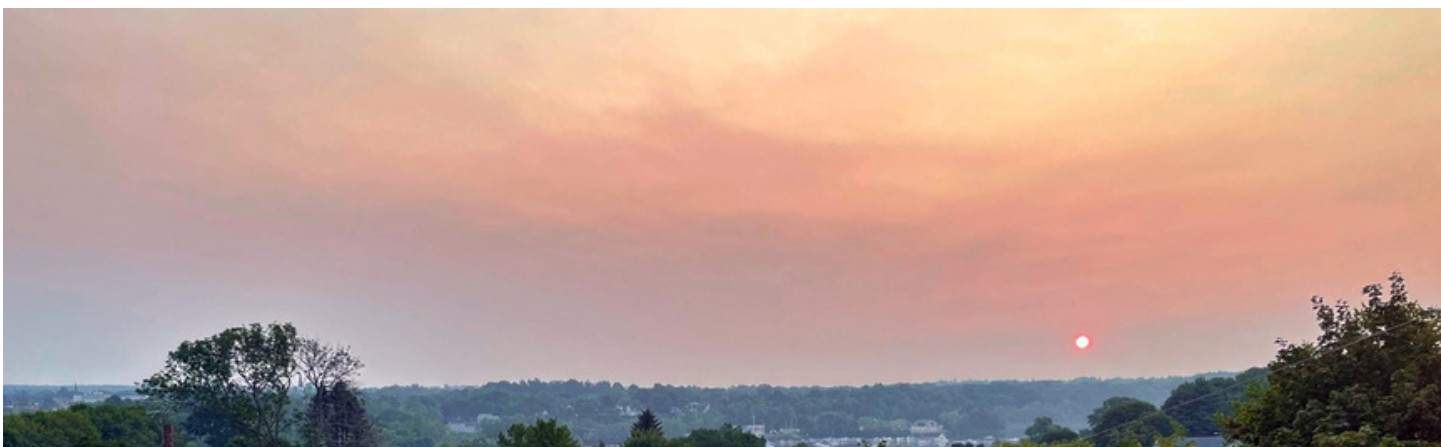
The impacts of climate change will not be felt evenly across the community, with portions of the population that will be more affected by climate hazards having less ability to prepare for, respond to, and recover from these hazards. Climate vulnerability is how strongly people or ecosystems are likely to be negatively affected by climate change.



Public Health

Extreme heat and heat waves are putting people at risk, especially those who are elderly, have health issues, or have limited access to home air conditioning. Extreme heat is the leading cause of weather-related deaths across the United States.

- Warmer, shorter winters are contributing to increased Vector-borne illnesses, such as Lyme disease. The prevalence of tickborne diseases has increased in York County in recent years. Diagnosis rates of Lyme disease have doubled and rare diseases like anaplasmosis and babesiosis have become more common.
- Like the rest of Maine, Biddeford's aging electrical grid is increasingly vulnerable to extreme storms and increasing temperatures. This will result in more frequent and longer duration power outages that can pose serious risks for public health and safety.
- Increasing frequency of wildfires, both locally and across North America will negatively affect public health by creating poor air quality and public safety risks.



Ashes from Away. Ashes falling in Maine from the 2021 fires in Oregon, thousands of miles away. PhotoVoice Contest 2023 Entry.

Elevated Risk

Downtown Biddeford is considered a "heat island", or area with a lot of impervious surfaces, such as buildings and pavement, that make the area hotter than normal, magnifying the impact of extreme heat. With more residents who are renters, have low annual incomes, and who face other social and health barriers, the Downtown community is especially vulnerable to extreme heat.



Infrastructure

Sea level rise, coastal storms, and extreme precipitation put coastal infrastructure at very high risk.

- Neighborhoods and infrastructure located around Biddeford Pool, Fortunes Rocks, Timber Point, and along the Saco River are vulnerable to flood hazards. With climate change these neighborhoods can expect more frequent coastal flooding events and associated damage to property, infrastructure, and the coastline.
- Types of infrastructure that are vulnerable to flooding include roads, bridges, culverts, and stormwater systems.
- Drinking water wells, septic systems, and subsurface infrastructure such as sewer and water mains are vulnerable to failure as coastal water tables rise and groundwater becomes contaminated by saltwater due to sea level rise.
- Extreme precipitation causes stormwater runoff and inland flooding, and Biddeford's proximity to the Saco River and its tributaries increases the risk of flooding.
- Drought and decreases in summertime precipitation are negatively impacting drinking water supply for both private wells and public water systems. Recent droughts resulted in historically low groundwater levels and streamflows in the Saco River, Biddeford's sole public water supply source.



How Will Our Infrastructure Function in the Future? PhotoVoice Contest 2023 Entry.

Elevated Risk

Many of Biddeford's coastal buildings were built before 1970, meaning that they are likely not constructed to modern building codes, making them more vulnerable to flooding. Many coastal residents are older, living alone, and potentially on a fixed income, limiting their ability to prepare for and safely navigate coastal storms events. Biddeford's coastal roads, including access and evacuation routes, are very vulnerable to storm-related flooding and could become impassable during and after storm events.



Elevated Risk

Downtown Biddeford is more likely to be impacted by flooding and stormwater overflow because of a high degree of impervious surfaces. With the oldest buildings, aging stormwater infrastructure, and a high proportion of residents facing social and health barriers, Downtown Biddeford community members are especially vulnerable to flooding.



Natural Environment

- Increases in precipitation, stormwater runoff, and saltwater intrusion into groundwater will negatively affect water quality and ecosystem health in Biddeford's watersheds, such as the Thatcher Brook Watershed.
- Sea level rise threatens to erode coastal beaches and tidal marshes. It will also lead to the landward migration of tidal marshes. Areas along Biddeford Pool, Little River, and the Saco River have been identified as being able to support future marsh migration.
- Average, extreme, and wintertime temperatures are stressing local flora and fauna and aiding the spread of invasive species, decreasing biodiversity in Biddeford's natural areas like Clifford Park, Blandings Park Wildlife Sanctuary, and Rotary Park.
- More frequent and severe extreme precipitation events will negatively impact coastal water quality and marine habitats.



As Our Past Washes Away. Shoreline erosion isn't new to Maine, but as storms grow more intense, water and wind threatens to carry away our coastal lands faster than ever before. PhotoVoice Contest 2023 Entry.

How Climate Change is Affecting Biddeford



Public Services

- More frequent flooding and extreme weather events will lead to higher municipal costs and will stress municipal capacity to respond to and repair after storm events.
- Higher sea levels and flooding may cut off emergency routes and access to neighborhoods during storm events, obstructing emergency services and disrupting local travel.
- Municipal property tax revenue could be affected if coastal properties, which generate a large portion of local tax revenue and provide vital funds that sustain community operations, services, and programs, are exposed to flooding and if development in flood-prone areas continues.



With 1.6 ft of sea level rise, flooding from a coastal storm event will cut off road access to 56 properties in Biddeford, putting the people who live there and emergency access to them at risk.



Properties that will be vulnerable to flooding from a coastal storm event after 1.6 ft of sea level rise have a total assessed value of almost \$4 million, representing more than 11% of city-wide assessed property value and almost 30% of the City's 2023 municipal budget.



Economy

- More frequent and intense droughts have the potential to reduce local farmers' production, increase their costs, and disrupt the local food system and economy.
- Tourism activity driven by Biddeford's sandy beaches and a healthy coastline could decline as flooding becomes more frequent and the amount of dry beach decreases as sea level rises.
- According to Biddeford's Assessing Department, coastal properties represent almost 29% of the city's tax base.



Soil at Girard Farm. PhotoVoice Contest 2023 Entry.

BIDDEFORD'S GREENHOUSE GAS EMISSIONS

Greenhouse gas (GHG) emissions are created when Biddeford's residents, visitors, and workers engage in daily activities such as driving, heating homes, and powering our appliances and devices. Measuring GHGs from specific sources helps us understand where and how to take action to achieve our goals.

Sources of Emissions

Transportation

Emissions from the burning of fossil fuels from cars, trucks, ships, trains and planes.

Residential Buildings

Emissions from homes are from burning fossil fuels for heat and electricity.

Commercial & Industry +

Emissions from businesses from electricity use and fossil fuel burning for heat and manufacturing.

Waste

Emissions from septic tanks, the Biddeford Wastewater Treatment Plant, and the incineration of trash sent to the EcoMaine waste-to-energy plant.

Types of Greenhouse Gases

Carbon Dioxide (CO₂)

Carbon dioxide is the main byproduct of fossil fuel combustion, such as burning gasoline, oil, coal, or other fuels for energy.

Methane (CH₄)

Methane is primarily emitted through agricultural activities, waste management, and natural gas combustion. Pound for pound, the comparative impact of methane is 25 times greater than carbon dioxide over a 100-year period.

Nitrous Oxide (NO₂)

Nitrous oxide is primarily emitted through agricultural soil management and fertilizer use. Fertilizer production and domestic wastewater management are also sources.

Fluorinated Gases

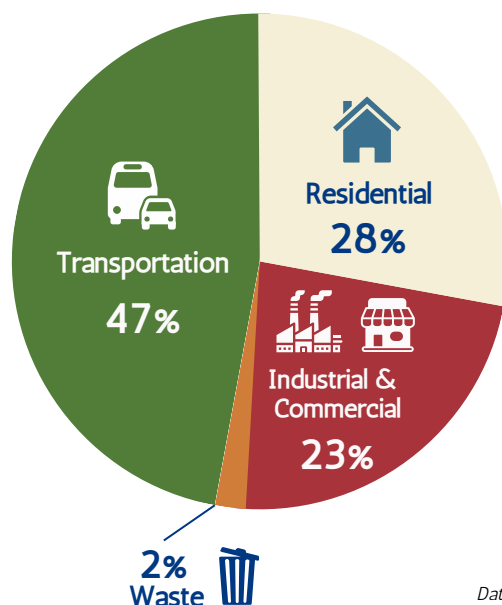
Synthetic gases that are emitted from a variety of household and commercial applications such as refrigerants, aerosol propellants, foam blowing agents, solvents, and fire retardants. Although they are emitted at far lower quantities, they are particularly potent and trap substantially more heat than carbon dioxide.



Where does this data come from?

This data comes from a 2019 Greenhouse Gas Inventory conducted by the City of Biddeford. See all the data in Appendix X: GHG Emissions Summary and Forecast.

Biddeford's Carbon Dioxide Emissions from Fossil Fuel Combustion by Source (2019)

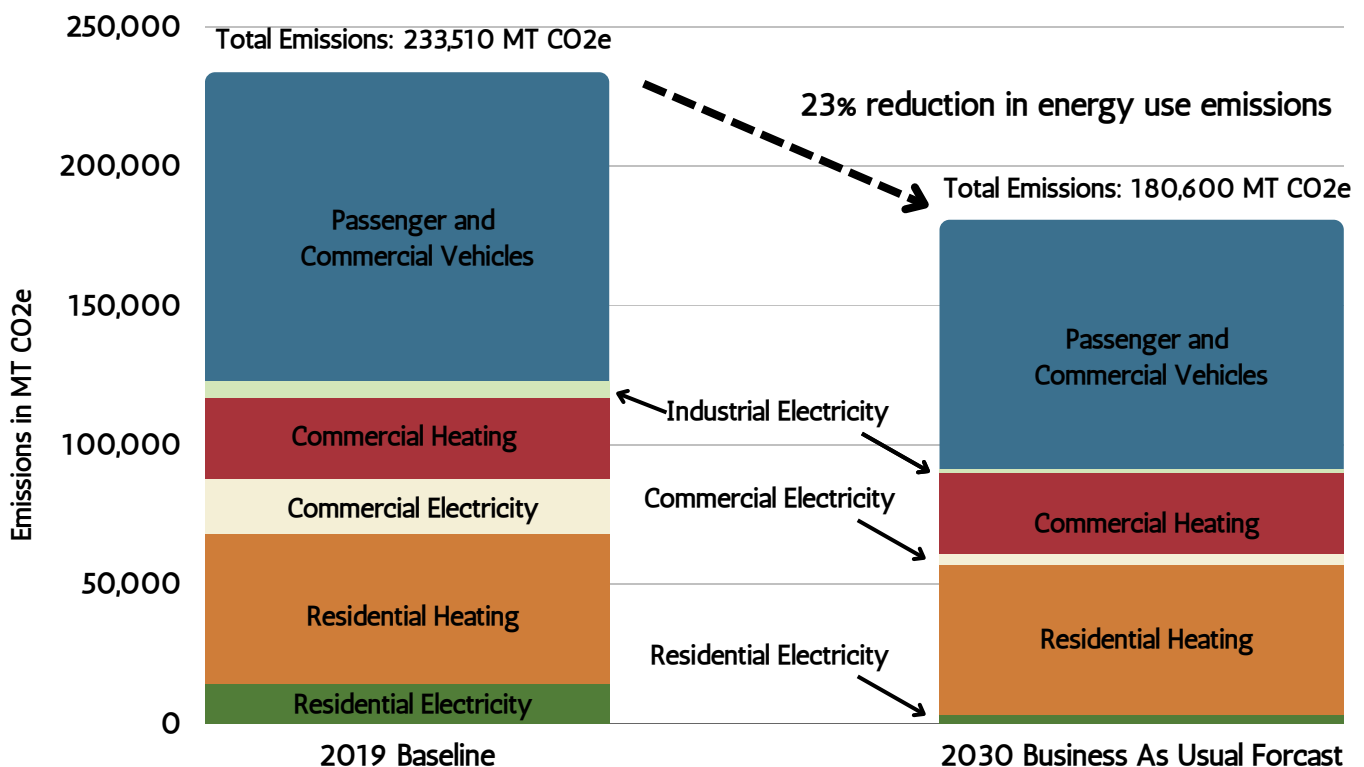


Data source::
Southern Maine Planning and
Development Commission, 2022

GHG INVENTORY KEY TAKEAWAYS

- ① Driving gasoline and diesel cars and trucks contributes the most GHG emissions in Biddeford.
- ② Residential heating is the 2nd largest source of GHG emissions. 80% of residential heating emissions come from burning heating oil in furnaces.
- ③ Municipal GHG emissions (from municipal buildings and vehicles) are only 2% of all the community's emissions.

2019 Emissions vs. Business As Usual Emissions



In order to change course on GHG emissions, we should be aware of efforts already underway. Forecasting "Business as Usual" emissions can help to identify the greatest barriers and opportunities for getting to net-zero emissions.

Without taking any additional action, Biddeford's GHG emissions from energy use are expected to fall 23% by 2030 driven by 1) increasing renewable energy sources on the electricity grid and 2) decreasing transportation emissions due to stricter fuel efficiency standards and electric vehicle expansion.

With ambitious but realistic actions to reduce emissions, Biddeford can achieve an even greater reduction in emissions and play our part in the global effort to prevent the worst impacts of climate change. [This plan outlines the additional activities the City has pledged to undertake to reduce emissions even more.](#)

CLIMATE ACTIONS



CLIMATE ACTIONS

Climate Actions Overview

To make a difference on climate change, we're focusing on taking action in five focus areas:



- **Buildings and Energy:** Making buildings and energy systems resilient and reducing their emissions.



- **Transportation and Land use:** Facilitating the transition to low and zero emissions transportation while supporting alternatives to single-occupancy vehicles and strengthening local infrastructure.



- **Natural Environment:** Protecting and enhancing natural resources while directing development to protect vulnerable people and places.



- **Health, Safety, and Well Being:** Ensuring the health and safety of Biddeford's community members and increasing overall community resilience.



- **Leadership and Support:** Building support and cooperation for climate action between municipal staff, community members, and partner organizations.

Guiding Criteria

To assess and prioritize actions that align with Biddeford's values and priorities, we used a framework that incorporates six guiding criteria.

Primary Criteria

Effective

Does this action reduce GHG emissions, reduce vulnerability, is effective in supporting overarching goals?

Efficient

Does this action maximize benefits relative to costs or efficient resources needed to enact it?

Equitable

Are the costs, benefits of this action distributed fairly?

Does this action minimize harm to the most vulnerable groups?

Secondary Criteria

Meets Community Needs

Does this action address other identified community needs (e.g. housing, infrastructure, service)?

Wider Co-benefits

Does this action provide broader benefits for health, social co-benefits, health and well-being, the environment, or the economy?

Feasible

Does this action have the necessary conditions to enable feasibility implementation (e.g. financing, public support, political will)?



Connection to Climate Change

The electricity, natural gas, and/or oil that we use in our homes, businesses, institutions, and municipal facilities result in over half of greenhouse gas emissions in Biddeford. We must enhance energy efficiency and switch our building systems and appliances over to electricity that is sourced from clean, low carbon energy. At the same time, we need to ensure that our buildings and energy systems are resilient to increasing climate hazards like storms, sea level rise, and extreme precipitation.

Our Goals

- Foster energy efficiency programs that reduce vulnerability to volatile fossil fuel prices.
- Reduce emissions by electrifying buildings and energy systems.
- Bolster the resilience of neighborhoods and critical facilities to natural disasters.

Where We Stand

- Taking steps to reduce municipal fossil fuel consumption and implement municipal energy efficiency measures.
 - Performed energy audits and efficiency upgrades of municipal facilities in 2007-2009
 - Upgraded lighting in municipal facilities in 2007-2009
 - Installed a solar wall at the Biddeford public works garage
 - Installing new windows in City Hall as part of renovations
 - Upgrading streetlight equipment to LEDs
- Promoting energy efficiency for residents and businesses
 - The Climate Task Force conducts outreach to residents and businesses
 - The City is developing a community weatherization program for low-income residents
- Enabling the development of and access to renewable energy
 - The City set an electrical permit fee for alternative energy resources of \$1 per kilowatt



Solar Comes to May Street. PhotoVoice Contest 2023 Entry.



Raise or Raze. PhotoVoice Contest 2023 Entry.

How We'll Get There

How to Read the Action Tables

- ★ Priority - Identified through public engagement
- Associated goal/action in Comprehensive Plan
- Potential Regional Action

Timeframe

Short = 1–2 years
 Medium = 3–4 years
 Long = 5+ years

Costs:

Low = \$
 Medium = \$\$
 High = \$\$\$

Action Description	Additional Benefits	Equity Considerations	Timeframe to Implement	Cost
Building Electrification				
B1. Renewable Energy				
★ Encourage and incentivize small scale renewable energy installation, such as rooftop solar panels.	• Cost Savings • Local Economy • Education • Job Creation	Connect low-income homeowners to programs with reduced upfront costs; support multi-family solar development.	Medium	\$
B2. Building Electrification				
● Shift existing buildings & new construction to all-electric heating and appliances.	• Cost Savings • Local Economy • Education • Air Quality • Job Creation	Prioritize and support low-income homeowners, multi-unit properties, homes using fuel oil.	Medium	\$\$
Building Energy Efficiency				
B3. Energy Efficiency				
★ Increase efficiency of large buildings and rental properties through local ordinances and standards. Includes standards to increase efficiency over time, programs to track and disclose energy consumption, and efficiency standards for rentals.	• Cost Savings • Education • Air Quality • Job Creation	Rental efficiency standards enhance equity by reducing energy costs for non-homeowners.	Medium	\$\$
B4. Maine 'Stretch Code'				
● Adopt the most up-to-date building codes (also known as "stretch codes") to help new buildings to be more efficient.	• Local Economy • Air Quality • Job Creation	Higher upfront costs, but buildings are more efficient and healthier.	Short	\$\$
B5. Building Weatherization				
● Create a program to help single family homes increase energy efficiency through weatherization efforts.	• Cost Savings • Local Economy • Air Quality • Job Creation	Prioritize and support low income weatherization programs.	Medium	\$

Action Description	Additional Benefits	Equity Considerations	Timeframe to Implement	Cost
Building Energy Efficiency (continued)				
B6. Municipal Energy Efficiency				
 Increase municipal energy efficiency through energy audits, renewable energy installation, and energy efficiency measures for all municipal facilities.	Cost Savings	Target buildings that provide public services to vulnerable community members.	Medium	\$ \$
Building Resilience				
B7. Risk Management				
 Reduce climate risks to buildings through improved information, education, and action, including. Requiring hazard disclosures for property transactions; Increasing awareness of adaptation options; Encouraging actions to manage flood risks.	Education	Risk reduction measures can prevent upfront costs for low income residents.	Short	\$
B8. Limit Reconstruction & Encourage Relocation				
 Limit reconstruction and/or encourage relocation of buildings damaged by hazards that are expected to recur or intensify with climate change.	- Cost Savings - Smart Growth - Greenspace and Recreation	Limit cost burdens and provide extra support to disadvantaged community members.	Long	\$
B9. Resilient Design Standards				
 Encourage or require new and redeveloped buildings to include sustainable and resilient design measures, especially in flood-prone areas.	- Cost Savings - Smart Growth - Community Development	Limit cost burdens and provide extra support to disadvantaged community members.	Short	\$
B10. Critical Facility Resilience				
 Increase the resilience of critical facilities such as our wastewater treatment facility through risk reduction or relocation.	- Education - Community Development		Long	\$ \$ \$

Action Description	Additional Benefits	Equity Considerations	Timeframe to Implement	Cost
Energy Resilience				
B11. Maintain Power at Critical Facilities				
Develop and implement a plan for maintaining power at critical facilities during power outages.	- Cost Savings - Education - Job Creation	Target facilities that provide public services to vulnerable community members (police, fire, healthcare, etc).	Long	\$\$\$
B12. Improve Grid Resilience				
 Work with power companies and state agencies to advocate for efforts to improve the resilience of the electrical grid.	- Local Economy - Education - Job Creation	Power outages have disproportionate negative effects on vulnerable populations, especially people who are older or who have health conditions.	Long	\$ - \$\$

How We'll Measure Success



Focus Area

Building Electrification	Number of permits issued for rooftop solar
	Percent of buildings using heating oil, natural gas, propane or coal
	Electrify 15% of existing homes using heating oil or propane every year
Building Energy Efficiency	Number of buildings participating in energy efficiency programs
	Perform energy efficiency retrofits to 15% of existing housing stock every year
	Perform energy efficiency retrofits to 15% of existing commercial square footage every year
	Total annual municipal energy use
	Most up-to-date energy code adopted
Building Resilience	Assess resilience needs for municipal facilities by 2027
	Number of "substantial improvement" or "substantial damage" floodplain permits issued
Energy Resilience	Municipal Power Plan created by 2024
	Frequency, duration, location, and causes of power outages



Do you want to learn more?

See the full Buildings and Energy Action matrix in the appendix to learn more about an action.



TRANSPORTATION AND INFRASTRUCTURE

FACILITATING THE TRANSITION TO LOW AND ZERO EMISSIONS TRANSPORTATION WHILE SUPPORTING ALTERNATIVES TO SINGLE-OCCUPANCY VEHICLES AND STRENGTHENING LOCAL INFRASTRUCTURE.

Connection to Climate Change

Our travel choices have a big impact on climate change, especially when most of us drive alone in gas or diesel vehicles to commute. Transportation emissions make up almost half of Biddeford's GHG emissions. We must create a sustainable transportation system that prioritizes safe, accessible, clean options for travel, including public transportation, bicycling, and walking. At the same time, we need to ensure that Biddeford's infrastructure, including roads, bridges, and wastewater systems, are resilient to increasing climate hazards like storms, sea level rise, and extreme precipitation.

Our Goals

- Enhance active mobility (walking and biking) and public transit as alternatives to single-occupancy vehicle use to improve health, safety, and accessibility.
- Reduce emissions by electrifying public and private vehicles.

Where We Stand

- Promoting and facilitating transit systems
 - Biddeford works closely with Biddeford-Saco-Old Orchard Beach Transit (BSOOB Transit). BSOOB has two all-electric buses and is acquiring two more.
- Promoting and facilitating pedestrian and bike networks
 - Biddeford has many current projects to address bikeability and walkability throughout the city and particularly in the downtown area. These include:
 - Hill, Water, and Main Street intersection redesign
 - Pearl Street Redevelopment
 - RiverWalk extensions
 - Pearl, Elm, and Spruce Street intersection review and potential redesign
 - A proposed pedestrian and bike bridge that would connect Pearl Street to the Saco Transportation Center
 - Extension of the Eastern Trail through downtown Biddeford to connect existing portions in Biddeford and Saco
 - Rotary Park bicycle and pedestrian connections
- Pursuing transit oriented development and transit-supportive land uses in new development
 - Biddeford worked with Saco and PACTS to put together a Transit-Oriented Development Plan in 2023.
- Supporting the adoption of EVs by leading by example with the municipal fleet and facilities
 - Biddeford installed 2 EV charging stations outside city hall.
 - Biddeford is leasing EVs for municipal use.



Recycle with Bicycle. PhotoVoice Contest 2023 Entry



EV Charing Station. PhotoVoice Contest 2023 Entry.

How We'll Get There

How to Read the Action Tables

- ★ Priority - Identified through public engagement
- Associated goal/action in Comprehensive Plan
- Potential Regional Action

Timeframe

Short = 1–2 years
 Medium = 3–4 years
 Long = 5+ years

Costs:

Low = \$
 Medium = \$\$
 High = \$\$\$

Action Description		Additional Benefits	Equity Considerations	Timeframe to Implement	Cost
Reduce Vehicle Miles Traveled					
T1. Public Transit					
★ ●	Expand access to and use of public transit services.	• Cost Savings • Local Economy • Mobility Improvement • Water and Air Quality	Public transit is an essential public service, especially for more vulnerable community members and those without a vehicle.	Medium	\$\$-\$\$\$
T2. Increase Walkability					
★	Improving the “walkability” of our city’s roadways through a safe, comfortable, and convenient network of pedestrian walkways.	• Cost Savings • Education • Mobility Improvement • Air Quality • Greenspace and Recreation	Incorporate equity into decisions about where to invest in pedestrian infrastructure.	Long	\$\$\$
T3. Increase Bikeability					
★	Improve the “bikeability” of our city’s roadways with safe, comfortable, and convenient networks of bikeways and bike-related infrastructure.	• Cost Savings • Education • Mobility Improvement • Air Quality • Greenspace and Recreation	Incorporate equity into decisions about where to invest in bicycle infrastructure.	Long	\$\$
T4. Transit-Oriented Development					
★	Concentrate housing, business, and leisure activities within easy walking distance to public transit in new development.	• Cost Savings • Local economy • Mobility Improvement • Smart Growth • Greenspace and Recreation • Job Creation • Community Development	Strategies must be put in place to ensure that TOD doesn't lead to gentrification and displacement but instead increases equity outcomes.	Long	\$\$\$

Action Description	Additional Benefits	Equity Considerations	Timeframe to Implement	Cost
Reduce Vehicle Miles Traveled (continued)				
T5. Reduce Single-Occupancy Vehicle Trips				
 Assess methods to reduce single-occupancy vehicle trips made by municipal staff.	• Cost Savings • Education • Air Quality		Short	\$
T6. Direct Development				
Decrease the need for private vehicles by reducing sprawl by directing new development to areas where services are easily accessible and reducing minimum parking requirements.	• Local Economy • Mobility Improvement • Smart Growth • Community Development	Ensure decisions about where to direct development consider equity and pair these with programs and opportunities that support current residents.	Medium	\$\$
Resilient Infrastructure				
T7. Protect Critical Infrastructure				
 Protect critical infrastructure such as wastewater treatment (WWTP) and evacuation routes from climate change hazards.	• Cost Savings • Community Development	Biddeford's WWTP is located in an area with elevated social vulnerability, meaning that public health impacts from failures would be borne by more disadvantaged community members.	Long	\$\$\$
T8. Vulnerability Assessment				
  Assess the vulnerability of transportation infrastructure to the impacts of heat, groundwater rise, and saltwater intrusion caused by sea level rise.	• Cost Savings • Smart Growth		Medium	\$\$
T9. Build Infrastructure Resilience				
 Modify roads, culverts, and bridges to increase their resilience to flooding, sea level rise, and other climate hazards, including raising, relocating, and/or upsizing.	• Local Economy • Mobility Improvement	Incorporate equity into decisions about where to invest in infrastructure upgrades.	Long	\$\$\$
Support Electric Vehicles				
T10. Encourage Transition to Electric Vehicles				
  Streamline permitting, install public EV chargers, require EV chargers in new development, and transition city fleets to EV.	• Cost Savings • Smart Growth	Reduce barriers to EVs and EV charging stations that have historically benefitted wealthier community members.	Short	\$ - \$\$

How We'll Measure Success



Focus Area	Performance Indicator
Reduce Vehicle Miles Traveled	BSOOB ridership, number of routes, number of bus stops
	Miles of "Complete Streets"
	Miles driven in municipal vehicles
	Number of Density Bonus approvals
	Reduce Vehicle Miles Traveled 25% by 2030
Resilient Infrastructure	Initiate the identification of vulnerable critical infrastructure by 2026
	Assessment of vulnerable infrastructure (in partnership with Public Works) complete by 2026
Support Electric Vehicles	Number of EV charging stations in Biddeford
	Number of EVs registered in Biddeford
	Increase total vehicle miles traveled by Electric Vehicles 30% by 2030
	Increase total Vehicle Miles Traveled by Electric Vehicles replacing diesel vehicles 15% by 2030.



Do you want to learn more?

See the full Transportation and Infrastructure matrix in the appendix to learn more about an action.



BSOOB has several electric buses.



LAND USE AND NATURAL ENVIRONMENT

PROTECTING AND ENHANCING NATURAL
RESOURCES WHILE DIRECTING DEVELOPMENT TO
PROTECT VULNERABLE PEOPLE AND PLACES.

Connection to Climate Change

Land use is how the physical world is modified or put to use for our purposes, while the natural environment includes all aspects of healthy and functioning ecosystems. How we use the land directly relates to how the natural environment is able to withstand and adapt to climate change impacts. We must ensure that Biddeford's land use policies and regulations protect the natural environment and encourage sustainable, healthy relationships with the land. In doing so our community will gain many resilience benefits, including cooling (through shade and evapotranspiration), reduction and filtration of stormwater runoff, and carbon sequestration— the removal of GHGs from the atmosphere.

Our Goals

- Implement land use policies that foster sustainable food production and reduce the impact of development on the natural world.
- Commit city ordinances and plans to limiting our carbon footprint and to protecting the natural environment.

Where We Stand

- Integrating climate resilience measures in zoning and development standards to address climate impacts
 - Adopting a model Low Impact Development (LID) stormwater ordinance
 - Establishing a minimum buffer requirement near waterways and wetlands
- Limiting growth and development in areas vulnerable to sea level rise and flooding
 - Biddeford is removing the Coastal Residential Zone from the growth areas in the Future Land Use Plan of the Biddeford Comprehensive Plan.
- Managing community forests and open space for long term resilience
 - Biddeford has an Open Space Plan from 2012 that guides conservation efforts.
- Partnering with local and regional land trusts for strategic land conservation and management of those lands
 - Biddeford works with the Biddeford Pool Land Trust and Saco Valley Land Trust.
- Managing and restoring the Thatcher Brook Watershed
- Biddeford has a management plan for the Thatcher Brook Watershed, which is the basis of several ongoing restoration projects. See the [story map here](#).



Biddeford (Tide)Pool. PhotoVoice Contest 2023 Entry.



Mullein. PhotoVoice Contest 2023 Entry.

Where We Stand

- Educating the community about the value of trees and native, climate resilient, and sustainable landscaping
- Education and outreach led by Project Canopy and the Conservation Commission. The city also works with YardScapes.
- Supporting pollinators for ecosystem resilience
 - This year was the 5th annual Spring Pollinator Festival hosted by Biddeford Community Gardens.
 - Biddeford signed on to the Mayor's Monarch Pledge and undertook actions to promote pollinator habitat.
- Supporting local food systems
 - Biddeford Community Garden runs a thriving network of community gardens and programming to support local foods.
- Working to enable and incentivize climate resilient and compact, mixed-use development
 - Promoting infill development in downtown area
 - Ensuring zoning allows for mixed use development where appropriate
 - Working to promote housing diversity and affordability



Mother's Forest. PhotoVoice Contest 2023 Entry.

How We'll Get There

How to Read the Action Tables

- ★ Priority - Identified through public engagement
- Associated goal/action in Comprehensive Plan
- Potential Regional Action

Timeframe

Short = 1-2 years
Medium = 3-4 years
Long = 5+ years

Costs:

Low = \$
Medium = \$\$
High = \$\$\$

Action Description	Additional Benefits	Equity Considerations	Timeframe to Implement	Cost
Protect Natural Resources				
LN1. Sustainable Landscaping				
★ Create and enforce climate resilient and sustainable landscaping approaches, including eliminating the use of fertilizers, herbicides, and pesticides, especially in city parks and green spaces.	• Cost Savings • Water Conservation • EducationWater and Air Quality • Greenspace and Recreation • Job Creation • Community Development	Historically disadvantaged neighborhoods often have less tree canopy to cool properties and offset heat island effects.	Medium	\$

Action Description	Additional Benefits	Equity Considerations	Timeframe to Implement	Cost
Protect Natural Resources (continued)				
LN2. Protect Vulnerable Areas				
 Conserve areas of the city that are vulnerable to climate hazards, as well as those that help to minimize climate risks through carbon storage and flood reduction.	• Education • Water and Air Quality • Greenspace and Recreation	The benefits of conservation may come at a cost to communities. Conserved areas should be identified, protected, and governed equitably.	Long	\$ \$
LN3. Nature Based Solutions				
 Promote and enable "nature-based solutions," such as the restoration of sand dunes or wetlands, to protect shorelines and coastal property from flooding and erosion.	• Cost Savings • Local Economy • Mun. Revenue Enhancement • Water Conservation • Education • Water Quality • Greenspace and Recreation • Job Creation	Nature based solutions should be identified, implemented, and managed equitably.	Long	\$ \$
LN4. Restoration of Natural Habitats				
Promote the restoration or enhancement of natural habitats for biodiversity and wildlife protection.	• Water Conservation • Education • Water and Air Quality • Greenspace and Recreation	The benefits of habitat restoration may come at a cost to communities. Restoration projects should be identified, managed, and governed equitably.	Long	\$ \$
Sustainable and Resilient Development				
LN5. Sustainable Food Systems				
 Promote and expand local and resilient food systems through sustainable practices such as actions that improve soil health and that store carbon.	• Local Economy • Education • Smart Growth	Resilient food systems must be accessible to all no matter their income or neighborhood.	Long	\$ \$
LN6. Mixed-Use Zoning				
 Implement zoning to allow a blend of residential and commercial uses in some areas of the city, in order to reduce sprawl and make neighborhoods more walkable.	• Local Economy • Mun. Revenue Enhancement • Education • Mobility Improvement • Smart Growth • Community Development	The city must consider how investments can be paired with affordability to ensure equitable access to livable, walkable areas.	Medium	\$

Action Description	Additional Benefits	Equity Considerations	Timeframe to Implement	Cost
Sustainable and Resilient Development (continued)				
LN7. Direct Development				
Direct development away from areas of the city that are exposed to climate-related risks, including sea level rise, erosion, and inland flooding.	• Mun. Revenue Enhancement • Smart Growth • Greenspace and Recreation • Community Development	Evaluate potential policies and regulations for their impact on socially vulnerable and traditionally marginalized populations.	Long	\$ - \$\$
LN8. Land Use Ordinance Review				
 Conduct a review of the city's land use ordinances and policies to identify changes needed to include climate resilience and sustainability measures and standards.	• Mun. Revenue Enhancement • Water Conservation • Education • Mobility Improvement • Smart Growth • Water and Air Quality • Greenspace and Recreation • Community Development	Review should explicitly incorporate equity, taking steps to avoid or "undo" unfair outcomes and mitigate the unequal ability to participate in or influence all parts of the zoning process.	Short	\$
LN9. Encourage Development in Appropriate Areas				
Encourage development in appropriate areas that are already developed, have public services (e.g., water and sewer), and are less vulnerable to natural hazards.	• Cost SavingsSmart GrowthGreenspace and RecreationCommunity Development	Can lead to the displacement of residents with lower incomes, especially if concentrated development results in increased demand.	Short	\$



Walmarshland. PhotoVoice Contest 2023 Entry.

How We'll Measure Success



Focus Area	Performance Indicator
Protect Natural Resources	City ordinance to reduce use of pesticides, insecticides, and herbicides
	Number of community members contacted with educational materials
	Acres of land in conservation areas
	Acres of preserved and revegetated wetlands
	Work with regional partners to identify conservation and climate resilience priorities by 2026
	Number and type of non-native species removed
	Number of community gardens per resident
	Number of acres of productive farmland and forest land
Sustainable and Resilient Development	Average distance of new housing to critical services (food, schools, etc.)
	Area of newly designated Limited Growth Areas
	Area of Overlay districts that protect hazard areas from development
	Number of new housing units created in the three Main Street Revitalization District zones (MSRD-1, MSRD-2, MSRD-3)
	Land Use Ordinance review completed



Do you want to learn more?

See the full Land Use and Natural Environment matrix in the appendix to learn more about an action.



HEALTH, SAFETY, AND WELL BEING

ENSURING THE RESILIENCE OF OUR COMMUNITY
TO CLIMATE-RELATED PUBLIC HEALTH HAZARDS
WHILE INCREASING COMMUNITY WELL BEING.

Connection to Climate Change

The impacts of climate change are heavily intertwined with public health and safety. Climate hazards like sea level rise, increasing tick populations, and increases in extreme heat will all affect our community, particularly our most vulnerable community members. We must ensure that Biddeford is prepared to respond to increasing public health hazards. We must also work to increase community resilience and meet all community members' needs for safe drinking water, housing, and green space.

Our Goals

- Ensure the health and safety of everyone in the Biddeford community to climate change hazards, especially those who are most vulnerable.
- Ensure community resilience to climate change through the expansion of public resources and affordable housing.

Where We Stand

- Maintaining a sustainable waste system that prioritizes reducing, reusing, and recycling waste
 - Partnered with We Compost It! to provide a free composting program at the Recycling Center for all Biddeford residents.
 - Implemented a Pay as You Throw trash system to reduce the amount of waste ending up in the trash
 - Revised the solid waste ordinance to allow for the revoking of recycling privileges to ensure a clean recycling stream
- Supporting residents during extreme temperatures
 - The City has partnered with Seeds of Hope to open a heating center (J. Richard Martin Community Center) and a cooling center (at Seeds of Hope)
- Preparing for extreme weather events
 - Biddeford is a part of a mutual aid agreement (police/fire/rescue/public works) with the communities of Saco, Arundel, Old Orchard Beach, Lyman, Kennebunk and Kennebunkport
 - Biddeford conducts emergency management tabletop exercises, like for ice storms and hurricanes.
- Supporting affordable housing
 - Biddeford had an Ad Hoc Housing Committee to address the pressing needs of new housing in the community.
 - Biddeford created the Diversity, Inclusion and Equity Committee



Will These Trees Be Here Tomorrow?
PhotoVoice Contest 2023 Entry



Downtown Biddeford is a heat island, but few bus stops have shade.

How We'll Get There

How to Read the Action Tables

★ Priority - Identified through public engagement

● Associated goal/action in Comprehensive Plan

● Potential Regional Action

Timeframe

Short = 1-2 years

Medium = 3-4 years

Long = 5+ years

Costs:

Low = \$

Medium = \$\$

High = \$\$\$

Action Description	Additional Benefits	Equity Considerations	Timeframe to Implement	Cost
Community Resilience/Disaster Preparedness				
H1. Resilience Hubs				
Establish a designated site to serve as a "resilience hub" that can provide critical services to residents during climate related emergencies or disruptions.	- Education - Community Development	Hubs should be in well-trusted community facilities. Hubs can serve as community gathering places and "community centers."	Medium	\$\$\$
Disaster Preparedness				
H2. Improve Disaster Planning				
● Improve disaster planning and response to be better prepared for climate change risks, including early warning systems and community evacuation plans.	Education	Ensure that public health outreach systems reach the most vulnerable community members.	Long	\$\$
H3. Climate Hazard Training				
● Provide emergency responders and medical providers with training about the types of illnesses that might occur as a result of climate hazards.	Education	Climate hazards will have a disproportionate impact on already vulnerable community members.	Short	\$
H4. Public Health Outreach				
● Conduct outreach about public health advisories for climate-related health impacts and weather events.	Education	Ensure that public health outreach systems reach the most vulnerable community members.	Medium	\$
Health and Safety				
H5. Affordable Housing				
★ Encourage and support the creation of resilient, energy-efficient, and low-carbon affordable housing.	- Local Economy - Mun. Revenue Enhancement - Smart Growth - Job Creation - Community Development	Affordable housing can protect tenants from rising costs and displacement.	Long	\$\$\$

Action Description	Additional Benefits	Equity Considerations	Timeframe to Implement	Cost
Health and Safety (continued)				
H6. Ensure Safe Drinking Water Supply				
★ ● Ensure the safety and quality of drinking water supplies, including through assessment and management of climate change impacts to septic systems and wells.	- Water Conservation - Water Quality Improvement - Community Development	Prioritize vulnerable and disadvantaged communities who have been historically been left out of decisions and opportunities for water infrastructure upgrades.	Medium	\$ - \$\$
H7. Shade Structure Ordinance				
★ Develop an ordinance to require shade structures (covered bus stops, gazebos, etc.) on city-owned properties.	Greenspace and Recreation	Access to shade for vulnerable community members is critical for preventing heat related illness.	Short	\$
H8. Tree Ordinance				
★ Develop an ordinance to increase tree canopy both on city-owned and private property.	Greenspace and Recreation	Tree canopy can reduce temperatures in vulnerable neighborhoods where copious hardscaping (concrete, asphalt) creates a heat island effect.	Short	\$
H9. Monitor Vector-Borne Diseases and Invasive Species				
● Explore options for monitoring and managing pests, like ticks and mosquitoes, that are associated with increases in diseases (e.g. Lyme disease) using natural and ecologically sound methods.	Education and Awareness	Vector-borne diseases more negatively impact younger and older community members and those without easy access to healthcare.	Medium	\$\$



How We'll Measure Success



Focus Area	Performance Indicator
Community Resilience/Disaster Preparedness	Number of designated resilience hubs in operations; number of users
Disaster Preparedness	Number and types of preparedness plans in place
	Hold annual trainings with Fire/Rescue and PD by 2026
	Number of emergency responders trained for climate-related illnesses
	Begin quarterly outreach and hazard-specific warnings by 2026
	Number of climate advisories distributed
	Number of affordable housing units created
Health and Safety	Number of private wells tested
	Number of shade structures
	Percent of transit stops with adequate shade structures
	Number of trees planted and monitored
	Number of property owners contacted with educational materials on invasive and native species
	Vector Borne disease rate reduction



73% of survey respondents indicated they were "Most Concerned" about climate related health risks.



Do you want to learn more?

See the full Health, Safety, and Well Being matrix in the appendix to learn more about an action.



LEADERSHIP AND SUPPORT

ENSURING OUR CITY HAS THE RESOURCES AND SUPPORT TO IMPLEMENT CLIMATE ACTIONS.

Connection to Climate Change

Biddeford's City government will be instrumental in providing leadership, resources, and accountability to implement our CAP. The City will work to ensure that departments and community members have the support and information to achieve the goals laid out in this plan.

Our Goals

- Ensure Biddeford City government has the funding, dedicated staff, and skills to address climate change effectively, efficiently, and equitably.
- Engage community members and regional partners to broaden the impact of resiliency actions.

Where We Stand

- Working with regional/national partners to address climate change
 - Biddeford is an active member of ICLEI - Local Governments for Sustainability
 - Biddeford has partnered with UNE on climate related projects
- Expanding municipal capacity to address climate change
 - Biddeford has the Climate Task Force, a formal municipal committee that supports the city's climate action planning efforts
- Formally adopting climate change goals, policies, and strategies
 - Biddeford adopted a Climate Emergency Resolution in 2020
 - Biddeford signed on to the ICLEI Race to Zero in 2022 and formally adopted emissions reduction targets and goals
- Incorporating climate change into city plans, policies, and regulations
 - Biddeford incorporated climate change into the Comprehensive Plan update. This includes a chapter on climate change.



Life on the Coast. PhotoVoice Contest 2023 Entry



Events like the PhotoVoice Contest are a great way to hear from community members.

How We'll Get There

How to Read the Action Tables

- ★ Priority - Identified through public engagement
- Associated goal/action in Comprehensive Plan
- Potential Regional Action

Timeframe

Short = 1-2 years
 Medium = 3-4 years
 Long = 5+ years

Costs:

Low = \$
 Medium = \$\$
 High = \$\$\$

Action Description	Additional Benefits	Equity Considerations	Timeframe to Implement	Cost
Community Outreach				
LS1. Create Climate Commission				
★ Create a municipal Climate Commission made up of city residents to assist with the implementation of the Climate Action Plan.	• Cost Savings • Local Economy • Education	The climate commission can weave equity considerations into all future climate actions to ensure that all people will benefit equally.	Short	\$
LS2. School Curricula				
★ Support local schools to include climate change and sustainability in school curricula.	• Education		Short	\$
LS3. Climate Change Training				
Provide climate change training for municipal boards, commissions, and committees.	• Education		Short	\$
Municipal Operations and Funding				
LS4. Create Position of Sustainability Coordinator				
★ Create a municipal Office of Sustainability and position of Sustainability Coordinator, whose mandate will be to implement the Climate Action Plan.	• Cost Savings • Local Economy • Water Conservation • Education • Mobility Improvement • Smart Growth • Water Quality Improvement • Greenspace and Recreation • Community development	A Sustainability Coordinator can weave equity considerations into all future climate actions to ensure that all people, regardless of age, race, income, etc., will benefit equally from progress made toward resiliency.	Short	\$\$

Action Description		Additional Benefits	Equity Considerations	Timeframe to Implement	Cost
Municipal Operations and Funding (continued)					
LS5. Establish Local Climate Funding					
	Establish local funding mechanisms to support implementation of the Climate Action Plan.	- Local Economy - Education - Water Quality Improvement - Greenspace and Recreation - Community development	Evaluate potential policies for their impact on socially vulnerable populations. Consider how use of funds could perpetuate disparities. Ensure there is transparency and community input in the decision making process.	Medium	\$ - \$\$
LS6. Include Climate in Municipal Investments					
★	Incorporate climate resilience and carbon emission measures into planned investments for city-owned infrastructure and equipment.	- Cost Savings - Smart Growth - Community development	Evaluate potential policies for their impact on socially vulnerable populations. Consider how use of funds could perpetuate disparities. Ensure there is transparency and community input in the decision making process.	Medium - Long	\$
LS7. Include Climate Considerations in Decision-Making					
	Incorporate future climatic conditions in land use planning and municipal policies.	- Cost Savings - Local Economy - Mun. Revenue Enhancement - Water Conservation - Education Mobility Improvement - Smart Growth - Water Quality Improvement - Greenspace and Recreation - Community development	Evaluate potential policies for their impact on socially vulnerable populations. Consider how use of funds could perpetuate disparities. Ensure there is transparency and community input in the decision making process.	Medium	\$ - \$\$
LS8. Build Municipal Capacity					
	Ensure municipal departments have the resources, guidance, and support to implement the Climate Action Plan.		Trainings for staff should include the ways that historically disadvantaged and vulnerable populations are more vulnerable to climate change impacts and should be incorporated with equity training.		\$ - \$\$

How We'll Measure Success



Focus Area	Performance Indicator
Community Outreach	Climate Commission created and operational by early 2024
	Hire an intern or AmeriCorps Volunteer to assist with CAP implementation
	Number of community engagement events conducted by 2026
	Establish relationships with appropriate school staff by 2025 and create relevant curricula by 2026.
	Number of teachers who incorporate climate and sustainability issues into lesson plans
	Present annually to all boards and commissions by 2025
	Create ongoing training materials and an online resource for boards and commissions by the end of 2026
	Number of commission, board and committee members engaged in climate training; Number of educational events conducted
Municipal Operations and Funding	Create Sustainability Coordinator Position by 2025
	Annual appropriations to new Climate Action Fund for climate action implementation
	Annual investment for Climate-related capital improvements
	Amount of funding for climate action implementation from federal, state, or private sources
	Number of state or regional climate initiatives undertaken
	Report annually to staff and City Council on climate progress



Do you want to learn more?

See the full Leadership and Support matrix in the appendix to learn more about an action.

CONCLUSION



WHAT'S NEXT

One of our priority actions in our plan is to request that City Council create a new Climate Commission. If approved by Council, this commission will work with city staff, boards, committees, and commissions to oversee the implementation of the actions outlined here, specify a timeline to achieve these actions, and designate partners we need to make consequential progress.

We will also increase participation in regional action, policy development, and climate advocacy. Through the Southern Maine CAP Cohort, we've been working with the Towns of Kittery, Kennebunk, and Kennebunkport to identify potential regional actions on which our communities could collaborate and coordinate. Part of our work will be exploring ways these actions and others can be implemented with regional coordination and support.



Potential Regional Strategies

Buildings and Energy



- **Building Electrification (B2) and Building Weatherization (B3)** - Supported through a regional incentive program.
- **Risk Management (B7)** - Advocate regionally for flood disclosure requirements for property transactions.
- **Improve Grid Resilience (B12)** - Support regional-level planning in cooperation with utilities and state agencies to increase regional grid resilience.

Transportation and Infrastructure



- **Public Transit (T1)** - Work regionally to expand transit connecting our communities.
- **Vulnerability Assessment (T8)** - SMPDC and regional transportation agencies could lead a regional assessment of transportation infrastructure vulnerability.
- **Encourage Transition to Electric Vehicles (T10)** - Coordinate regionally and with the state on the distribution of public EV charging stations.

Land Use and Natural Resources



- **Sustainable Landscaping (LN1)** - Advocate regionally for statewide limits on residential use of fertilizers, pesticides, and herbicides, particularly in shoreland areas.

Leadership and Support



- **School Curricula (LS2)** - Advocate regionally for inclusion of climate change and resiliency into core curricula requirements.
- **Climate Change Training (LS3)** - Work with SMPDC to develop and deliver climate change training that is applicable to municipal councils, boards, commissions, and committees throughout the region.

LOOKING AHEAD

Southern Maine is a rapidly changing region, and Biddeford is no exception. With the development of new technologies, shifting populations, and a changing climate, it is vital that the actions and timelines we've laid out in this CAP are adaptable to future conditions. **Our CAP is a dynamic document that we will constantly refer to and revise when necessary and appropriate to determine the best path forward to make progress on our climate goals.** We will also hold ourselves accountable to report on our progress in meeting our milestones and targets.

Pending Council approval of a Climate Commission, this commission will report annually to Council and city staff to provide progress made toward the goals and targets outlined in this plan. Biddeford's Greenhouse Gas Emission Inventory will be updated every 2 to 4 years as recommended by ICLEI, and this plan will be updated and revised within 3 years of adoption to document accomplishments and adjust goals and actions as needed.

We would not have been able to create this plan without years of momentum-building climate initiatives in Biddeford. It is our hope that this momentum will carry forward and will bring the changes needed to make Biddeford a more resilient community for all. Success with this plan will depend on the time, effort, and other resources we can put toward achieving significant change. If each of us makes a small effort, we can more easily accomplish the work before us.

How To Stay Involved

Stay up-to-date on the work we are doing on climate and the progress we make through the City of Biddeford's Climate Newsletter. We also will report our progress at our.biddefordmaine.org, where you can offer suggestions and stay connected.



APPENDICES



BIDDEFORD

CLIMATE CHANGE VULNERABILITY ASSESSMENT SUMMARY

CONTENTS

INTRODUCTION.....	3
Key Takeaways	4
SOCIAL VULNERABILITY	5
Demographic Profile	6
Key Takeaways	7
SUPPLEMENTAL COMMUNITY INFORMATION	20
Climate Gentrification.....	22
Housing Characteristics.....	22
Key Takeaways	22
Age of Buildings	27
Household Heating Fuel Types	28
Key Takeaways	28
Zoning.....	34
Land Cover and Carbon Sequestration	35
EXTREME STORMS & PRECIPITATION	36
Key Takeaways	36
Background Info, Trends, & Projections	37
Power Outages and Electric Grid Resilience	43
FLOODING: SEA LEVEL RISE AND STORM SURGE	46
Key Takeaways	46
Background Info, Trends, & Projections	47
Property Impacts	51
Infrastructure Impacts	52
Impacts to the Natural Environment.....	60
EXTREME TEMPERATURES & AIR QUALITY	62

Key Takeaways	63
Background Information, Trends, & Projections	63
Urban Heat Islands	65
Public Health Impacts.....	67
Impacts to the Natural Environment.....	70
DROUGHT & WILDFIRES.....	71
Key Takeaways	71
Background Info, Trends, & Projections	72
Water Supply Impacts	74
Impacts to the Natural Environment.....	77
Agricultural Impacts.....	79
CHANGING MARINE CONDITIONS.....	80
Key Takeaways	80
Background Info, Trends, & Projections	81
Habitat Shifts and Carbon Sinks	82
Economic Impacts.....	85

INTRODUCTION

One of the first steps to understanding how communities can plan for and address climate change impacts is to assess climate hazards that are projected to impact an area as well as the things, people, and places that are vulnerable to those hazards. **Climate**

vulnerability is commonly defined as the product of **exposure** to climate hazards, **sensitivity** of the built, social, and natural systems to those hazards, and the **adaptive capacity** of those systems for responding to change and stressors (Figure 1). The more sensitive something or someone is to a hazard and the lower their adaptive capacity to respond to the hazard, the greater their

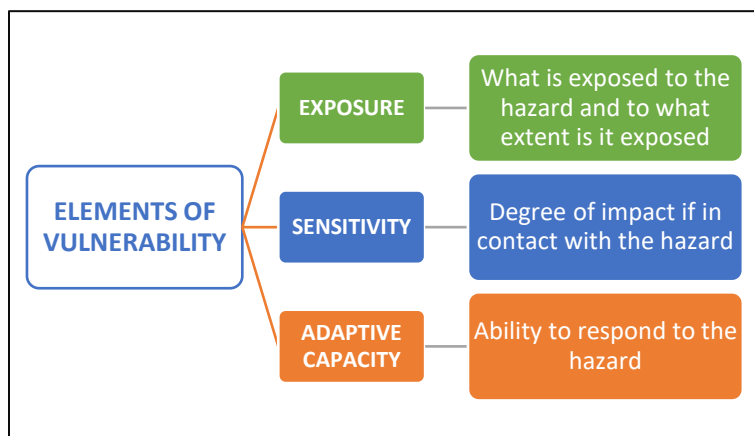


Figure 1. Diagram of the elements of vulnerability.

vulnerability (Figure 2). Vulnerability also increases as exposure to the hazard does.

Evaluating vulnerabilities, including what will be impacted by climate hazards, and to what extent those impacts will occur, provides a baseline for developing targeted strategies, measures, and solutions for reducing vulnerabilities.

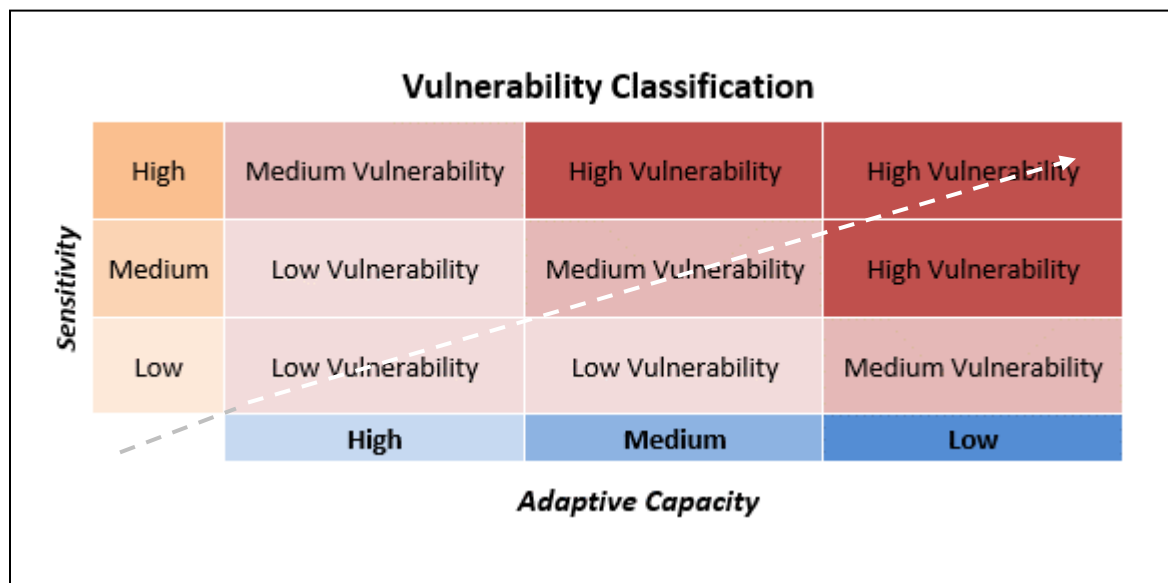


Figure 2. Higher sensitivity and lower adaptive capacity contribute to greater vulnerability. Figure adapted from NOAA 2022. Implementing the Steps to Resilience: A Practitioner's Guide.

This draft vulnerability assessment summary presents an overview of climate hazards and associated impacts and vulnerabilities for the community of Biddeford. The assessment uses local, regional, state, and national data pertaining to climate hazards, historical conditions, trends, and future projections to assess impacts of and local vulnerabilities associated with the following:

- Precipitation and extreme storms
- Flooding from sea level rise and storm surge
- Extreme temperatures
- Drought and wildfires
- Changing marine conditions

The assessment evaluates impacts of those hazards to the built, social, and natural environment; public health; and the economy. The ‘desktop’ vulnerability assessment generated quantitative-based information about climate hazard exposure within each Cohort community. Information about adaptive capacity and sensitivity, which is usually more qualitative in nature and not readily captured by state or national datasets or numeric data, as well as information about what/where/who is of greatest concern to the community, was gathered through Task Force input and community engagement.

Key Takeaways

- Climate change will impact all facets of the community and compounding climate change vulnerabilities will impact all areas of life, including public health, natural areas, the local economy, municipal fiscal health, and community well-being.
- The impacts of climate change will not be felt evenly across the community and will not be uniformly distributed among population groups. Socially vulnerable and marginalized populations will be disproportionately affected by climate change as they generally have less capacity to prepare for, respond to, and recover from climate-related hazards and effects.
- Biddeford’s downtown area has the highest social vulnerability compared with all other areas of the community. This vulnerability is driven by the prevalence of people/households with low annual incomes, without a vehicle, no internet access, living alone, are disabled, renters, or are age 65+ and living alone.
- The downtown area also is designated as ‘disadvantaged’ by the US Council on Environmental Quality due to the area’s low life expectancy, elevated rates of asthma, and low household income relative to national conditions and co-occurring climate and/or environmental hazards, including heat and flooding. Biddeford is the only community in southern Maine with a designated ‘disadvantaged’ area and the designation carries priority for certain federal funding programs.
- Extreme heat and temperatures are increasing in Biddeford and areas of the community with existing social vulnerabilities, such as the downtown, are already urban heat islands. Increasing air temperatures will exacerbate existing

vulnerabilities, especially for the elderly, young, people with existing health conditions, and those with limited access to air conditioning, and will pose a risk to people and the natural environment.

- Coastal areas of Biddeford, especially Biddeford Pool, Fortunes Rocks, and Granite Point, as well as low-lying areas along the Saco River, are extremely vulnerable to the increasing impacts of flooding, storm surge, and sea level rise. Some of the areas most exposed to flooding also have a relatively high percentage of older individuals and structures built before modern building codes, making them more sensitive to flood hazards.
- Drought is becoming a hazard of increasing concern, particularly in the more rural regions where there could be negative impacts to private wells and agriculture and could lead to increased wildfire risk.
- Biddeford's power systems are increasingly vulnerable to extreme storms and flooding, both of which will be exacerbated by climate change.
- Increasing rates of vector borne diseases and incidents of extreme heat will negatively impact public health.

SOCIAL VULNERABILITY

The impacts of climate change will not be felt evenly across the community and will not be uniformly distributed among population groups. The ability to adapt and respond to climate change varies widely based on individual and household resources and characteristics, as well as existing social inequities. Individuals who already have increased social vulnerability are at greatest risk of climate change and will be disproportionately affected by climate hazards, as they generally have lower capacity to prepare for, respond to, and recover from hazard events and disruptions. Socially vulnerable groups include children; older adults; people with existing health conditions; disabled individuals; households with lower or moderate incomes; those with less formal education; people of color; and those who have limited connectivity, either physically and/or digitally, to others and resources. Demographic information can help determine local populations' adaptive capacity, or the ability to adapt and respond to a disaster.

Age can be correlated with decreased adaptive capacity, in the case of the very young, or older populations. Generally, families with children require more time and space to evacuate, and people who are 17 or younger are more dependent on family or other networks than other age brackets. Some people who are 65 and older may also be dependent on family, friends, or organizations, and may face challenges anticipating the event or finding information on how and when to evacuate or adapt. The unique physical

and psychosocial challenges of the population ages 65 and over may impact their ability to prepare for, respond to, and recover from storms events.¹

Maine is known to be one of the least diverse states in the country and demographic data collected from the 2021 American Community Survey supports that statistic. This highlights the need to pay specific attention to the minority populations that do live throughout the state, who may have cultural or language barriers to accessing information, resources, or accommodations. Gaps in resources, and access to those resources, leave many minority groups vulnerable to exclusion from adaptation based on economic factors.²

The coastal York County towns are among the wealthiest in the state, but they are not without low-moderate income households. Income is a significant indicator of social vulnerability with respect to natural hazards such as flooding. Households with lower income levels generally have a lower adaptive capacity to respond and adapt to natural hazards since someone with limited or no disposable income would have fewer resources to pay for evacuation, transportation, accommodation, and repair activities.

The following demographic information summarizes indicators of social vulnerability and adaptive capacity at the community level and US Census-designated block group level, which is the smallest geographic unit at which this demographic data is available. Information about the community's social vulnerability is supplemented and contextualized with information gathered from the Task Force and community members through project engagement efforts

Demographic Profile

Figure 3 outlines 17 demographic indicators of social vulnerability at the community-wide and block group levels, which align closely with those used for the Maine Social Vulnerability Index (see also Map 2, Map 3, Map 4, Map 5, Map 6, Map 7, Map 8, and Map 9).³ These data are from the 2021 American Community Survey (ACS), which is conducted by the U.S. Census Bureau. The 2021 ACS is the most current demographic data available because the results of the 2020 Decennial Census have not been released yet. Block groups are the smallest geographic unit for which the U.S. Census provides demographic data. Block groups are delineated based on population and contain between 600 to 3,000 people. There are a total of 19 block groups in Biddeford. The locations of Biddeford's 19 block groups are shown in Map 1.

¹ EPA. 2021. Climate Change and Social Vulnerability in the United States: A Focus on Six Impacts. U.S. Environmental Protection Agency, EPA 430-R-21-003. www.epa.gov/cira/social-vulnerability-report

² EPA. 2021. Climate Change and Social Vulnerability in the United States: A Focus on Six Impacts. U.S. Environmental Protection Agency, EPA 430-R-21-003. www.epa.gov/cira/social-vulnerability-report

³ Johnson et al., 2018, A lifeline and social vulnerability analysis of sea level rise impacts on rural coastal communities

The ACS is conducted annually on an ongoing basis throughout the year to collect information about changing socioeconomic characteristics of communities. Unlike the Decennial Census which surveys every household, the ACS only surveys a portion of households in the community and uses the results to estimate demographic characteristics across the community. In small communities, like many of those along the coast of Maine, the accuracy of ACS estimates may be imperfect due to the small sample size. In larger communities the estimates tend to be more accurate because the sample size is more statistically robust. The ACS also surveys seasonal residents which can make it difficult to understand the characteristics of the year-round population in seasonal communities. The 17 demographic indicators can inform the development of strategic climate actions by providing important information about areas of the community that may be more socially vulnerable to the impacts of climate change. However, qualitative anecdotal information about the community gathered from the Task Force, community members, and City staff helps to refine demographic data and aid with interpretation of local social vulnerability information.⁴

Demographic data are presented at the population and household level. The U.S. Census Bureau defines a household as a group of people who live within the same housing unit regardless of whether or not they are related. A housing unit is a room or group of rooms that is designed to be separate living quarters such as a house, apartment, or condo.⁵

There are three income thresholds referenced in Figure 3. These thresholds were selected because they approximate the U.S. EPA climate change and social vulnerability income threshold (\$51,500), the 2021 State median income (\$64,767), and the 2021 York County median income (\$73,856).

Key Takeaways

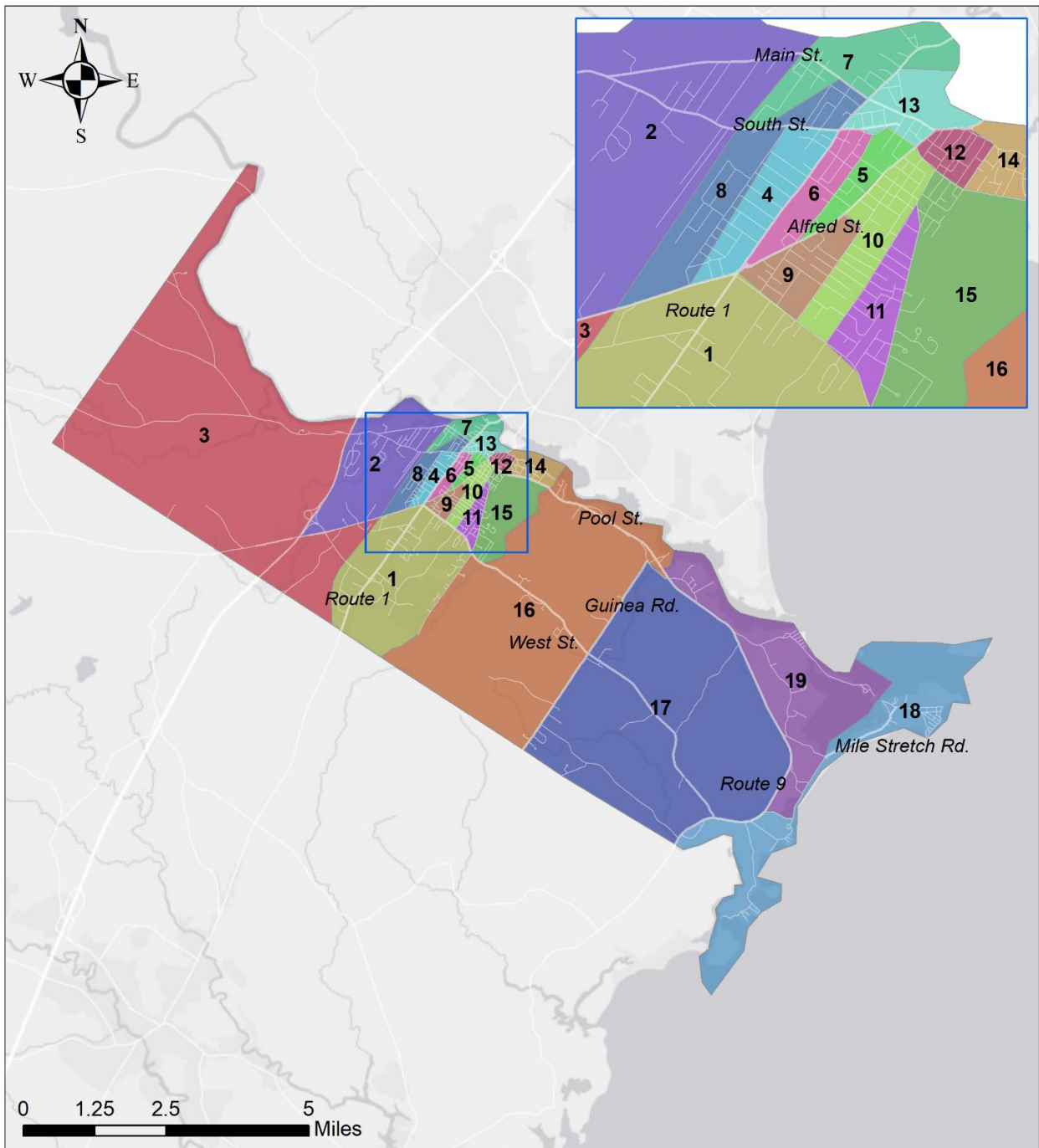
- Downtown Biddeford (block groups 4-14) is the most socially vulnerable area based on the 17 demographic indicators. This area has elevated social vulnerability across all indicators except for the percent of the block group population that is over the age of 65.
- The neighborhood around the downtown USPS Post Office (block group 5) has the highest percentage of the population and households within the block group that have a person with disabilities, are below the national poverty level, have an annual income below the EPA climate change and social vulnerability threshold, are below the County and State median incomes, have no vehicle, are living alone, and are age 65 or older living alone. This block group also has an elevated percentage of households with no internet access compared to the rest of the community.

⁴ Johnson et al., 2018, A lifeline and social vulnerability analysis of sea level rise impacts on rural coastal communities

⁵ U.S. Census Bureau, Subject Definitions: <https://www.census.gov/programs-surveys/cps/technical-documentation/subject-definitions.html#household>

- The neighborhood around Springs Island, east of Biddeford High School (block group 7) has an elevated percentage of households within the block group that have a person with disabilities, are below the national poverty level, single parent households, below the EPA climate change and social vulnerability income threshold, below the County and State median incomes, and have no vehicle or internet access compared to the rest of the community.
- The neighborhood around the old mill buildings (block group 13) has an elevated percentage of the population within the block group that are minorities, speak English less than well, have no high school diploma, and are unemployed compared to the rest of the community.
 - Local information provided by the Task Force highlighted the neighborhood around the old mill buildings (block group 13) as an area with rapidly changing demographics. Approximately 300 new upscale housing units have made this area much more affluent, and an additional 600 or so units will be built in the next 24-36 months.
- Across the entire community 32% percent of households have at least one person with disabilities, 41% are below the EPA climate change and social vulnerability income threshold, and the majority of households are below the County and State median incomes.

U.S. Census Block Groups Biddeford



Data source: U. S. Census Bureau
Map created by SMPDC

Map 1. Census block groups in Biddeford. Data source: U.S. Census Bureau 2021 American Community Survey.

Lowest Value

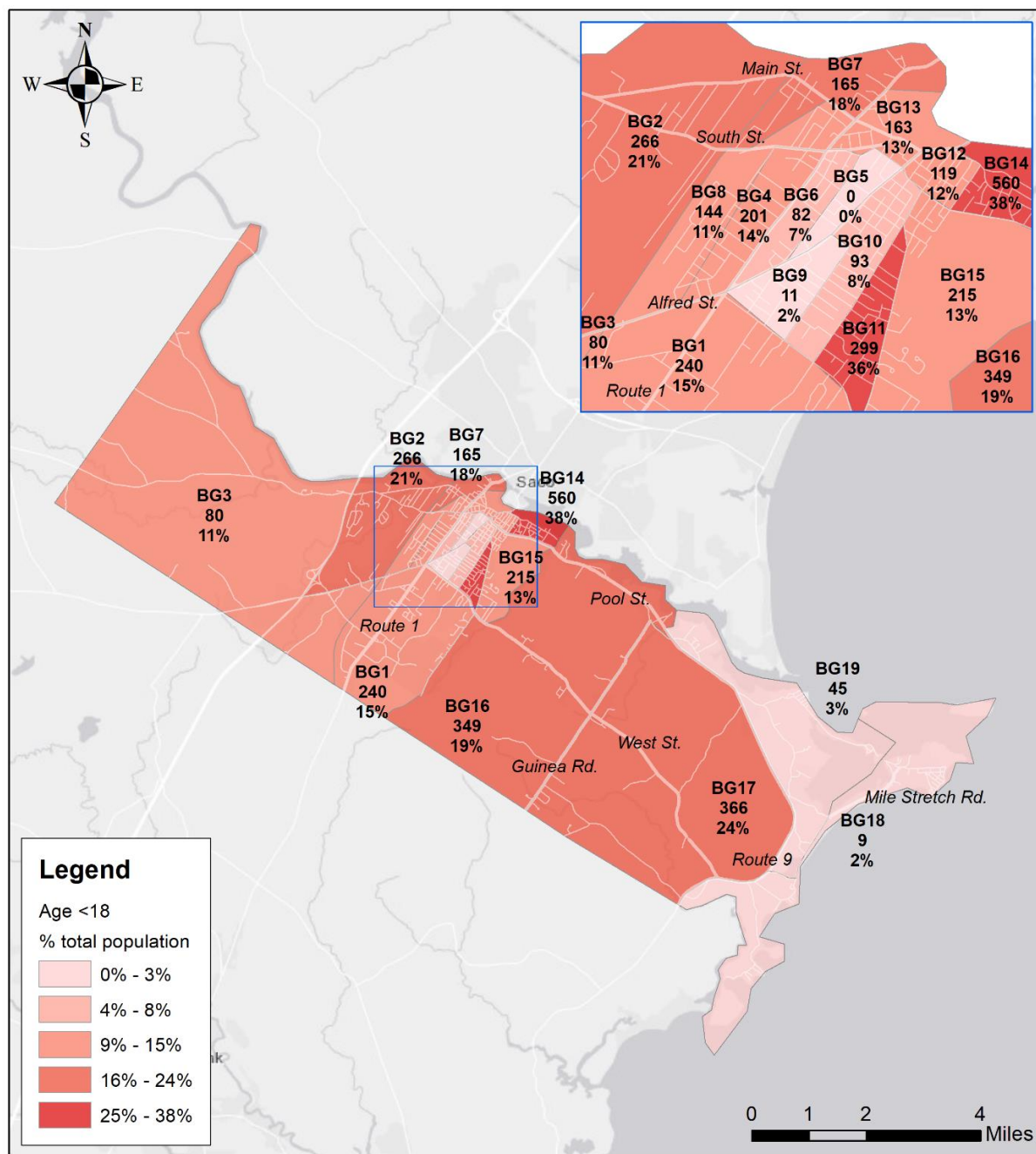
Highest Value

10

	Community wide	Block Groups																		
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Total Population	22,331	1,603	1,264	715	1,443	337	1,130	917	1,365	697	1,167	820	971	1,215	1,491	1,691	1,820	1,522	370	1,793
Total Households	9,198	694	463	303	769	192	589	463	508	393	675	251	464	591	414	631	652	503	215	428
Age <18	3,407	240	266	80	201	0	82	165	144	11	93	299	119	163	560	215	349	366	9	45
% total population	15%	15%	21%	11%	14%	0%	7%	18%	11%	2%	8%	36%	12%	13%	38%	13%	19%	24%	2%	3%
Age 65+	3,724	347	183	81	268	103	162	124	233	124	236	120	137	49	26	223	426	262	213	407
% total population	17%	22%	14%	11%	19%	31%	14%	14%	17%	18%	20%	15%	14%	4%	2%	13%	23%	17%	58%	23%
Minority	2,083	68	523	46	50	28	44	193	193	23	305	17	38	181	45	0	113	108	10	98
% total population	9%	4%	41%	6%	3%	8%	4%	21%	14%	3%	26%	2%	4%	15%	3%	0%	6%	7%	3%	5%
Speaks English "Less than well"	133	17	1	0	0	0	7	0	7	0	2	0	0	39	0	11	21	19	0	9
% population 5+	1%	1%	0%	0%	0%	0%	1%	0%	1%	0%	0%	0%	0%	3%	0%	1%	1%	1%	0%	1%
No HS Diploma	929	95	49	8	58	14	42	116	32	87	39	56	59	58	18	40	120	19	0	19
% population 25+	6%	8%	6%	1%	5%	6%	4%	21%	3%	13%	4%	13%	8%	7%	2%	4%	9%	2%	0%	2%
1+ Persons with a Disability	2,950	128	204	55	252	135	157	291	188	149	251	48	201	253	50	174	217	72	30	95
% households	32%	18%	44%	18%	33%	70%	27%	63%	37%	38%	37%	19%	43%	43%	12%	28%	33%	14%	14%	22%
Below Poverty Level	1,153	21	13	0	50	75	12	159	26	0	111	92	47	92	118	160	65	40	10	62
% households	13%	3%	3%	0%	7%	39%	2%	34%	5%	0%	16%	37%	10%	16%	29%	25%	10%	8%	5%	14%
Unemployment	602	8	0	91	0	0	17	0	115	1	0	55	41	113	58	34	53	11	0	5
% population 16+	3%	1%	0%	14%	0%	0%	2%	0%	9%	0%	0%	9%	5%	10%	6%	2%	3%	1%	0%	0%
Income <\$50k	3,779	226	74	86	284	185	202	345	229	71	470	94	279	425	153	145	134	147	110	120
% households	41%	33%	16%	28%	37%	96%	34%	75%	45%	18%	70%	37%	60%	72%	37%	23%	21%	29%	51%	28%
Income <\$60k	4,761	291	106	96	347	185	222	426	247	182	494	141	356	549	219	296	148	168	110	178
% households	52%	42%	23%	32%	45%	96%	38%	92%	49%	46%	73%	56%	77%	93%	53%	47%	23%	33%	51%	42%
Income <\$75k	5,714	395	171	117	504	185	400	442	260	253	537	141	374	549	311	348	191	192	115	229
% households	62%	57%	37%	39%	66%	96%	68%	95%	51%	64%	80%	56%	81%	93%	75%	55%	29%	38%	53%	54%
No Internet	842	105	0	0	85	36	45	76	45	44	106	25	11	120	13	42	27	9	4	49
% households	9%	15%	0%	0%	11%	19%	8%	16%	9%	11%	16%	10%	2%	20%	3%	7%	4%	2%	2%	11%
No Vehicle	554	0	13	0	137	37	48	33	44	0	15	23	41	93	0	16	36	0	5	13
% households	6%	0%	3%	0%	18%	19%	8%	7%	9%	0%	2%	9%	9%	16%	0%	3%	6%	0%	2%	3%
Single Parent	870	0	115	0	23	0	0	103	87	0	8	84	24	80	138	141	7	46	8	6
% households	9%	0%	25%	0%	3%	0%	0%	22%	17%	0%	1%	33%	5%	14%	33%	22%	1%	9%	4%	1%
Living Alone	2,636	202	90	45	316	125	203	188	29	218	289	60	190	207	63	110	102	17	87	95
% total population	12%	29%	19%	15%	41%	65%	34%	41%	6%	55%	43%	24%	41%	35%	15%	17%	16%	3%	40%	22%
65+ Living Alone	1,018	103	31	0	220	86	7	50	29	30	76	25	95	19	0	56	74	17	75	25
% total population	5%	6%	2%	0%	15%	26%	1%	5%	2%	4%	7%	3%	10%	2%	0%	3%	4%	1%	20%	1%

Figure 3. Demographic Profile Summary Table. Data source: U.S. Census Bureau 2021 American Community Survey

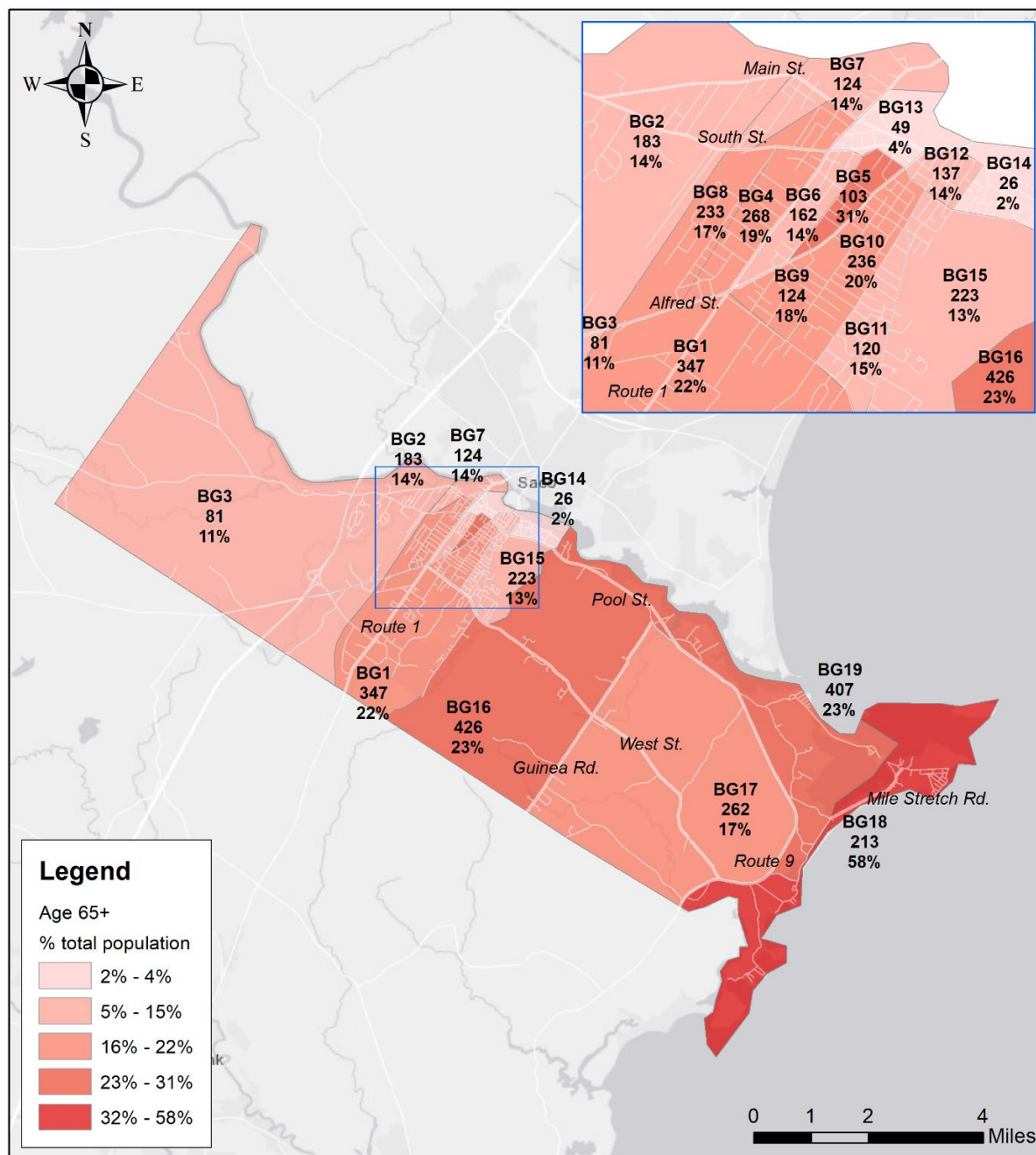
Demographics - Age 17 Years or Younger Biddeford



Data source: U.S Census Bureau 2021 American Community Survey
Map created by SMPDC

Map 2. Breakdown of the total population in Biddeford, by block group, that is 17 years old or younger. The block group is labeled (BG#) and includes the total number of individuals in the block group that are 17 years or younger and the percent of the total population within the block group that is 17 years or younger. Data source: U.S. Census Bureau 2021 American Community Survey

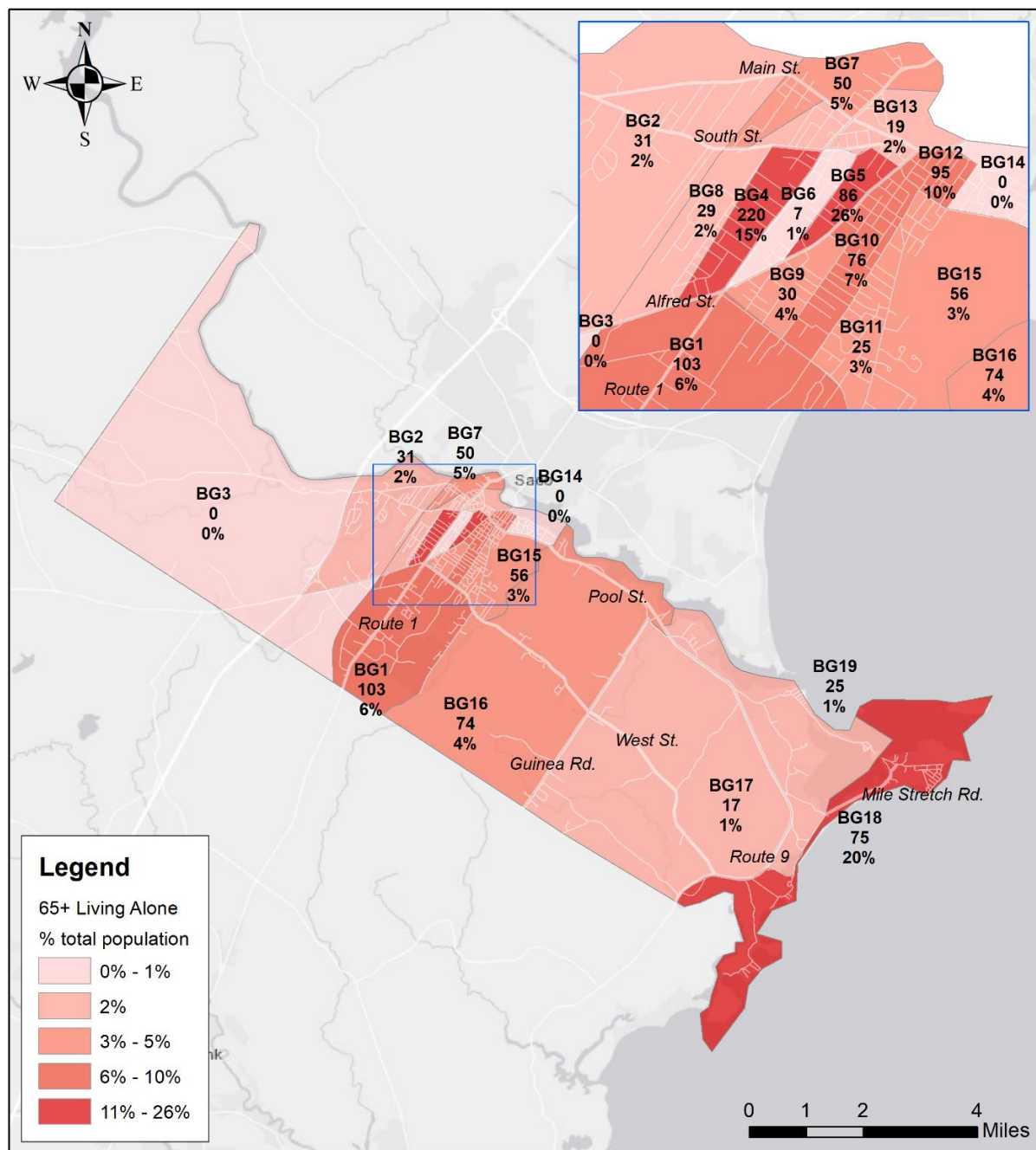
Demographics - Age 65 Years or Older Biddeford



Data source: U.S Census Bureau 2021 American Community Survey
Map created by SMPDC

Map 3. Breakdown of the total population in Biddeford, by block group, that is 65 years or older. The block group is labeled (BG#) and includes the total number of individuals in the block group that are 65 years or older and the percent of the total population within the block group that is 65 years or older. Data source: U.S. Census Bureau 2021 American Community Survey.

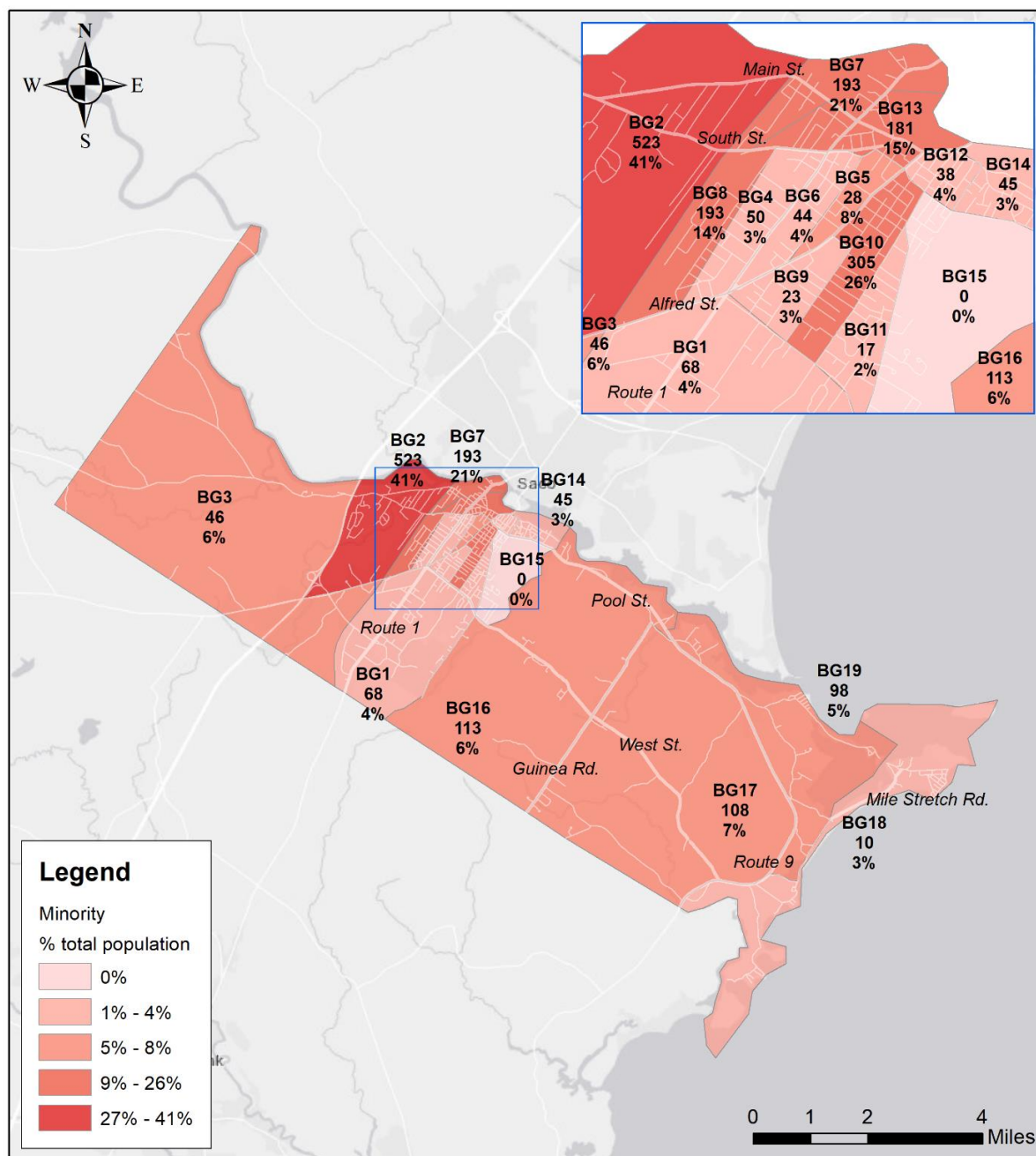
Demographics - Age 65+ and Living Alone Biddeford



Data source: U.S Census Bureau 2021 American Community Survey
Map created by SMPDC

Map 4. Breakdown of the total population in Biddeford, by block group, that is 65 years or older and living alone. The block group is labeled (BG#) and includes the total number of individuals in the block group that are 65 years or older and living alone, and the percent of the total population within the block group that is 65 years or older and living alone. Data source: U.S. Census Bureau 2021 American Community Survey.

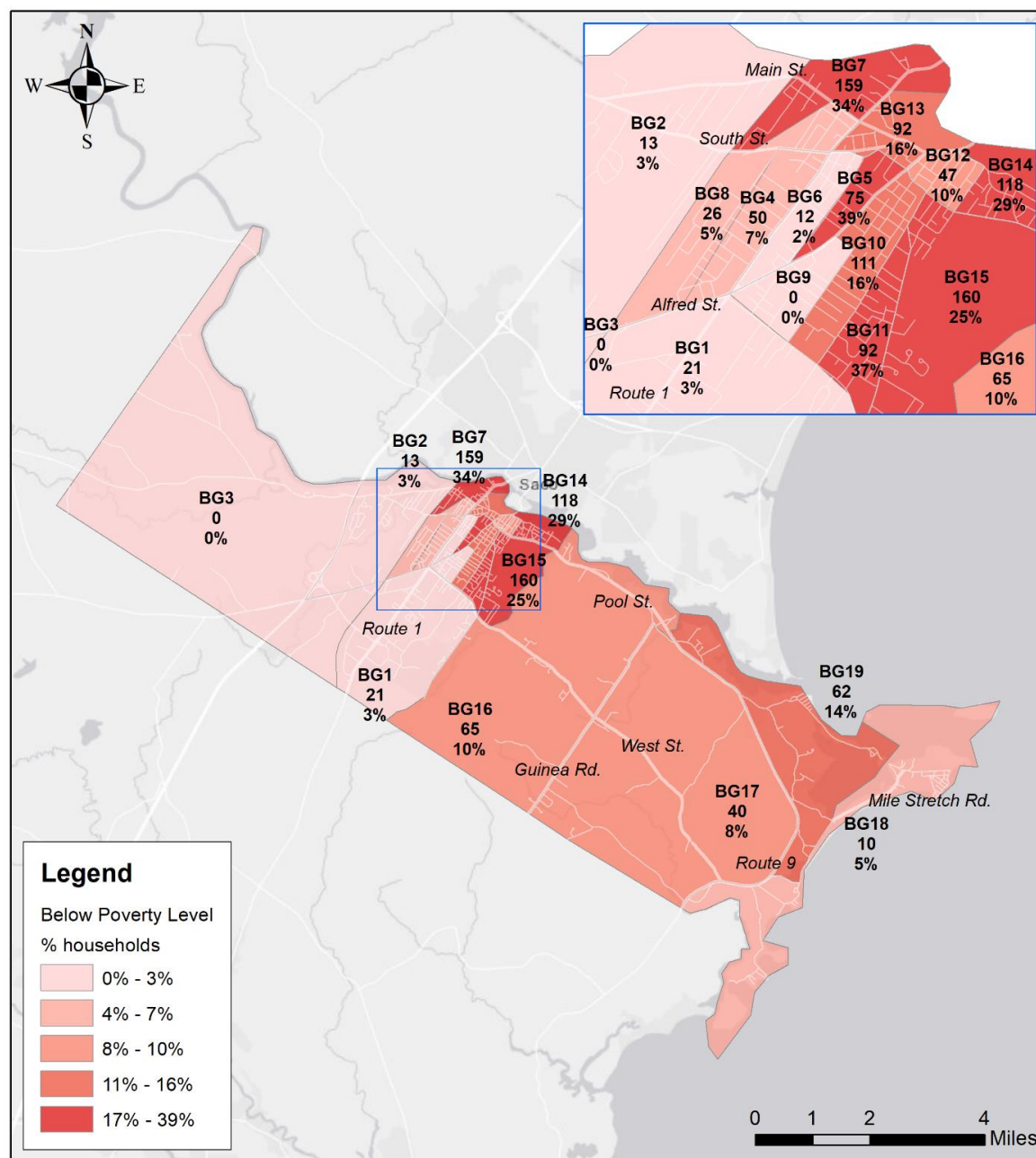
Demographics - Minority Biddeford



Data source: U.S Census Bureau 2021 American Community Survey
Map created by SMPDC

Map 5. Breakdown of the total population in Biddeford, by block group, that is a racial or ethnic minority (non-white). The block group is labeled (BG#) and includes the total number of individuals in the block group that are a racial or ethnic minority and the percent of the total population within the block group that is a racial or ethnic minority. Data source: U.S. Census Bureau 2021 American Community Survey.

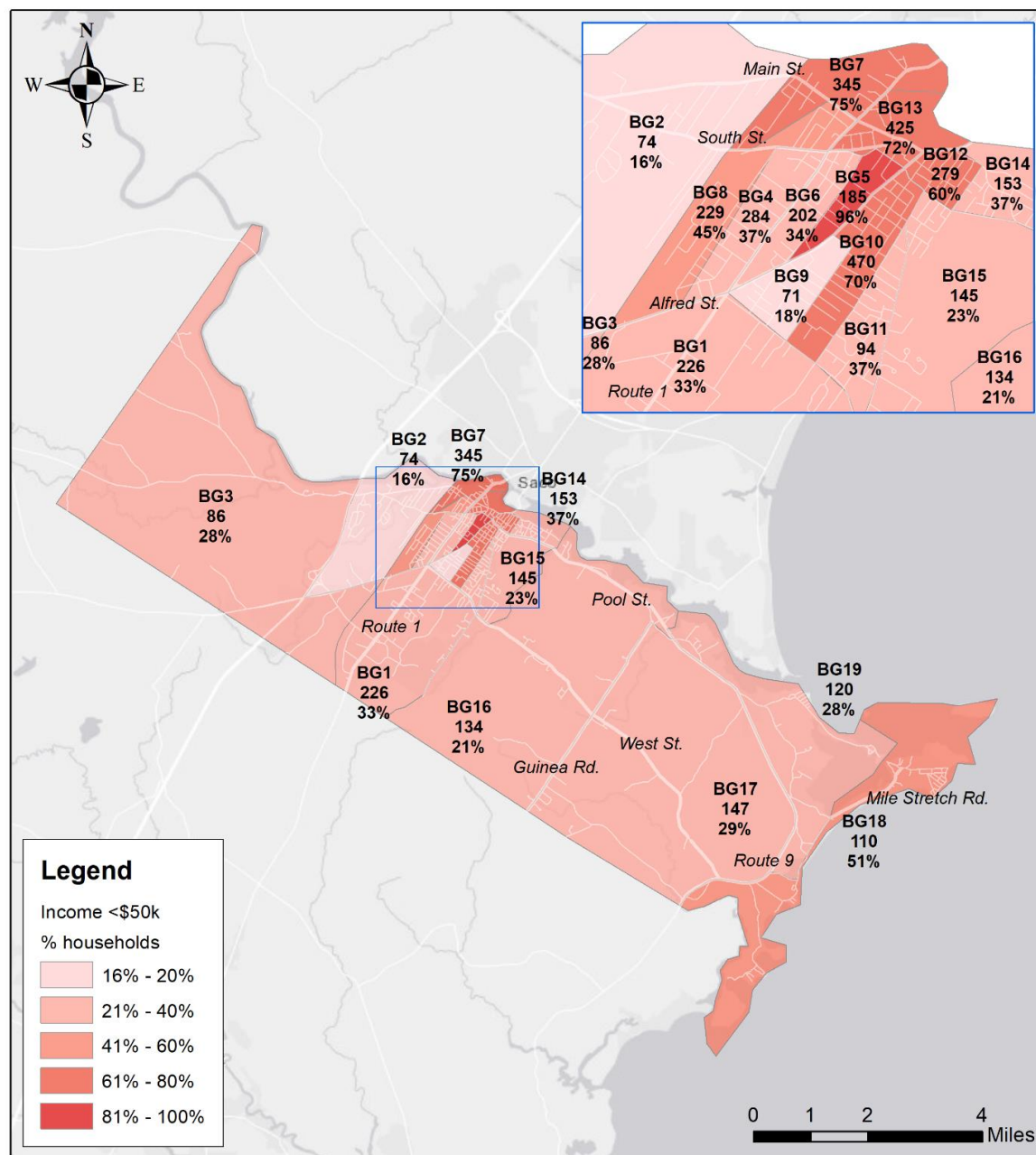
Demographics - Below Poverty Level Biddeford



Data source: U.S Census Bureau 2021 American Community Survey
Map created by SMPDC

Map 6. Breakdown of households in Biddeford, by block group, that are below the national poverty level. Households do not include vacant housing units, so this data is representative of occupied housing units in Biddeford. The block group is labeled (BG#) and includes the total number of households in the block group that are below the national poverty level and the percent of households within the block group that are below the national poverty level. Data source: U.S. Census Bureau 2021 American Community Survey.

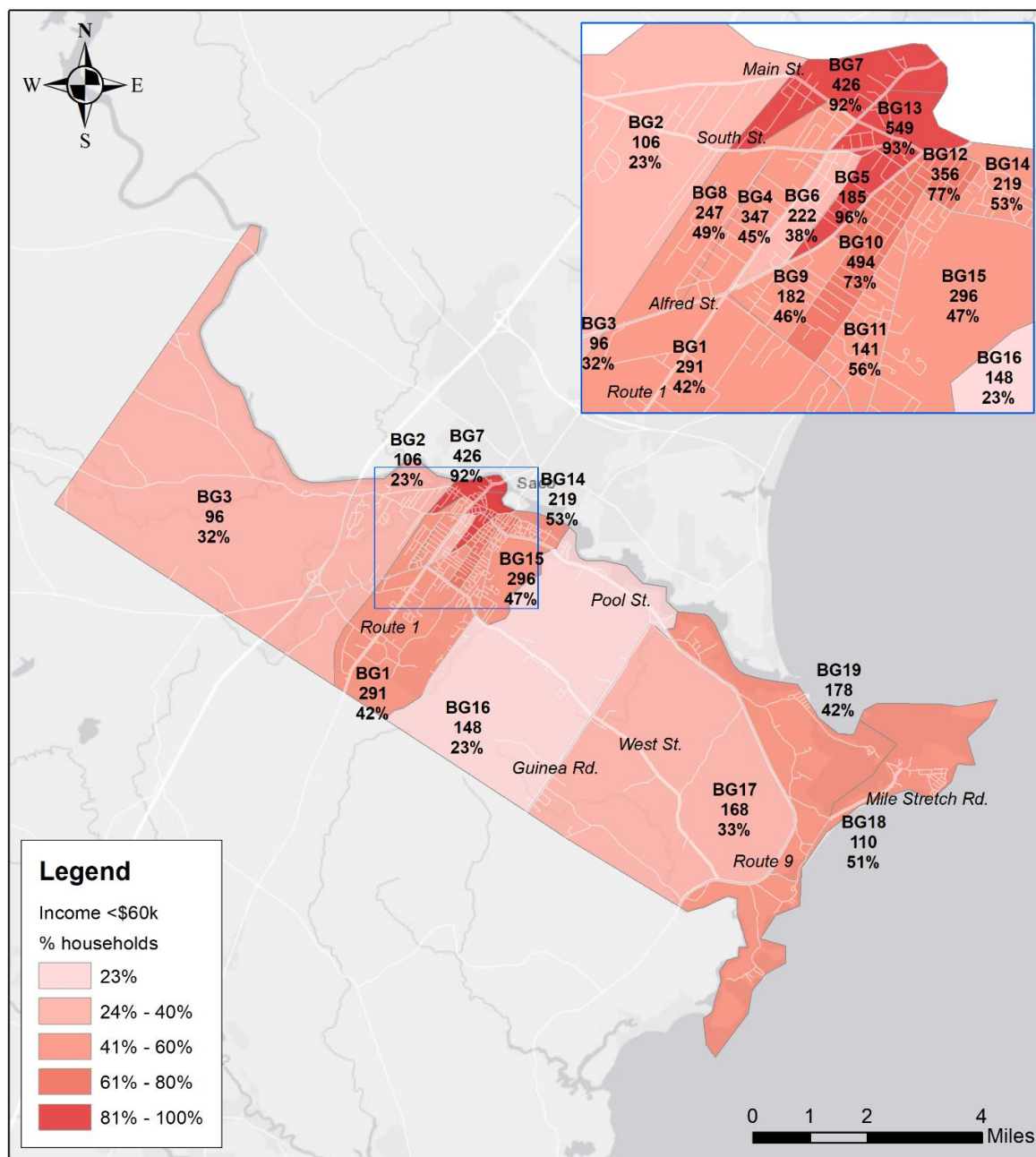
Demographics - Income Below \$50,000 Biddeford



Data source: U.S. Census Bureau 2021 American Community Survey
Map created by SMPDC

Map 7. Breakdown of households in Biddeford, by block group, that have an annual income below \$50,000. The US EPA climate change and social vulnerability income threshold is \$51,500. Households do not include vacant housing units, so this data is representative of occupied housing units in Biddeford. The block group is labeled (BG#) and includes the total number of households in the block group that have an annual income below \$50,000 and the percent of households within the block group that have an annual income below \$50,000. Data source: U.S. Census Bureau 2021 American Community Survey

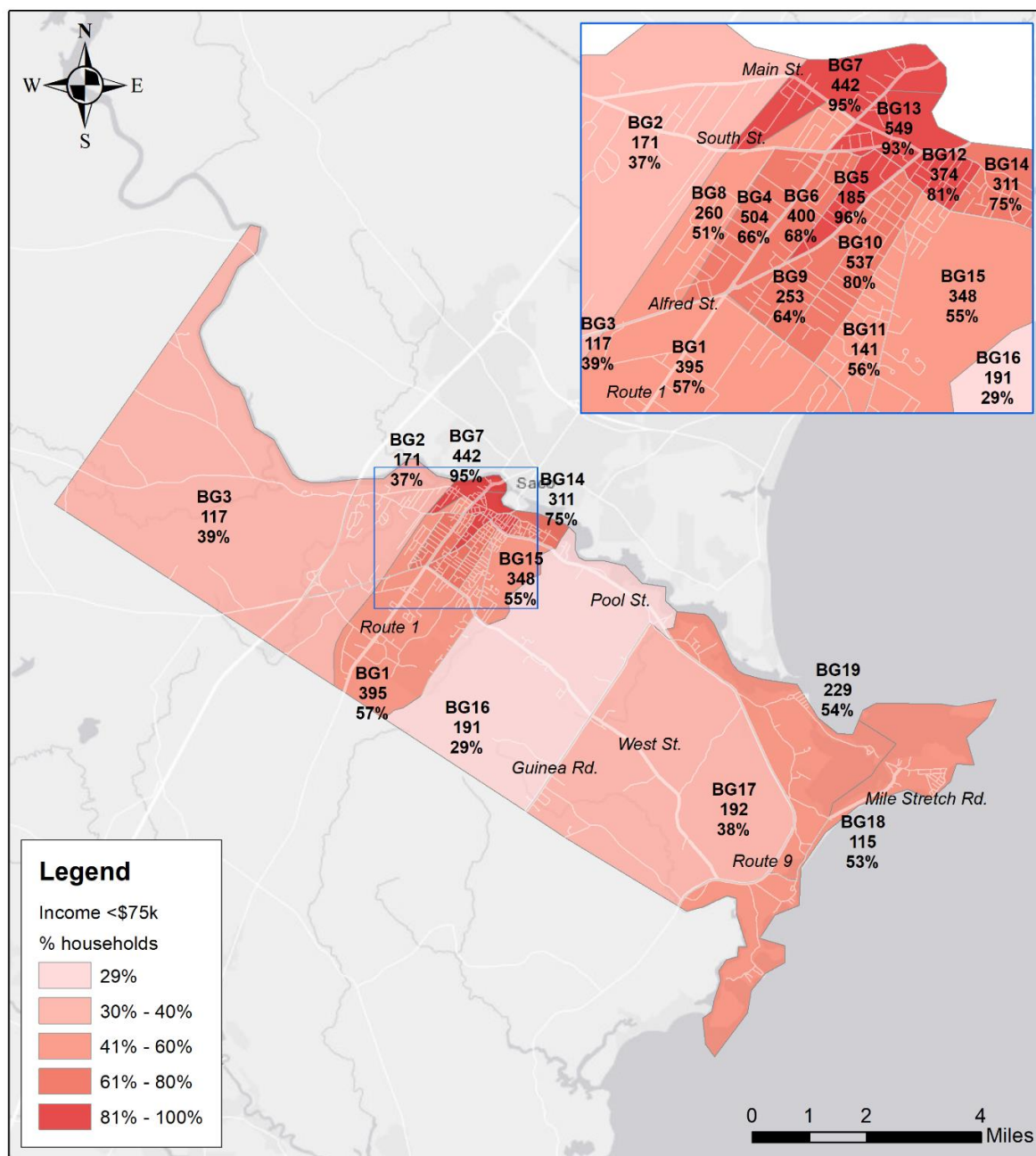
Demographics - Income Below \$60,000 Biddeford



Data source: U.S Census Bureau 2021 American Community Survey
Map created by SMPDC

Map 8. Breakdown of households in Biddeford, by block group, that have an annual income below \$60,000. The 2021 Maine state median income was \$64,767. Households do not include vacant housing units, so this data is representative of occupied housing units in Biddeford. The block group is labeled (BG#) and includes the total number of households in the block group that have an annual income below \$60,000 and the percent of households within the block group that have an annual income below \$60,000. Data source: U.S. Census Bureau 2021 American Community Survey

Demographics - Income Below \$75,000 Biddeford



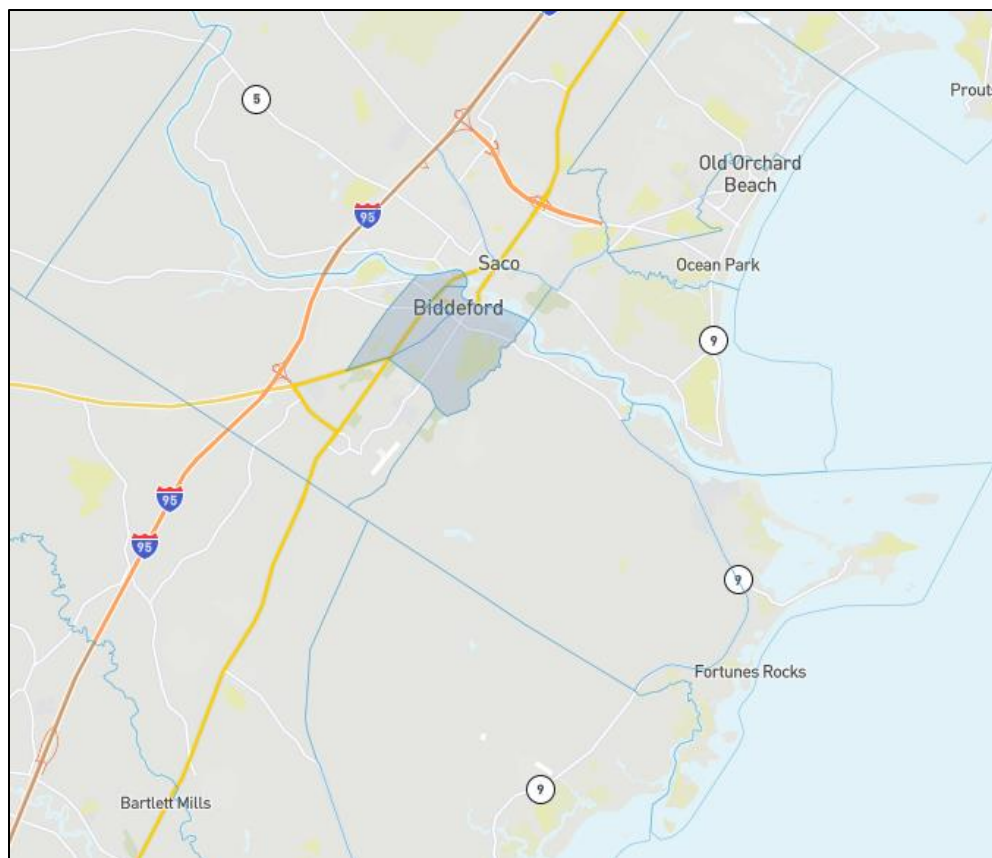
Data source: U.S. Census Bureau 2021 American Community Survey
Map created by SMPDC

Map 9. Breakdown of households in Biddeford, by block group, that have an annual income below \$75,000. The 2021 York County median income was \$73,856. Households do not include vacant housing units, so this data is representative of occupied housing units in Biddeford. The block group is labeled (BG#) and includes the total number of households in the block group that have an annual income below \$75,000 and the percent of households within the block group that have an annual income below \$75,000. Data source: U.S. Census Bureau 2021 American Community Survey

“Disadvantaged” Designation of Biddeford’s Downtown Area

The Council on Environmental Quality developed a Climate and Economic Justice Screening Tool which combines environmental and climate hazard data with demographic data to identify where elevated hazards and social vulnerability occur. This tool used data at the census tract level, which is a larger geographic unit than block groups. Census tracts are statistical subdivisions of a county and contain between 1,200 to 8,000 people. The tool ranked census tracts at the national level based on indicators representing environmental, climate, health and other hazards as well as socioeconomic indicators of social vulnerability. Thresholds were established for each indicator to designate heightened hazards or social vulnerability. Census tracts are considered disadvantaged if they meet the threshold for at least one environmental, climate, or other hazard, and meet the threshold for social vulnerability.

There are two census tracts in downtown Biddeford—containing block groups 4 through 15—that are identified as disadvantaged (highlighted in blue in Map 10). **This area is designated as disadvantaged because of low life expectancy, elevated rates of asthma, and low household incomes.** This means that the downtown area of Biddeford has high health hazards co-occurring with elevated social vulnerability and is therefore overburdened and underserved compared to the rest of the country. Areas with disadvantaged designations will be given priority for federal funding through the [Justice40 Initiative](#).



Map 10. The heart of Biddeford's downtown is encompassed by the two highlighted census tracts, which the Council on Environmental Quality's Climate and Economic Justice Screening Tool identifies as disadvantaged.

SUPPLEMENTAL COMMUNITY INFORMATION

Biddeford, along with the rest of Maine, is experiencing a housing affordability crisis. Access to affordable housing, especially for socially vulnerable populations, is a critical need that affects an individual's or household's exposure to climate hazards and adaptive capacity. In the last 20 years, Maine home prices have risen dramatically while household incomes have stagnated (Figure 4). As of 2021, the median home price in Biddeford was \$65,000 higher than the state-wide median home price, and the median income in Biddeford was \$7,414 lower than the state-wide median (Figure 5). MaineHousing calculates the Homeownership Affordability Index based on the ratio of the affordable home price at the median income to the median home price. An index of less than 1 indicates that households earning the median income cannot afford the median home price and housing is considered unaffordable. The 2021 index for Biddeford was 0.55, substantially lower than the County (0.72) and State (0.80) indices, indicating that homeownership is more unaffordable for residents in Biddeford compared to the rest of the County or State.

Relative Increases in Income and Home Price (Maine)

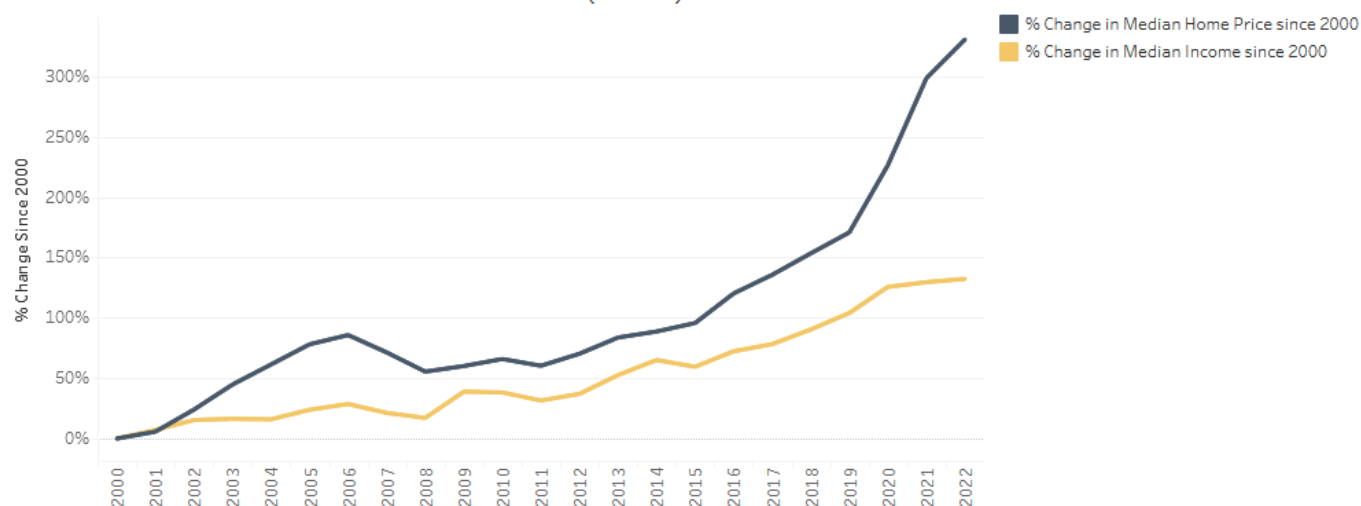


Figure 4. Long-term income trend across the state of Maine compared to the home price trend. The median home price has risen exponentially in the last 20 years while the median income has risen only slightly. The growing gap between incomes and home prices is one factor driving housing unaffordability in Maine. Figure from the [MaineHousing housing data dashboard](#).

2021 Homeownership Affordability			
	Biddeford	York County	Maine
Homeownership Affordability Index	0.55	0.72	0.80
Households Unable to Afford Median Home Price (%)	77%	67%	62%
Median Home Price	\$360,000	\$389,900	\$295,000
Home Price Affordable to Median Income	\$199,090	\$280,921	\$236,223
Median Income	\$56,007	\$72,883	\$63,421
Income Needed to Afford Median Home Price	\$101,274	\$101,157	\$79,202
Percentage of Unattainable Homes Sold	97%	79%	65%

Figure 5. Summary of 2021 home affordability indicators, including the Homeownership Affordability Index which is based on the ratio of the affordable price of a home at the median income to the median home price. An index of less than 1 indicates that households earning the median income cannot afford the median home price, and housing is considered unaffordable. As of 2021, the gap between median household income and housing prices was greater for Biddeford residents compared to the County and State. Data from the [MaineHousing housing data dashboard](#).

The Biddeford Affordable Housing Task Force published a report in late 2022 on housing conditions and recommendations for improving affordability.⁶ The Task Force found that rental affordability has improved in recent years. The HUB rental affordability index⁷ increased from 0.71 in 2017 to 0.97 in 2020 because the median income of Biddeford renters increased 52%. However, this was largely due to new residents with higher

⁶ [Mayor's Affordable Housing Task Force Final Report and Recommendations, December 2022](#)

⁷ The U.S. Department of Housing and Urban Development (HUB) rental affordability index is an indicator used to compare rental prices across communities. Affordability is defined as no more than 30% of a household's income going to housing costs. The index is the ratio of 30% of the media income to the median rental price. An index of less than one means an area is unaffordable.

incomes moving to the City rather than rising incomes among existing residents. The Task Force concluded that “long term Biddeford residents are struggling to continue to afford a home in our city, while new residents with higher salaries are moving into the community and taking over the rents of those who have been priced out.” Continuing gentrification in Biddeford could make it even more challenging for socially vulnerable populations to access affordable housing, impacting their ability to adapt to climate change.

Climate Gentrification

Gentrification occurs when wealthier people move into a lower income area and change the character of the community, increase housing costs, and displace longtime residents. Climate gentrification, specifically, is caused by the influx of climate migrants leaving areas with higher climate risks and moving to areas with lower climate risks. Maine has the potential to become a destination for climate migrants because, despite the worrisome impacts of climate change, it is expected to be more hospitable than places like the Southeast, Texas, or Florida. The COVID-19 pandemic demonstrated what this future could look like, with over 34,000 people flocking to the State.⁸ As a highly desirable, growing, and vibrant city, Biddeford could become a haven for climate migrants moving to Maine, exacerbating existing gentrification challenges affecting the City.

Housing Characteristics

Map 11, Map 12, and Figure 6 show data about housing characteristics including multi-unit housing structures, mobile homes, and renter occupied homes. These characteristics are associated with elevated social vulnerability and/or reduced adaptive capacity. For example, renters and multi-unit households generally have less adaptive capacity than single family homeowners because they tend to have lower incomes/financial resources and have less ability to make property improvements. Additionally, multi-unit households are often occupied by renters, and landlords have little incentive to improve energy efficiency because energy costs are commonly borne by tenants. Mobile homes have a higher energy cost per square foot than site-built homes and are generally more vulnerable to the impacts of climate hazards. Rented, multi-unit, and mobile homes also tend to be associated with socially vulnerable populations (see Demographic Profile for a description of ACS data).

Key Takeaways

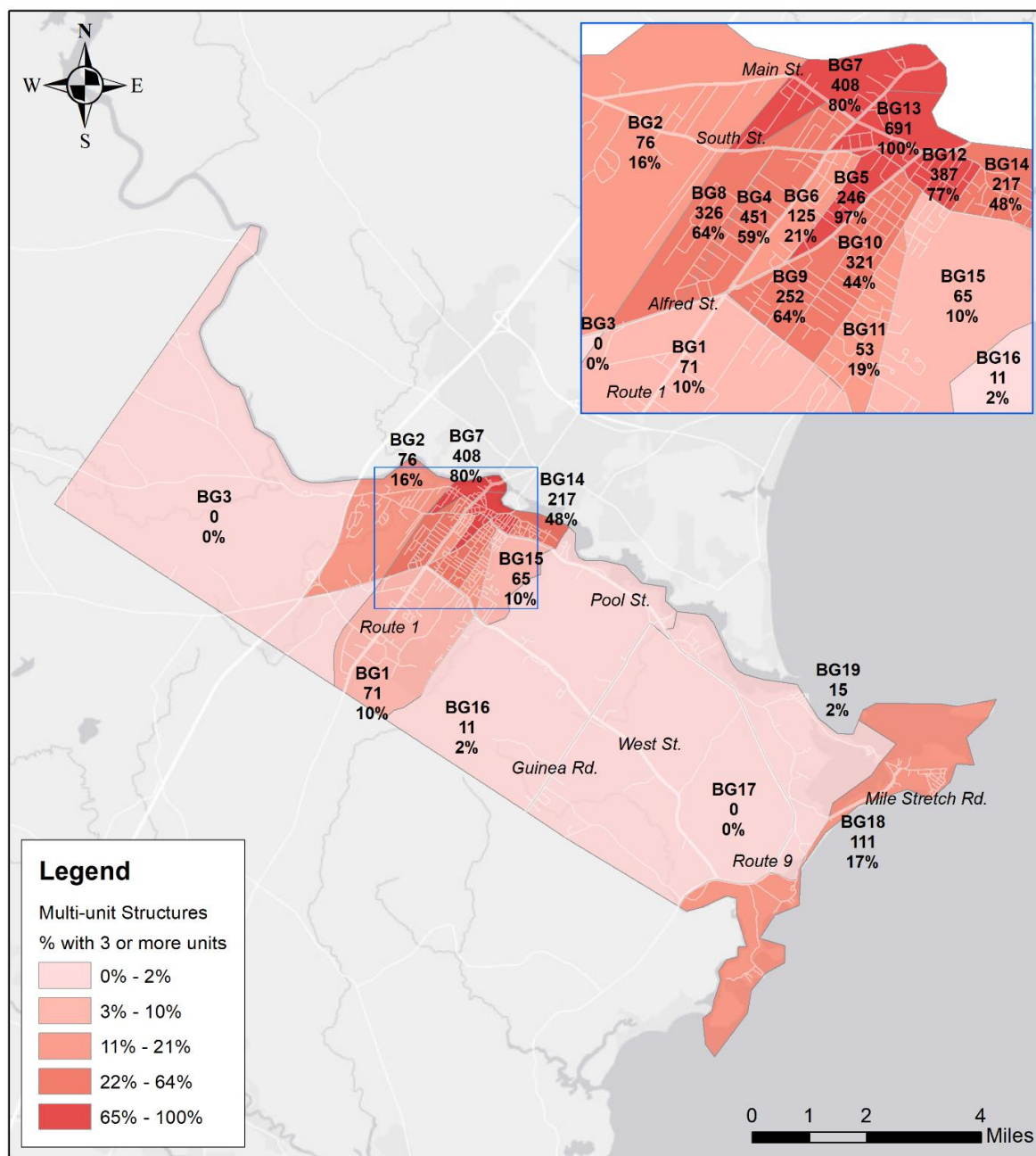
- In the neighborhood around the old mill buildings (block group 13) 100% of households are renter occupied and 100% of housing units are multi-unit structures.
- Local information provided by the Task Force highlighted this neighborhood as an area with rapidly changing demographics. Approximately 300 new

⁸ [The climate migrants are coming!... Maybe?, Maine Monitor, April 2023](#)

upscale housing units have made this area much more affluent, and an additional 600 or so units will be built in the next 24-36 months.

- Compared to the rest of the community, the downtown neighborhoods along Main Street (block groups 5, 7, 12, and 13) have elevated percentages of renter occupied households and multi-unit structures.
- Mobile homes are 1% of all housing units in Biddeford (88 units community wide) and are only present in the more rural neighborhoods outside of downtown (block groups 1, 3, and 16) and the neighborhood around Hannaford (block group 6). The highest number of mobile homes is located west of I-95 (block group 3).

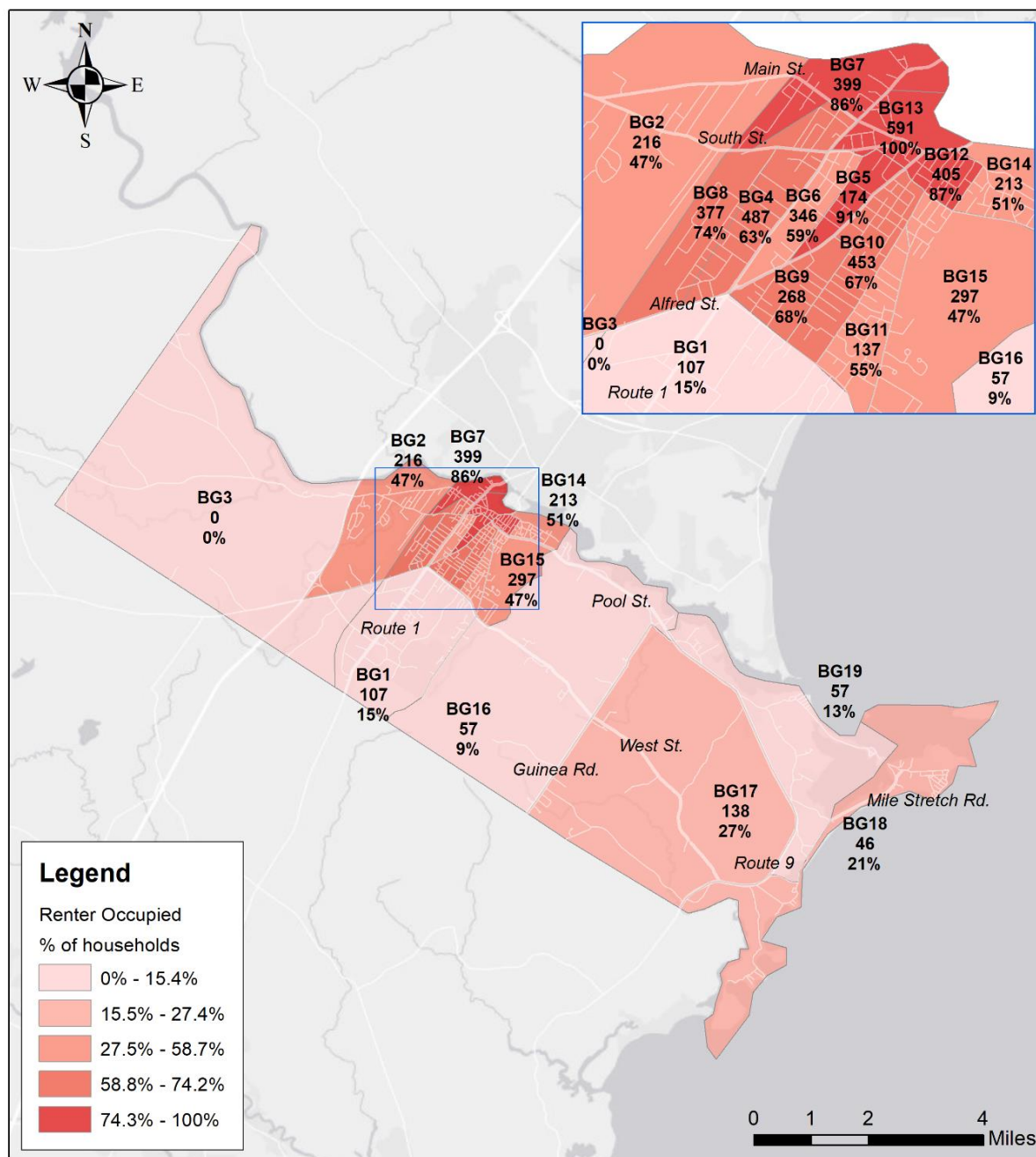
Multi-unit Housing Structures Biddeford



Data source: U.S Census Bureau 2021 American Community Survey
Map created by SMPDC

Map 11. Breakdown of multi-unit (3 or more units) housing structures in Biddeford by block group. Housing units include occupied households as well as vacant units and represent the total housing stock in Biddeford. The block group is labeled (BG#) and includes the total number of multi-unit housing units in the block group and the percent of total housing units within the block group that are multi-unit. Data source: U.S. Census Bureau 2021 American Community Survey

Renter Occupied Homes Biddeford



Data source: U.S. Census Bureau 2021 American Community Survey
Map created by SMPDC

Map 12. Breakdown of renter occupied households in Biddeford by block group. Households do not include vacant housing units, so this data is representative of occupied housing units in Biddeford. The block group is labeled (BG#) and includes the total number of renter occupied households in the block group and the percent of households that are renter occupied within the block group. Data source: U.S. Census Bureau 2021 American Community Survey

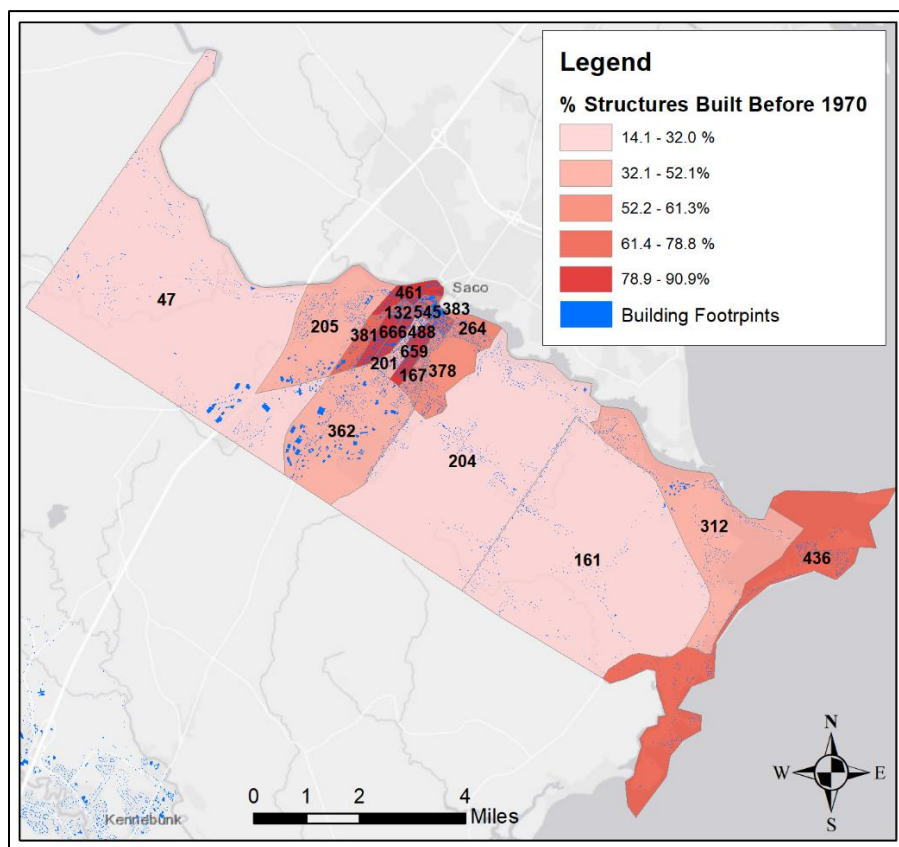
Community wide		Block Groups																		
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Total Housing Units	10,350	733	463	331	769	253	589	507	508	393	731	272	505	691	454	656	652	503	635	705
Total Households	9,198	694	463	303	769	192	589	463	508	393	675	251	464	591	414	631	652	503	215	428
Renter Occupied	4,768	107	216	0	487	174	346	399	377	268	453	137	405	591	213	297	57	138	46	57
% households	52%	15%	47%	0%	63%	91%	59%	86%	74%	68%	67%	55%	87%	100%	51%	47%	9%	27%	21%	13%
Multi-unit	3,826	71	76	0	451	246	125	408	326	252	321	53	387	691	217	65	11	0	111	15
% total with 3+ units	37%	10%	16%	0%	59%	97%	21%	80%	64%	64%	44%	19%	77%	100%	48%	10%	2%	0%	17%	2%
Mobile Homes	88	7	0	35	0	0	28	0	0	0	0	0	0	0	0	0	18	0	0	0
% total units	1%	1%	0%	11%	0%	0%	5%	0%	0%	0%	0%	0%	0%	0%	0%	0%	3%	0%	0%	0%

Figure 6. Community wide and block group level housing characteristics in Biddeford. Housing units include both occupied and vacant units and represent the total housing stock in Biddeford. Households do not include vacant housing units and represent occupied housing units only. Data source: U.S. Census Bureau 2021 American Community Survey

Age of Buildings

Maine has one of the oldest housing stocks in the country. Older buildings tend to be less energy efficient, which is especially problematic during the winter and summer months when outdoor temperatures are at their extremes. Further, houses constructed before 1970 were built prior to the adoption of modern building codes and significant federal and state/local risk-reduction policies (National Flood Insurance Program (1968), Maine Shoreland Zoning (1971)). Older buildings are ideal targets for weatherization, energy efficiency upgrades, and resilience retrofits.

Map 13 shows the percentage of structures, at the block group level, built before 1970. In Biddeford, areas with the highest concentration of buildings constructed before 1970 are in the downtown area and along the coastline. These areas also have elevated social vulnerability based on demographic characteristics and are vulnerable to hazards, including coastal and riverine flooding, sea level rise, and urban heat islands. The concentration of older buildings in flood prone areas means that it is likely those structures are not built to modern codes and are not elevated above projected future flood levels, or even current flood levels.



Map 13. Percent and actual number of structures built before 1970 presented at the block group level. The block groups are color-coded by the percentage of structures built before 1970 and are labelled with the number of structures built before 1970. (Data source: year structures built: US Census American Community Survey; building footprints: Microsoft)

Household Heating Fuel Types

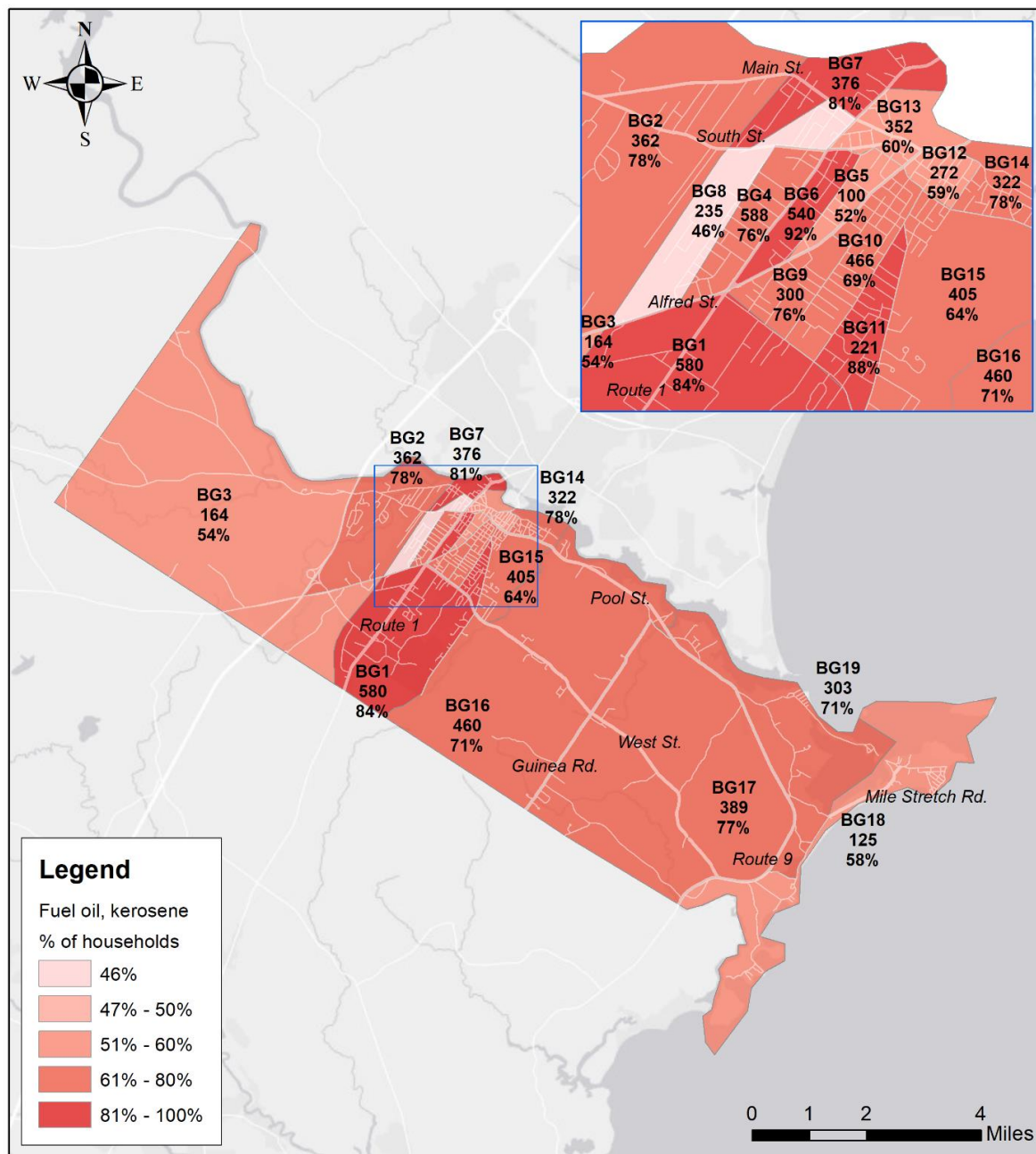
Household heating fuel data is from the 2021 American Community Survey. This section includes fuel oil, kerosene, propane, natural gas, and electricity used as households' primary heating sources. Additional heating sources such as wood burning stoves, pellet stoves, or bio-bricks are not included due to limited or non-existent data. Information about household heat pump usage and other sustainable alternatives is also not included due to data limitations.

Understanding heating fuel trends is important for evaluating the potential impacts of electrifying the heating sector to reduce greenhouse gas emissions. Electrification must be paired with electricity grid resilience measures to ensure that the grid can withstand increased electricity consumption as well as climate hazards such as flooding, high winds, high temperatures, and wildfires (see Extreme Storms & Precipitation: Power Outages for more information about these impacts). Map 14, Map 15, Map 16, Map 17, and Figure 7 show data about primary heating fuel types across Biddeford, which provides context about where fossil fuels are used most heavily and therefore where electricity consumption for heating is expected to increase.

Key Takeaways

- The vast majority of households (74%) primarily heat their homes using fuel oil or kerosene followed by natural gas, propane, and electricity.
- The neighborhood around Hannaford (block group 6) has the highest percentage of households that heat their homes using fuel oil and kerosene, followed by the neighborhoods north of Biddeford Middle School (block group 11), around the Biddeford Municipal Airport (block group 1), and east of Biddeford High School (block group 7).
- The neighborhood around the downtown USPS Post Office (block group 5) has the highest percentage of households that use propane to heat their homes.
- The neighborhood east of May Street (block group 8) has the highest percentage of households that use natural gas to heat their homes, followed by the neighborhood around the downtown USPS Post Office (block group 5).
- The neighborhood east of May Street (block group 8) and the neighborhood around Clifford Park (block group 15) have the highest percentage of households that use electricity to heat their homes.

Home Heating Fuel Type - Fuel Oil, Kerosene Biddeford

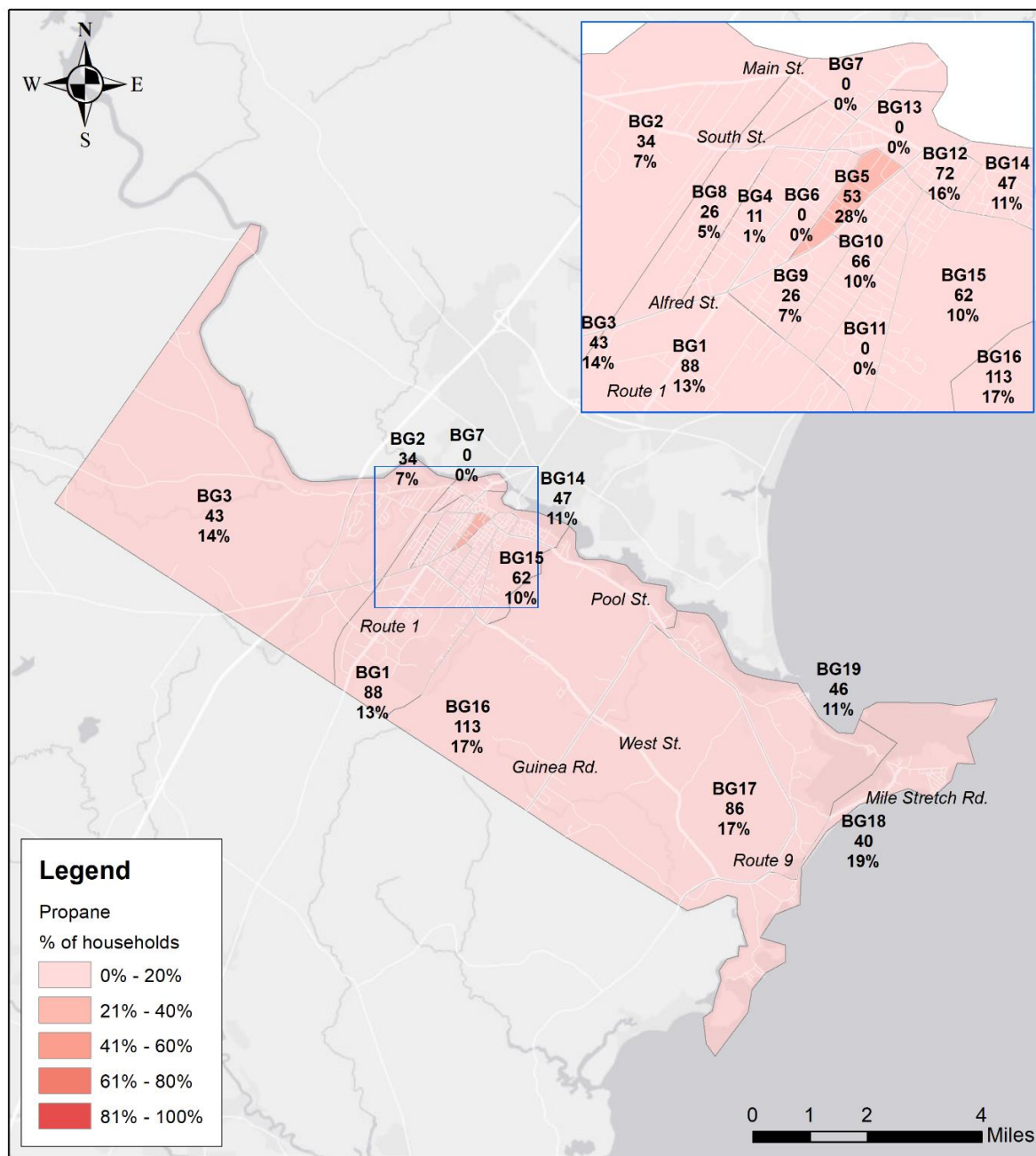


Data source: U.S Census Bureau 2021 American Community Survey
Map created by SMPDC

Map 14. Breakdown of households in Biddeford, by block group, that use fuel oil or kerosene for heating. Households do not include vacant housing units, so this data is representative of occupied housing units in Biddeford. The block group is labeled (BG#) and includes the total number of households within the block group that use fuel oil or kerosene for heating and the percent of households within the block group that use fuel oil or kerosene for heating. Data source: U.S. Census Bureau 2021 American Community Survey

Biddeford – August 2023

Home Heating Fuel Type - Propane Biddeford

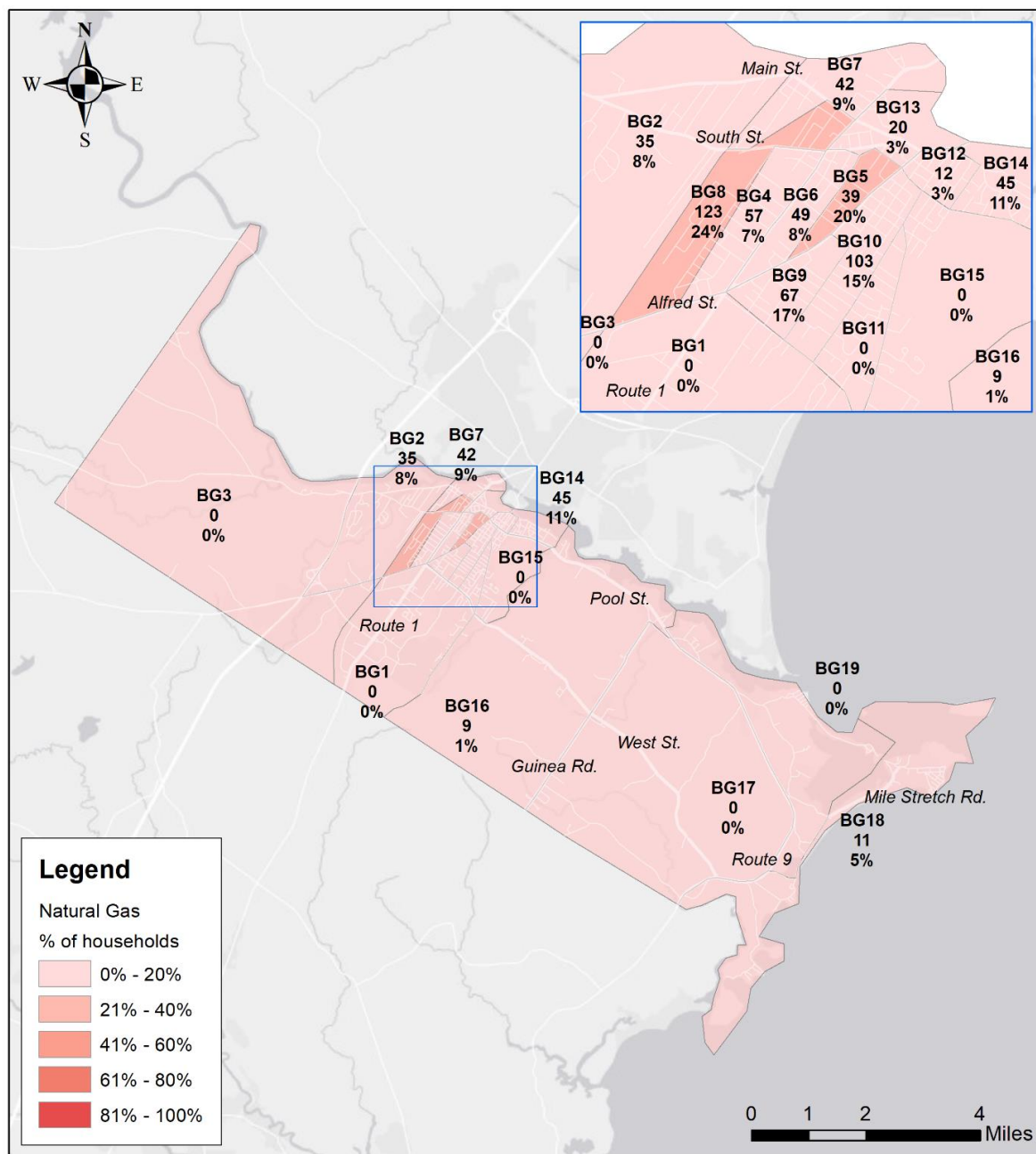


Data source: U.S Census Bureau 2021 American Community Survey
Map created by SMPDC

Map 15. Breakdown of households in Biddeford, by block group, that use propane for heating. Households do not include vacant housing units, so this data is representative of occupied housing units in Biddeford. The block group is labeled (BG#) as well as the total number of households within the block group that use propane for heating and the percent of households within the block group that use propane for heating. Data source: U.S. Census Bureau 2021 American Community Survey

Biddeford – August 2023

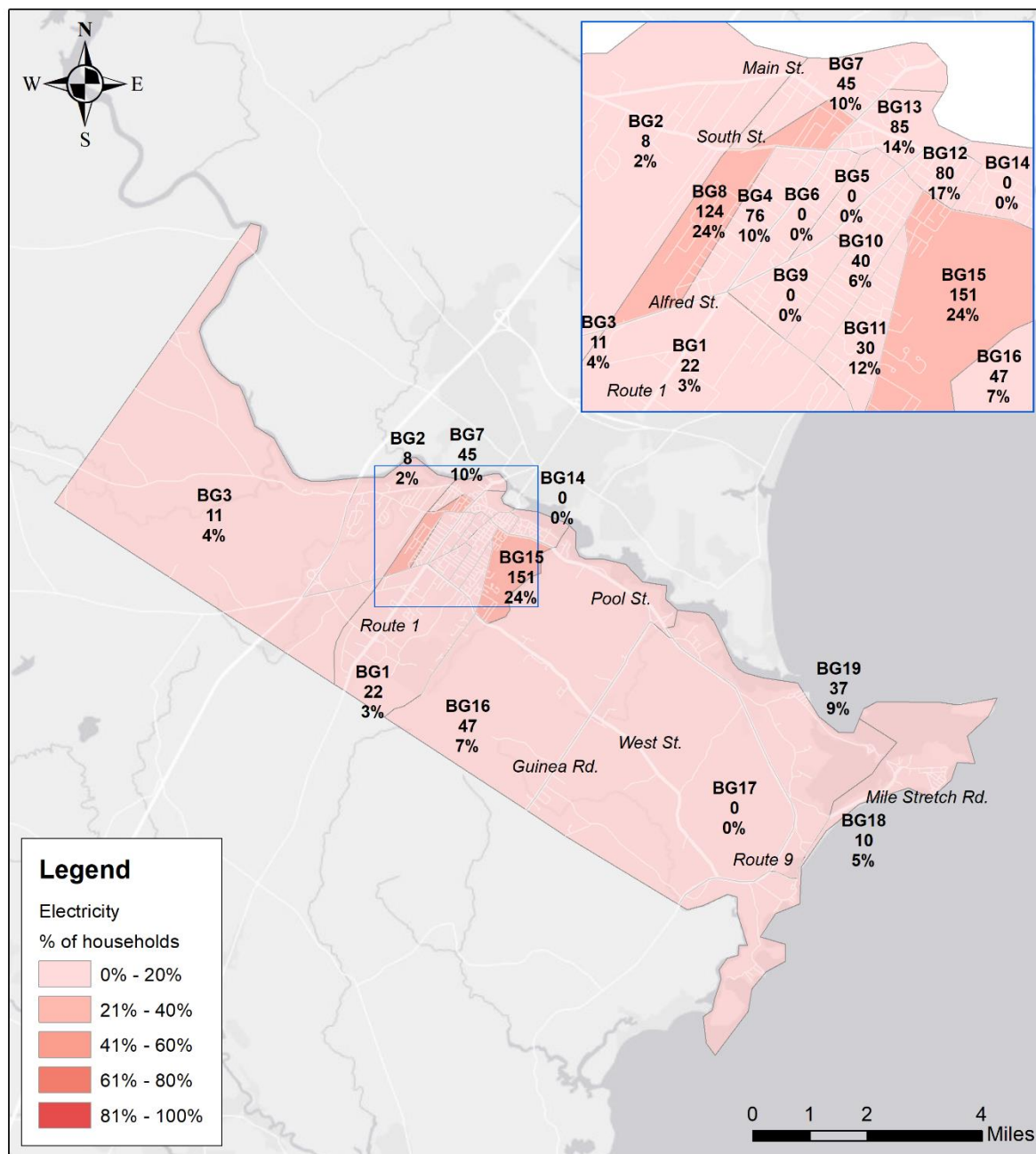
Home Heating Fuel Type - Natural Gas Biddeford



Data source: U.S Census Bureau 2021 American Community Survey
Map created by SMPDC

Map 16. Breakdown of households in Biddeford, by block group, that use natural gas for heating. Households do not include vacant housing units, so this data is representative of occupied housing units in Biddeford. The block group is labeled (BG#) as well as the total number of households within the block group that use natural gas for heating and the percent of households within the block group that use natural gas for heating. Data source: U.S. Census Bureau 2021 American Community Survey

Home Heating Fuel Type - Electricity Biddeford



Data source: U.S Census Bureau 2021 American Community Survey
Map created by SMPDC

Map 17. Breakdown of households in Biddeford, by block group, that use electricity for heating. Households do not include vacant housing units, so this data is representative of occupied housing units in Biddeford. The block group is labeled (BG#) as well as the total number of households within the block group that use electricity for heating and the percent of households within the block group that use electricity for heating. Data source: U.S. Census Bureau 2021 American Community Survey

Biddeford – August 2023

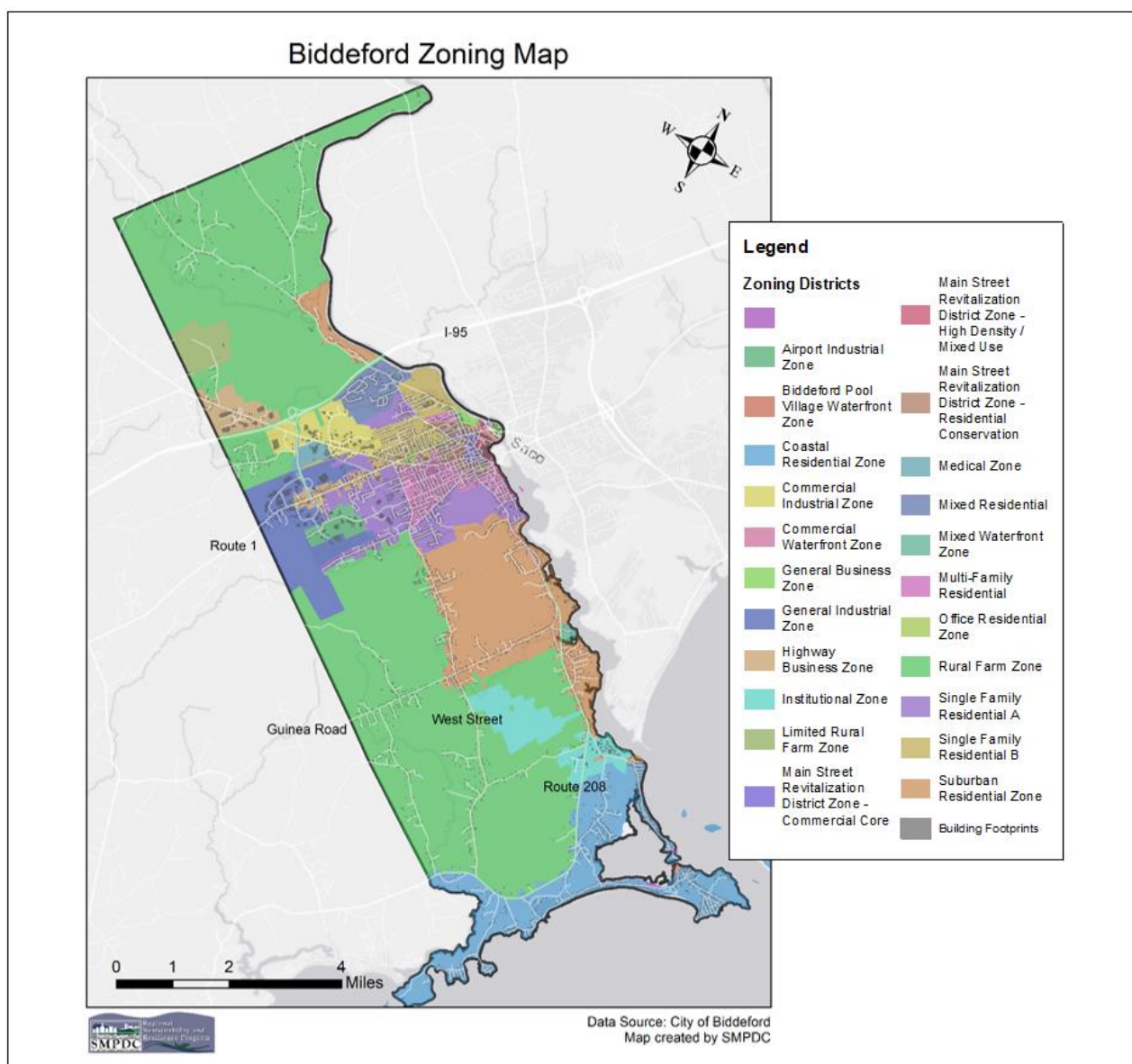


Community wide		Block Groups																		
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Total Households	4,374	694	463	303	769	192	589	463	508	393	675	251	464	591	414	631	652	503	215	428
Fuel oil, kerosene	3,245	580	362	164	588	100	540	376	235	300	466	221	272	352	322	405	460	389	125	303
% households	74%	84%	78%	54%	76%	52%	92%	81%	46%	76%	69%	88%	59%	60%	78%	64%	71%	77%	58%	71%
Propane	281	88	34	43	11	53	0	0	26	26	66	0	72	0	47	62	113	86	40	46
% households	6%	13%	7%	14%	1%	28%	0%	0%	5%	7%	10%	0%	16%	0%	11%	10%	17%	17%	19%	11%
Natural gas	412	0	35	0	57	39	49	42	123	67	103	0	12	20	45	0	9	0	11	0
% households	9%	0%	8%	0%	7%	20%	8%	9%	24%	17%	15%	0%	3%	3%	11%	0%	1%	0%	5%	0%
Electricity	286	22	8	11	76	0	0	45	124	0	40	30	80	85	0	151	47	0	10	37
% households	7%	3%	2%	4%	10%	0%	0%	10%	24%	0%	6%	12%	17%	14%	0%	24%	7%	0%	5%	9%

Figure 7. Community wide and block group level household heating fuel types in Biddeford. Households do not include vacant housing units, so this data is representative of occupied housing units in Biddeford. Data source: U.S. Census Bureau 2021 American Community Survey

Zoning

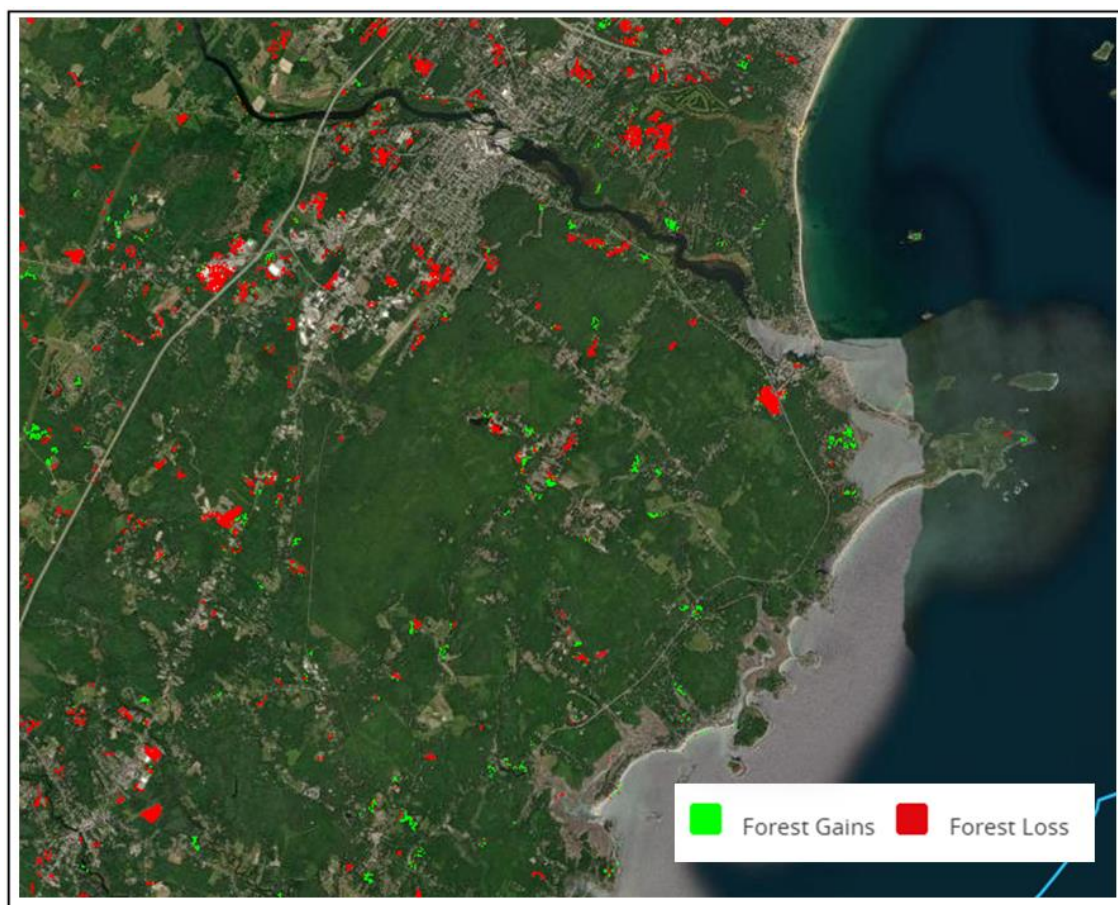
Local zoning will impact where in the community (*i.e.* particular geographic areas) certain types of development-related climate mitigation and adaptation strategies would likely have more impact due to where different types of development are allowed and what the standards are for those types of development. The zoning map below (Map 18) is provided for reference to show where areas zoned for commercial, industrial, and residential uses are located.



Map 18. Biddeford's adopted zoning map.

Land Cover and Carbon Sequestration

Forests, wetlands, and grasslands store high amounts of organic carbon. Coastal wetlands are among the largest natural carbon sinks of all terrestrial ecosystems, particularly on a per unit area basis. Undisturbed forest soils also store substantial amounts of carbon. Certain land use activities can enhance carbon storage, such as soil health and conservation practices, whereas others can be a source of carbon release⁹. In built environments, carbon is stored in trees, grassy areas, gardens, and in wooden structures and are increasingly important for reducing carbon in the atmosphere. Changes in land cover, such as conversion of forest to developed land, impacts not only the health of the natural environment, but the carbon sequestration potential of land. Map 19 shows the change in forested land coverage in Biddeford from 1996 to 2016. Biddeford has experienced more forest loss than gain, especially in on the periphery of the downtown area.



Map 19. Changes in forested land cover from 1996 to 2016. Green areas indicate a transition of non-forested land to forested, while red areas indicate a transition from forested land to a different type of land cover (e.g., impervious, grassland, wetland, shrub-scrub habitat, etc.). Source: NOAA Coastal Change Analysis Program (C-CAP) Land Cover Atlas.

⁹ State of Maine. 2022. Maine Soil Carbon Incentives Study Policy Recommendations.

EXTREME STORMS & PRECIPITATION

Key Takeaways

- Since 1895 annual precipitation in York County has increased 6.9 inches, and extreme precipitation events (greater than 2 inches in a day) have become more frequent. Future projections indicate that annual precipitation will likely continue to increase, and extreme precipitation events will become even more frequent.
 - Flooding events are the most common type of disaster in York County and the most destructive. In the last quarter century, flooding events have caused nearly \$45 million in property damage across coastal York County, and coastal floods alone have caused about \$22 million in property damage.
 - Downtown Biddeford is particularly vulnerable to flooding and stormwater overflow during extreme precipitation events because of a high degree of impervious surfaces.
 - This is also the area of highest social vulnerability in the community and where the oldest and most vulnerable buildings are located.
 - This area has already experienced significant damage from flooding associated with high flows of the Saco River. Notably, the riprap bank along the River in the Mill District was washed out during an extreme precipitation event in 2021 (**Error! Reference source not found.**).
 - The Biddeford Pool and Fortunes Rocks Beach also have a high degree of impervious surfaces and are more vulnerable to the combined impacts of extreme precipitation and coastal flooding during severe storms.
 - This area also has the highest concentration of residents who are 65+, many of whom are living alone. The buildings in this area are also older and more vulnerable compared to other parts of the City.
 - Rotary Park, an important recreational and open space asset for the community, is at risk of flooding from the 1% annual chance precipitation event.
 - Biddeford's aging electric grid is increasingly vulnerable to several climate impacts, including extreme storms and precipitation as well as increasing temperatures. This will likely result in more frequent and longer duration power outages in Biddeford that can pose serious risks for public health and safety.

Background Info, Trends, & Projections

Storms and heavy rainfall are becoming more frequent and intense with climate change. From 1895 to 2022 total annual precipitation in York County increased 6.9 inches (Figure 9), which is slightly higher than the statewide trend of about 6 inches. Shifting weather patterns are causing more precipitation to fall as rain rather than snow,¹⁰ and extreme precipitation events (greater than 2 inches in a day) are becoming even more frequent. Coastal communities like Biddeford are experiencing even more frequent extreme storms and precipitation events because of the influence of Atlantic storm tracks.¹¹ Hurricanes and tropical storms are tracking further northward and there is a high increase in the probability of lower category storms impacting the East Coast. A recent national study found that the Northeast is expected to see the largest increases in the annual probability of at least tropical storm wind conditions or higher, as hurricanes are expected to move further up the Atlantic coast in the future. This may have a significant impact on buildings that are not built to a code that considers the wind speeds they will likely face over the next 30 years.¹²



Figure 8 A section of the stone riprap along the Saco River in the Biddeford Mill District was damaged during an extreme precipitation event and subsequent high River flows in late October 2021. Credit: A. Sherwin

¹⁰ ME Climate Council, Scientific Assessment of Climate Change and Its Effects in Maine, 2020: <http://climatecouncil.maine.gov/reports>

¹¹ University of Maine, Maine's Climate Future, 2020: <https://climatechange.umaine.edu/climate-matters/maines-climate-future/>

¹² First Street Foundation. 2023. Embargoed: The 7th National Risk Assessment: Worsening Winds

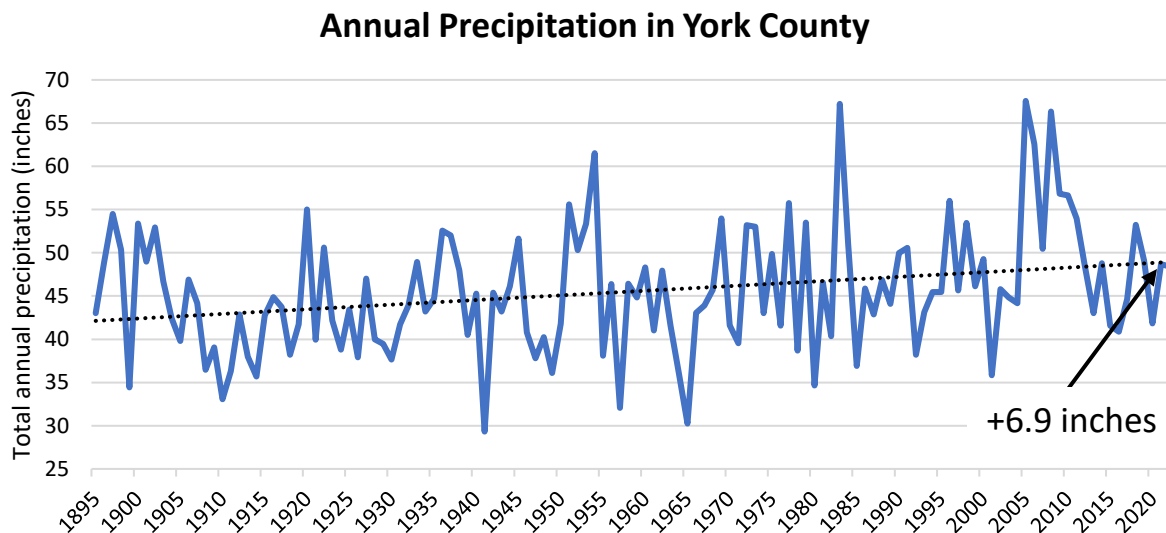


Figure 9. Total annual precipitation in York County from 1895 to 2022 based on monthly data from the [NOAA National Centers for Environmental Information](#). Over this time period total annual precipitation has increased by 6.9 inches.

Since 1970 there have been 34 federally declared disasters in York County related to storm events. Severe storms with heavy rains, strong winds, and coastal flooding have been the most common type of event and have occurred most frequently during the months of February and March followed by October.¹³ NOAA maintains a database of all reported storm events, including storms that did not qualify for a disaster declaration. Since 1996 there have been a total of 361 storm events in coastal York County, and 122 events that caused significant property damage totaling about \$54 million (Figure 10). Flooding events, including coastal flooding, have caused nearly \$45 million in damage across the region and coastal flooding events alone have caused approximately \$22 million in damage.¹⁴

Storm Events in Coastal York Co. from 1996-2022		
Event Type	Number	Property Damage
Coastal Flood	58	\$21,659,000
Flash Flood	8	\$12,625,000
Flood	10	\$10,653,500
Ice Storm	2	\$7,930,000
High/Strong Wind	28	\$537,500
High Surf	8	\$229,000
Lightning	8	\$145,000
TOTAL	122	\$53,779,000

Figure 10. Cumulative storm events and property damage in coastal York County from 1996 to 2022 based on data from the [NOAA Storm Events Database](#)

¹³ FEMA Disaster Declarations Summary, as of 2022: <https://www.fema.gov/openfema-data-page/disaster-declarations-summaries-v1>

¹⁴ NOAA Storm Events Database, as of 2022: <https://www.ncdc.noaa.gov/stormevents/>

Recent notable storms include:

- December 23rd Storm, 2022 – The highest water level recorded at the Portland tide gauge was 13.72 ft MLLW, the third highest ever recorded. Heavy rainfall, high winds, and storm surge caused extensive power outages, coastal flooding, and property damage along the coast of Maine. Governor Mills requested a disaster declaration in February 2023, but FEMA has not made a determination yet.
- Flash flood, October 2021 – (Federally declared disaster) Biddeford reported 6.7 inches of rain in a 6-hour period. A stone embankment supporting the RiverWalk near the Pepperell Mill was washed away during the storm causing millions of dollars in damage. It also caused widespread power outages and flooded roads.¹⁵
- Nor’easters, March 2018 – (Federally declared disaster) Two nor’easters, only days apart, brought heavy rainfall, high storm surge, and high winds which caused severe coastal flooding and damage.¹⁶
- Patriot’s Day Storm, April 2007 – (Federally declared disaster) High wind, waves, and coastal flooding caused severe damage to roads, bridges, and wastewater treatment plants as well as private homes and businesses. Extensive power outages left residents without electricity for days. The most extensive damage occurred along the coastline and was caused by flooding and storm surge.¹⁷
- Mother’s Day Storm, May 2006 – Southern Maine received up to 16 inches of rain, exceeding precipitation amounts associated with the 100-year storm event and resulting in extensive flooding and damage.¹⁸

Historically, flooding has been the most common type of disaster in York County, particularly coastal flooding caused by nor’easters.¹⁹ Storm tides cause extensive coastal flooding and occur when a storm surge coincides with an astronomical high tide. The highest water level recorded at the Portland tide gauge (the closest official NOAA tide gauge to Biddeford) occurred during the Blizzard of 1978 and exceeded 14 feet MLLW (Figure 11). The 2018 nor’easter and 2007 Patriot’s Day Storm also caused storm tides within the top 20 water levels recorded at the Portland tide gauge. During the recent December 23rd storm (which is not included in Figure 11) a water level of 13.72 feet MLLW was recorded in Portland, about an inch lower than the 2018 nor’easter storm tide.²⁰ In Biddeford, coastal neighborhoods like the Biddeford Pool and Fortunes Rocks Beach have experienced the most severe coastal flooding impacts. In the future, as sea level rises and

¹⁵ York County Emergency Management Agency, Hazard Mitigation Plan, 2022:

<https://www.yorkcountymaine.gov/emergency-management>

¹⁶ SMPDC, Economic Resilience Planning for Coastal York County, 2022: <https://smpdc.org/coastal>

¹⁷ York County Emergency Management Agency, Hazard Mitigation Plan, 2022:

<https://www.yorkcountymaine.gov/emergency-management>

¹⁸ SMPDC, Tides, Taxes, and New Tactics, 2021: <https://smpdc.org/coastal>

¹⁹ York County Emergency Management Agency, Hazard Mitigation Plan, 2022:

<https://www.yorkcountymaine.gov/emergency-management>

²⁰ NOAA Tides and Currents: <https://tidesandcurrents.noaa.gov/waterlevels.html?id=8418150>

storms become more frequent and intense, Biddeford can expect to see more damage from heavy rainfall, coastal flooding, and high winds.

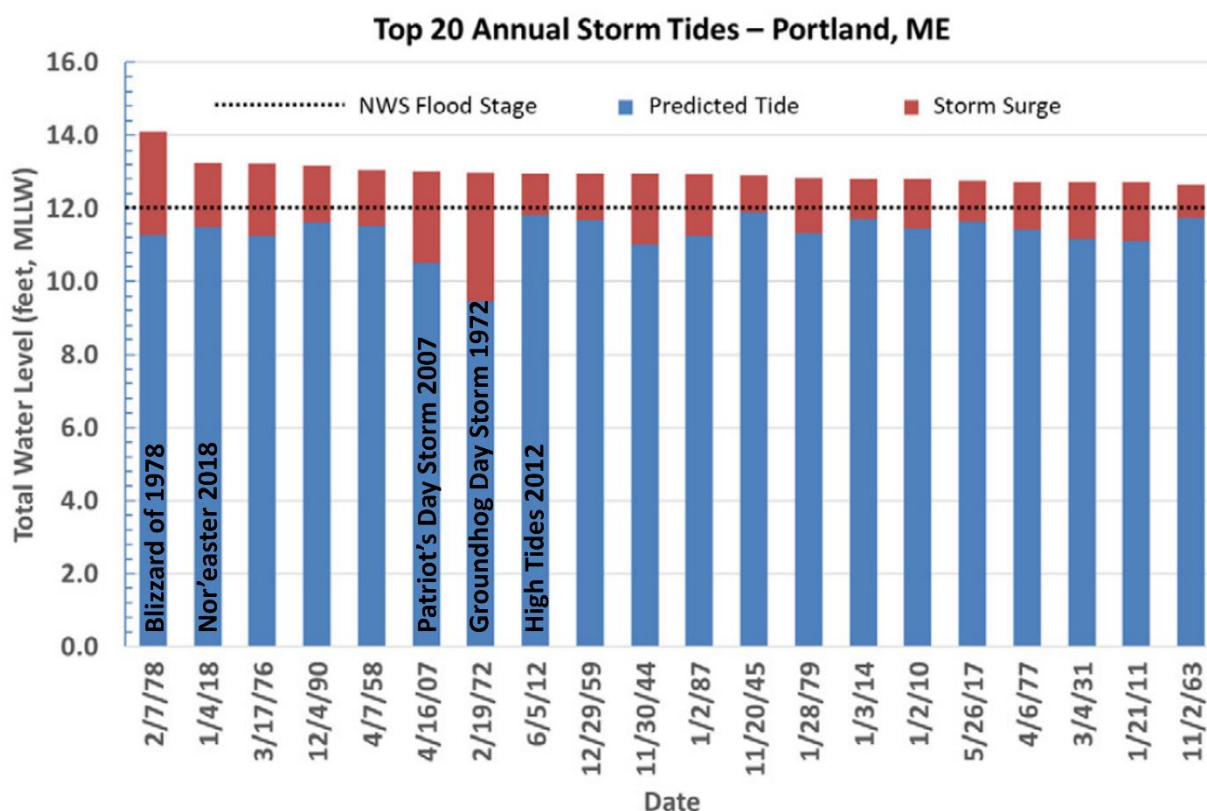


Figure 11. Major storm events and top 20 annual storm tides recorded at the Portland, ME tide gauge from 1912-2019. The National Weather Service Flood Stage of 12 feet MLLW is shown as a dashed line. This threshold indicates when elevated water levels begin to create a hazard to public safety, property, and infrastructure. Graph was created by Pete Slovinsky at the Maine Geological Survey for the [ME Climate Council, Scientific Assessment of Climate Change and Its Effects in Maine, 2020](#).

Intense storms and heavy precipitation can cause inland flooding along rivers and streams and exacerbate coastal flooding. Developed areas with lots of impervious surfaces such as roads, parking lots, sidewalks, and buildings experience more flooding during heavy rainfall because the water has nowhere to go. Stormwater systems can overflow because of limited capacity to handle high water volumes, causing runoff into lakes and rivers. Inland and urban flooding pose a threat to public safety, infrastructure, and property. Stormwater runoff also increases the risk of contaminated drinking water supplies and degraded water quality in coastal areas making it unsafe to swim.²¹

Like coastal flooding, inland and urban flooding may occur during winter nor'easters, but it also occurs during summer and fall tropical storms or intense thunderstorms. Flash floods

²¹ York County Emergency Management Agency, Hazard Mitigation Plan, 2022: <https://www.yorkcountymaine.gov/emergency-management>

are historically uncommon in Maine, but in October 2021 a flash flood dropped 6.7 inches of rain on Biddeford in 6 hours. The resulting flash flood caused extensive damage, especially along the developed areas of the Saco River. Inland flooding is difficult to predict due to the complex interaction of factors that contribute to precipitation-based flooding conditions, but changing weather patterns and more frequent and intense hurricanes in the southern U.S. have the potential to cause more inland and urban flood events in coastal communities like Biddeford.²²

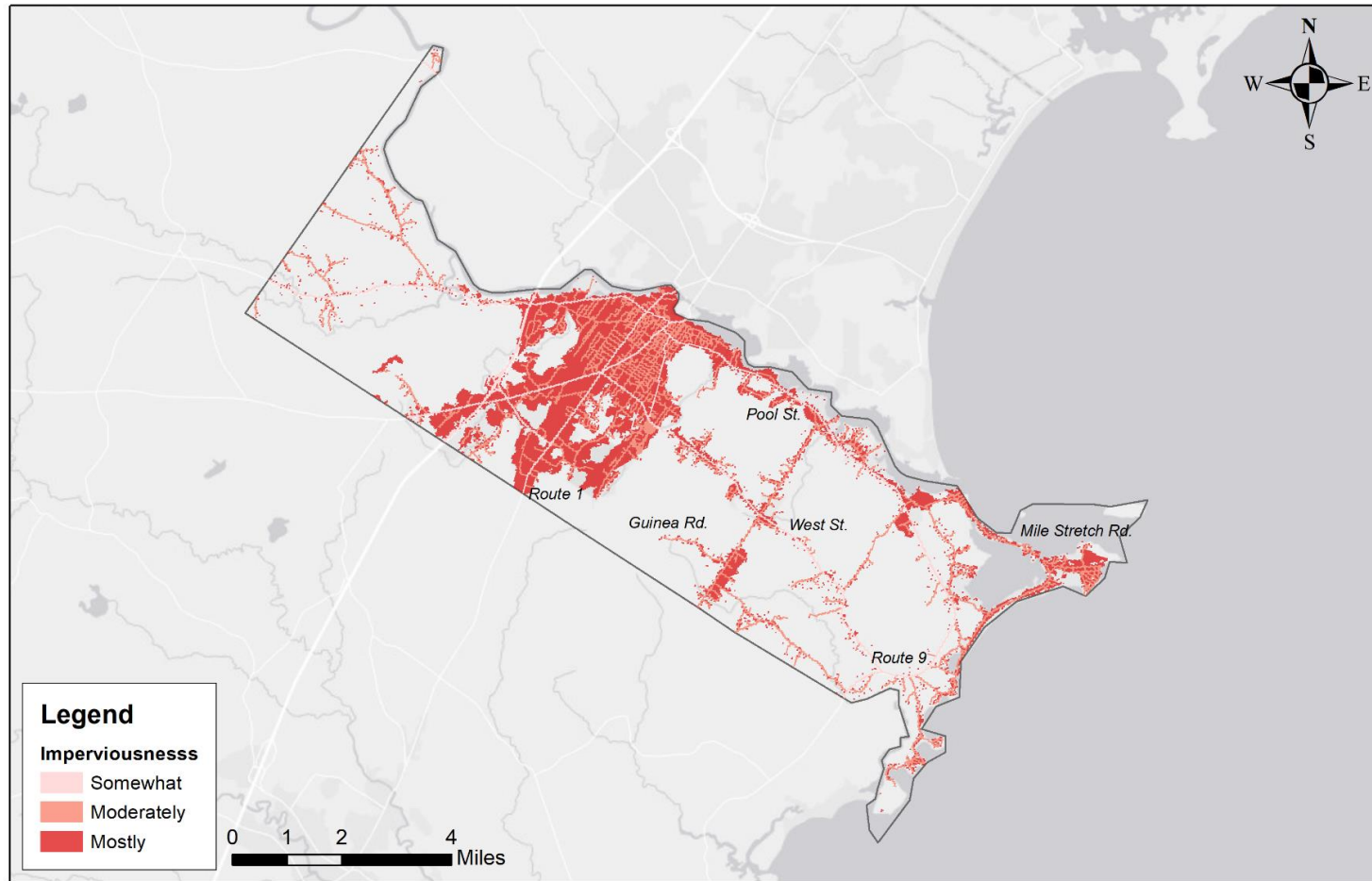
Biddeford's proximity to the Saco River and its tributaries increases the community's risk of inland flooding. Biddeford's downtown is highly impervious as are the corridors along Alfred Road and Route 1 (Map 20). Downtown Biddeford also has the highest degree of social vulnerability compared to the rest of the community and is where the oldest and most vulnerable buildings are located. There is a higher degree of imperviousness adjacent to the Saco River along Pool Street, in the Biddeford Pool neighborhood, and along Fortunes Rocks Beach. Biddeford Pool and Fortunes Rocks Beach also have the highest concentration of residents who are 65+, many of whom are living alone, and the buildings are older and more vulnerable compared to the rest of City. The high degree of impervious surfaces in these downtown and coastal neighborhoods increases the risk of flooding and stormwater overflow from extreme precipitation events. In Biddeford Pool and Fortunes Rocks Beach, heavy rainfall coupled with a high degree of impervious surfaces can also exacerbate the impacts of coastal flooding. In the future, with more intense storms and extreme precipitation events these areas will be at a higher risk of flooding due to exposure to inland and coastal flood hazards, elevated social vulnerability, and older buildings.

Increasing precipitation and subsequent stormwater runoff could be particularly impactful for Thatcher Brook (Map 21). The Thatcher Brook Watershed covers an area of approximately 7 square miles, spanning the borders of Biddeford and Arundel, and draining into the Saco River. There are a variety of land-use types in this area from agricultural and forested lands to dense residential and commercial areas. Thatcher Brook is designated as an impaired water body by the Maine Department of Environmental Protection (MDEP) due to contamination from stormwater runoff. The high degree of impervious surfaces within and around the watershed (Map 20) increase stormwater runoff in this area. The City completed a Watershed Management Plan²³ in 2015 and is working with the York County Soil and Water Conservation District (YCSWCD) to restore the watershed. Increasing stormwater runoff from extreme precipitation events could hamper these efforts and make it increasingly difficult to restore water quality in Thatcher Brook.

²² York County Emergency Management Agency, Hazard Mitigation Plan, 2022: <https://www.yorkcountymaine.gov/emergency-management>

²³ [Thatcher Brook Watershed Management Plan, City of Biddeford, 2015](#)

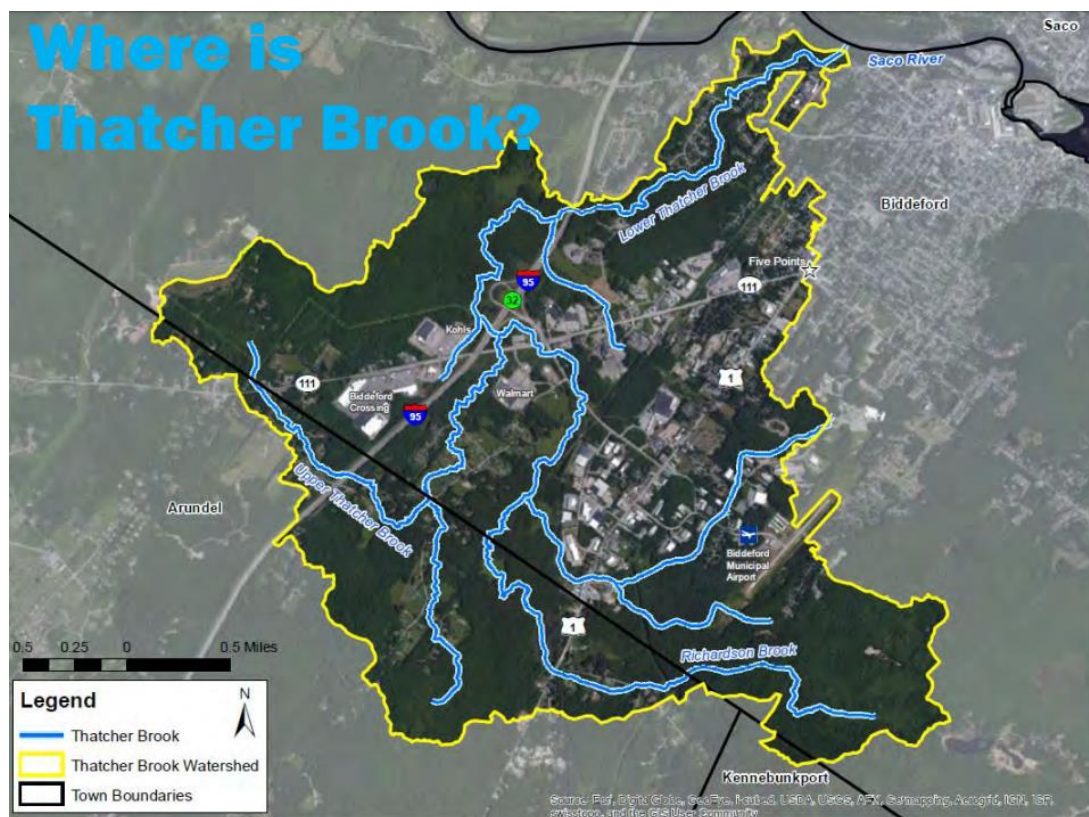
Impervious Surfaces Biddeford



Data source: National Landcover Dataset (2019)
Map created by SMPDC

Map 20. Impervious surfaces in Biddeford based on their level of imperviousness (somewhat, moderately or mostly impervious). Data is from the [2019 National Landcover Dataset](#).

Biddeford – August 2023



Map 21. The Thatcher Brook Watershed is located southwest of downtown Biddeford and extends into the northern part of Arundel. Map from the [Thatcher Brook Watershed Management Plan webpage](#).

Power Outages and Electric Grid Resilience

The reliability of the electric grid is vital to the day-to-day well-being and quality of life of Biddeford's community members, the City's operations, and local economic activities. Breakdowns in grid operations and infrastructure result in power outages that can have significant impacts and hazards for a community. Power outages can jeopardize essential public safety services as well as drinking water and wastewater systems. Downed wires during power outages can make roads impassable or dangerous. Lack of heating/cooling and electricity during power outages puts vulnerable community members at risk. Homes and businesses also face significant costs due to power outages.

Biddeford is served by the ISO-New England Electric Grid, which oversees the day-to-day operation of New England's electricity grid. Grid components, including substations, transmission lines, and distribution lines, are owned by energy delivery service companies. In Biddeford the delivery service company is Central Maine Power, who provides Biddeford with electricity on several circuits that link Biddeford with the surrounding communities of Kennebunkport, Arundel, and Saco.

The New England electricity grid is aging and is characterized by an extensive network of older, lower-capacity transmission lines serving as feeder lines to transformers and other critical system components. It is also increasingly vulnerable to several climate impacts, including extreme storms and precipitation as well as increasing temperatures.

Currently, the greatest source of power outages in the broader region is storm events, including nor'easters, ice storms, snowstorms, and high wind events. A combination of high storm frequency, aging electric grid infrastructure, and an abundance of trees results in Maine having some of the worst power outages in the country. From 2015-2019 Maine had the highest average annual frequency of power outages per customer of any state (3.9 outages per year). Maine also had the second longest average duration of power outages per customer annually (14.1 hours), only behind Florida (14.6 hours).

Major weather events and storms significantly increase the duration of power outages, greatly impacting the number of hours Mainers spend without power. In 2020, a greater number of severe weather events meant that CMP customers experienced an average of 29.5 hours without power. However, in 2021 (a year with far fewer extreme weather events) CMP customers experienced only an average of 5.25 hours of power outages.

Currently, the leading cause of power outages in Biddeford is motor vehicle accidents (45% of all customer outage hours in 2021), followed by tree limbs falling on power lines due to high winds or heavy ice or snow loads on trees (30%). Tree limbs can cause outages by leaning on conductor lines, pulling lines down completely, or by damaging utility poles.²⁴

In the future, increases in extreme storm frequency and duration will likely result in more power outages from downed lines, blown transformers, and other damage to regional grid infrastructure. Additional climate impacts will also strain grid infrastructure and cause power outages in the following ways:

- Increased likelihood of equipment breakdown from flooding of coastal and inland grid infrastructure from increases in storm surge and extreme precipitation events. In particular, substations can be significantly damaged by flooding. Substations are a key part of electrical power generation, transmission and distribution systems and often serve circuits that span multiple municipal jurisdictions. Flooding can damage substation components, leading to power outages and even fires. Also, during extreme storms, damage to roads and other infrastructure can prevent utility services from reaching and repairing sub-stations, prolonging power outages. The City of Biddeford is served by several CMP substations. One is located on Morin St. while another is located on Saco Island. While located close to the Saco River, the substation on Saco Island is well elevated and therefore unlikely to be at high risk of

²⁴ Data supplied by Central Maine Power

flooding. Some of coastal Biddeford is served by a CMP substation located on School Street in Kennebunkport, which could be potentially vulnerable to extreme flooding of Grist Mill Pond due to extreme precipitation or storm surge.

- Reduction in the grid transmission capacity and increase in the risk of damage to transformers due to higher average temperatures and nighttime temperatures.
- Increased risk of physical deformation of powerlines, damage to transformers, and disruptions to service due to extreme high temperatures.
- Increased demand for electricity, due to both the electrification of other energy systems as well as increased average and peak cooling demand during warmer temperatures and longer, more frequent, and more severe heat waves.

Taken together, these impacts mean that the regional electric grid is extremely vulnerable to climate change, while at the same time electrification and electricity demand are going up. These vulnerabilities are exacerbated by aging grid infrastructure that has an increasingly limited capacity to take on more electricity transmission. At the same time, increases in average and extreme temperatures lead to greater health risks for Biddeford's vulnerable community members, which in turn amplifies the need for reliably electrified and conditioned spaces to ensure their safety.

FLOODING: SEA LEVEL RISE AND STORM SURGE

Key Takeaways

- Neighborhoods and infrastructure located around Biddeford Pool, Fortunes Rocks, Timber Point, and along the Saco River are vulnerable to flood hazards associated with climate change. As sea levels rise, and storms become more frequent and intense, these neighborhoods can expect more frequent coastal flooding events and associated damage to property, infrastructure, and the coastline. These areas also have elevated social vulnerability and a high percentage of structures built before 1970, meaning that they are likely not constructed to modern building codes increasing sensitivity to flooding.
- The Biddeford Pool area (block group 18) has the highest percentage of 65+ population (58%), with 20% of the people in that block group 65+ and also living alone. Additionally, 50% of the people in this block group have incomes less than \$50k. This suggests that community members most vulnerable to coastal flooding impacts are older, more likely to live alone, and potentially on a fixed income. These factors increase their sensitivity to storm impacts and also limit their adaptive capacity.
- Tourism activity driven by Biddeford's sandy beaches and a healthy coastline could decline as flooding becomes more frequent and the amount of dry beach decreases as sea level rises.
- As coastal properties become increasingly exposed to flooding, their market and assessed values could decline, reducing local tax revenues from affected parcels and potentially straining municipal fiscal health. \$391 million in assessed property value is vulnerable to flooding from storm surge associated with the 1% annual chance event plus 1.6 feet of sea level rise, representing 11.1% of the city-wide assessed property value.
- Road access to 56 parcels will be cut off by flooding with the 1.6 ft scenario and 260 will be cut -off with the 3.0 ft scenario, putting the people who live there and emergency access to them at risk.
- Route 208/Mile Stretch Road, a designated evacuation route, is vulnerable to sea level rise and is the only access route in and out of the Biddeford Pool neighborhood, which is an area of elevated social vulnerability based on the percentage of the population over the age of 65 living alone and percentage of households with an annual income of less than the state and county median income as well as the EPA climate change and social vulnerability income threshold.
- The Timber Point walking trail, an important recreational area for residents and visitors, is vulnerable to flooding from both the 1.6 ft and 3.0 ft scenarios.

- In Biddeford, future sea level rise will cause regular inundation of low-lying coastal areas during high tide, likely leading to contamination of groundwater aquifers and wells from saltwater intrusion, and increased erosion of sandy beaches, dunes, and salt marshes.
- Most coastal properties in Biddeford have private wells which are at risk of saltwater intrusion from rising seas, placing drinking water supplies for those homes at risk.
- The majority of engineered coastal structures (e.g., seawalls, riprap, etc.) along Ocean Avenue, Biddeford Pool, and the middle and southern portions of Hills Beach are vulnerable to overtopping by water from the 1% annual chance event.
- Areas along Biddeford Pool, Little River, and the mouth of the Saco River have been identified as being able to support future marsh migration.

Background Info, Trends, & Projections

Sea level in Maine has been rising in the long-term, but over the past few decades the rate of rise has accelerated. That rise is increasing the frequency of nuisance or high tide flooding, with southern Maine seeing 4 times as many nuisance flooding events over the last decade compared with the average of the past 100-years²⁵. According to a recent State assessment, there is a 67% probability that sea level will rise between 1.1 and 1.8 feet by 2050, and between 3.0 and 4.6 feet by the year 2100 under intermediate global greenhouse gas emissions scenarios, with higher sea level rise amounts possible²⁵. With that rate of sea level rise, not accounting for increased intensity and frequency of storms, Maine will see a 15-fold increase in coastal flooding by 2050²⁵. Those scenarios do not account for more intense rainfall that climate change is bringing to the region, which will exacerbate flood risk. With just 1.6 feet of sea level rise by 2050, it's estimated that cumulative damage costs caused by coastal flooding could be \$16.9-\$18.2 billion statewide²⁶.

As sea level rises in the future, normal high tides will be higher and storms, and accompanying storm surge, will be more impactful, causing extensive coastal flooding to roads, homes, and businesses. Storm surge is the abnormal rise in ocean water level during a storm event, measured as the height of the water above the normal predicted astronomical tide. It is caused primarily by storm winds pushing ocean water onshore. This rise in water level can cause extreme flooding in coastal areas, especially when storm surge coincides with normal high tide. While future sea level rise will occur gradually over time, extreme storm events can cause damaging flooding episodically in the short-term.

²⁵ Maine Climate Council, Scientific Assessment of Climate Change and Its Effects in Maine, 2020: <http://climatecouncil.maine.gov/reports>

²⁶ Eastern Research Group. 2020. Assessing the Impacts Climate Change May Have on the State's Economy, Revenues, and Investment Decisions: Volume 2, Cost of Doing Nothing Analysis. Prepared for the State of Maine. Governor's Office of Policy Innovation and the Future.

In addition to rising seas, storm surge, and more nuisance flooding events, southern Maine's coastal areas are seeing more frequent and intense precipitation events. Further, the intensity and frequency of precipitation is expected to increase in the future with climate change. Stormwater runoff from rainfall events combined with surge and future sea level rise will lead to more extensive flooding in coastal areas.

Coastal flooding threatens public health and safety by putting transportation corridors, evacuation routes and provision of emergency services at risk; disrupts economic activity through lost business and reductions in tourism; reduces property values; and imperils municipal revenue and budgets. Additionally, individuals who already have increased social vulnerability will be disproportionately affected by sea level rise and climate change as they have less capacity to prepare for, respond to, and recover from coastal hazard events.

Sea level rise threatens not only the landscape above ground, but also the below-grade environment. Along the coast, groundwater and saltwater are naturally separated by the seaward movement of groundwater. As seas rise, landward intrusion of seawater pushes groundwater levels up and shifts the interface of fresh groundwater and saltwater inland. Low-lying coastal communities and critical infrastructure are at risk of impacts including intrusion of saltwater into groundwater and drinking water resources, increased flooding from higher coastal water tables, and water damage to pavement from below. Potential impacts of unmitigated groundwater rise include:

- Water quality degradation
- Premature septic system failure
- Mobilization of hazardous waste
- Saltwater intrusion into drinking water supplies
- Wetland expansion, transition, or drowning
- Flooding due to higher coastal water tables
- Damage to pavement and other hardscape surfaces

To plan for sea level rise and associated impacts, the Maine Climate Council recommends an approach of committing to manage for a higher probability, lower risk scenario, but also preparing to manage for a lower probability, higher risk scenario. That concept involves building flexibility into designs and decisions so that adjustments can be made to address more extreme sea level rise. It accounts for some of the variability and uncertainty regarding global emissions reductions efforts and evolving science about potential future melting of land-based ice. The State recommends that Maine commit to manage for 1.5 feet of relative sea level rise by 2050, and 3.9 feet of sea level rise by the year 2100, but prepare to manage for 3.0 feet by 2050, and 8.8 feet by 2100, all in relation to 2000 local

sea level²⁷. When planning for sea level rise, consideration should be given to the risk tolerance of different kinds of infrastructure. In other words, the intended lifespan, criticality, and exposure of infrastructure and assets to flood hazards should be considered when evaluating what sea level rise scenarios and planning horizons to account for in design and maintenance decisions.

In Biddeford, future sea level rise will cause regular inundation of low-lying coastal areas during high tide, leading to contamination of groundwater aquifers and wells from saltwater intrusion, and increased erosion of sandy beaches, dunes, and salt marshes.

This section presents assessment results of the impacts of modeled flooding from storm surge combined with sea level rise to represent what flooding from storm events could look like in the future²⁸. The two flooding scenarios, listed below, align with the Maine Climate Council’s planning recommendation of committing to manage 1.5 feet of rise by 2050 and preparing to manage 3.0 feet by 2050.

Flooding scenarios used for assessment²⁹:

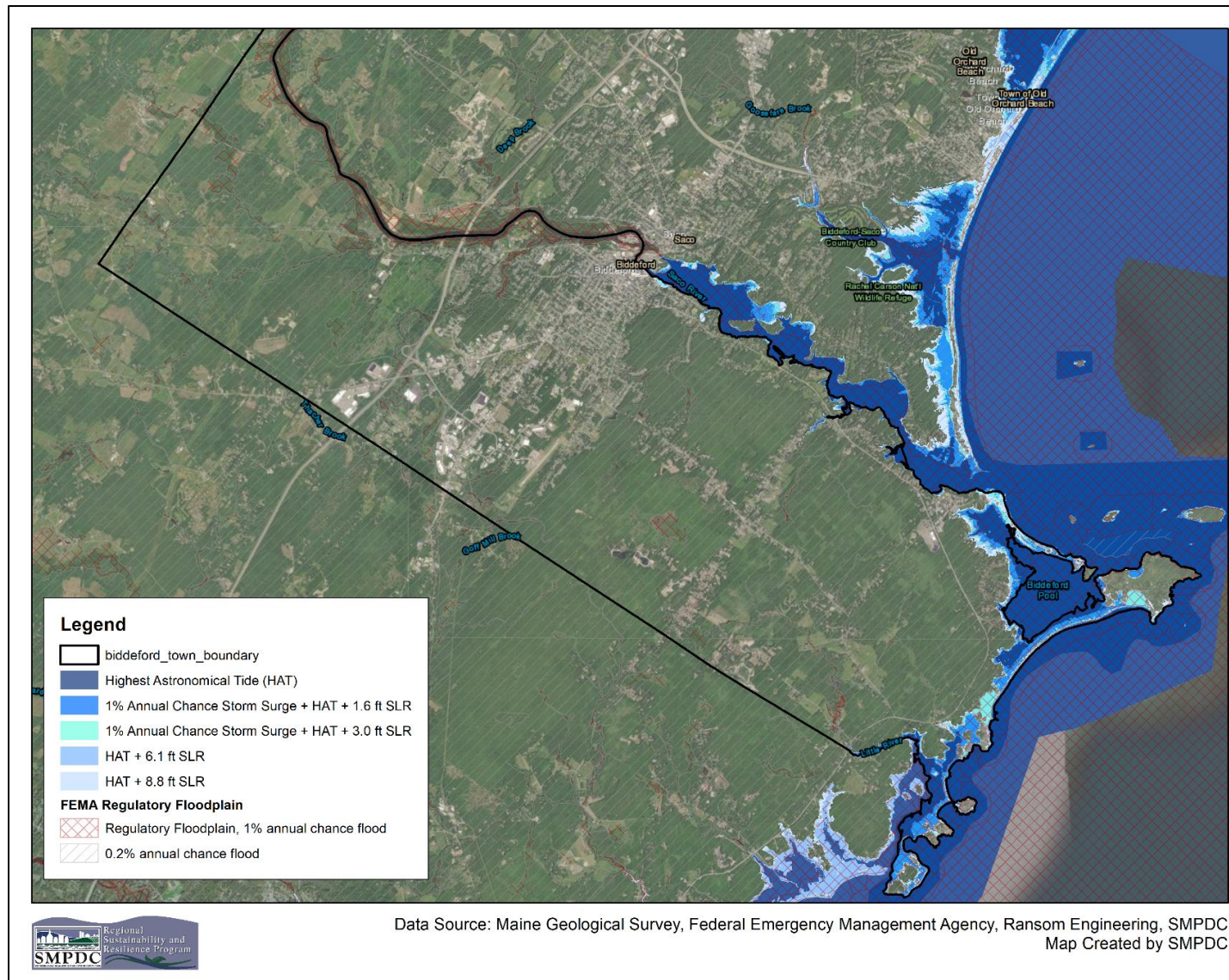
- **Storm surge from 1% annual chance storm event (*i.e.* 100-year storm) + 1.6 feet of sea level rise**
- **Storm surge from 1% annual chance storm event + 3.0 feet of sea level rise**

The assessment results presented below use the terms ‘vulnerable’, ‘impacted’, and ‘at-risk’ to describe impacts. All three terms mean that the parcel, asset, or area is touched by water under the given inundation scenario. It is important to note that the modeled flood scenarios show inundation at high tide, so not every area or thing that is directly impacted by the flood scenarios will be permanently inundated.

²⁷ Maine Climate Council. 2020. Maine Won’t Wait: A Four-Year Plan for Climate Action.

²⁸ Southern Maine Planning and Development Commission. 2021. Coastal Assessment for Biddeford, Saco, and Old Orchard Beach.

²⁹ The sea level rise scenarios were developed by the Maine Geological Survey and do not account for wave action or precipitation. The storm surge values were provided by Ransom Consulting, LLC, and consist of storm surge and static wave set-up, without additional wave action due to crests or wave runup.



Map 22. Modeled inundation from sea level rise (SLR), storm surge, and the 1% annual chance storm event (Special Flood Hazard Area depicted on the FEMA-Issued Flood Insurance Rate Map).

Property Impacts

Where and how we choose to develop land profoundly impacts the resilience of our community. Buildings located in areas exposed to natural hazards like flooding are at greater risk of climate change impacts. Biddeford's municipal budget, like most southern Maine coastal communities, is highly dependent on revenue from local property taxes and coastal development provides a substantial portion of the municipal tax base, generating vital funds that sustain community operations, services, and programs. However, it is that same development that is most susceptible to coastal flooding, placing residents, visitors, and municipal fiscal health at risk. Studies have shown that coastal hazards and climate change diminish the value of impacted properties³⁰. Municipal fiscal health could be negatively impacted if coastal properties, which generate a large portion of local tax revenue, are exposed to flooding and if development in vulnerable areas continues. In addition, the coastal areas and resources, especially sandy beaches, which serve as the economic engine for towns, the region, and state are particularly vulnerable to storms and rising seas as increasing water levels reduce the area of dry beach available.

Map 26 shows the locations of buildings and facilities that are critical for community safety, function, and well-being, and the location of historic properties. It also shows parcels that are vulnerable to, or 'impacted' by, projected flooding from the two modeled scenarios.

- There are designated historic properties along the Saco River and in Biddeford Pool that are located in areas that are vulnerable to flood hazards, including sea level rise, storm surge, and flooding from the 1% annual chance event.
- Parcels that are expected to be impacted by flooding with the 1.6 ft sea level rise scenario total slightly more than \$391 million in assessed property value, representing 11.1% of the city-wide assessed property value (Figure 12).
- Road access to 56 parcels will be cut off by flooding with the 1.6 ft scenario and 260 will be cut off with the 3.0 ft scenario, putting the people who live there and emergency access to them at risk.
- Properties along Hills Beach, Biddeford Pool, Fletcher Neck, Fortunes Rocks Beach, Granite Point, and Timber Point are vulnerable to flooding from the open Ocean and the tidal Little River from both the 1.6 ft and 3.0 ft scenarios. These areas also have elevated social vulnerability and a high percentage of structures built before 1970, meaning that they are likely not constructed to modern building codes increasing sensitivity to flooding.
- The Timber Point walking trail, an important recreational area for residents and visitors, is vulnerable to flooding from both the 1.6 ft and 3.0 ft scenarios.

³⁰ Shi, L., Varuzzo, A. M. (2020). *Surging seas, rising fiscal stress: Exploring municipal fiscal vulnerability to climate change*. Cities 100 (2020) 102658.

	Assessed Parcel Value: Only Land Impacted	Assessed Parcel Value: Buildings & Land Impacted	Total Assessed Value Impacted	% of City- Wide Assessed Value (2022)
Storm surge + 1.6 ft SLR	\$45,475,401	\$345,621,800	\$391,097,201	11.1%
Storm surge + 3.0 ft SLR	\$47,957,468	\$492,041,100	\$539,998,568	15.3%

Figure 12. Assessed value of parcels impacted by flooding from storm surge combined with sea level rise (Source: SMPDC. 2022 coastal economic resilience assessment, phase 2. Unpublished.)

Infrastructure Impacts

Sea level rise threatens surface and subsurface infrastructure. Inundation of surface infrastructure can cause short-term disruptions due to road closures and limited access to infrastructure. It can also cause substantial damage to infrastructure, including pavement, culverts, stormwater infrastructure, and utility infrastructure. Higher water levels can reverse or reduce efficiency of stormwater drainage and wastewater outfall operations.

Along the coast, groundwater and saltwater are naturally separated by the seaward movement of groundwater. As seas rise, landward intrusion of seawater pushes groundwater levels up and shifts the interface of fresh groundwater and saltwater inland. Studies conducted in coastal New Hampshire show that sea level rise induced groundwater rise is projected to extend up to three to four times further inland than surface tidal water inundation from sea level rise³¹.

Low-lying coastal communities and important infrastructure are at risk of impacts including intrusion of saltwater into groundwater and drinking water resources, increased flooding from higher coastal water tables, and water damage to roadways and other infrastructure from below. Researchers are working to model and assess this phenomenon in New England to better understand coastal hazards stemming from sea level rise. No assessment has yet been completed for Biddeford, however, subsurface stormwater, transportation, and utility infrastructure; contaminated sites; septic systems; and drinking water wells in coastal areas will likely be negatively impacted by rising groundwater and saltwater intrusion. Rising groundwater can impede the ability of septic systems to function properly as the vertical separation between the groundwater table and leachfield is reduced. This can result in contamination from septic systems into groundwater and nearby surface waters. The U.S. Geological Survey (USGS) notes that if too much freshwater is pumped from an aquifer system, saltwater can migrate landward³². Wells located near the

³¹ Knott, J.F.; Jacobs, J.M.; Daniel, J.S., and Kirshen, P., 2019. Modeling groundwater rise caused by sea-level rise in coastal New Hampshire. *Journal of Coastal Research*, 35(1), 143–157. Coconut Creek (Florida), ISSN0749-0208.

³² U.S. Geological Survey. 2019. <https://www.usgs.gov/mission-areas/water-resources/science/saltwater-intrusion>

landward migrating freshwater/saltwater interface, saltwater could be contaminated from saltwater entering the well, threatening drinking water supplies. However, the USGS also notes that this is less likely to happen with residential wells and is a larger concern for municipal or community-size wells where pumping rates are much higher.

In Biddeford, most coastal areas in town have access to public water via either Maine Water or Kennebunk, Kennebunkport, and Wells Water District, limiting vulnerability of private drinking water wells from saltwater intrusion. The majority of coastal areas do not appear to be served by public sewer and likely have septic systems which could be vulnerable to failure due to rising groundwater.

- **Stormwater and sewer infrastructure:** Storm and sewer infrastructure vulnerable to flooding are located along Mile Stretch Road, Pool Street near the UNE campus, at the end of Lafayette Street, in the downtown area along the mill buildings adjacent to the Saco River, and at the wastewater treatment facility (Figure 13, Map 23).
 - The Yates Street pump station in Biddeford Pool is vulnerable to flooding from the 1.6 ft scenario.
 - The wastewater treatment plant is vulnerable to flooding the 3.0 ft scenario.
- **Water infrastructure:** Biddeford is served by Maine Water and public water infrastructure (mains, hydrants, etc.) around Biddeford Pool, especially along Hills Beach Road, Channel Cove Lane, and Oceanview Drive, are located in areas that are vulnerable to flooding from the 1.6 ft scenario.
- **Critical facilities:** the Biddeford Pool Fire Department is not exposed to flooding from the two modeled scenarios, but access from the Department to other locations along the coast is impacted by extensive flooding of Mile Stretch Road.
- Almost 25,000 linear feet of road are vulnerable to flooding from storm surge plus 1.6 feet of sea level rise. Vulnerable roads include **Route 208/Mile Stretch Road, Granite Point Road, Fortunes Rocks Road, Hills Beach Road and Timber Point Road**. Infrastructure such as culverts associated with the roads are also vulnerable. These road impacts make the coastal area of Biddeford particularly vulnerable to coastal flooding and sea level rise because they are the only access roads to their associated coastal neighborhoods and homes (Map 24). A complete list of roads impacted by both flooding scenarios can be found at the end of this section.
- **Route 208/Mile Stretch Road** is a designated evacuation route that is vulnerable to flooding. The road is projected to be flooded in the modeled scenario of storm surge plus 1.6 feet of sea level rise. Mile Stretch Road is the only access route in and out of the Biddeford Pool neighborhood, which is a block group of elevated social vulnerability based on the percentage of the population over the age of 65 living alone and percentage of households with an annual income of less than the state and county median income as well as the EPA climate change and social vulnerability income threshold.

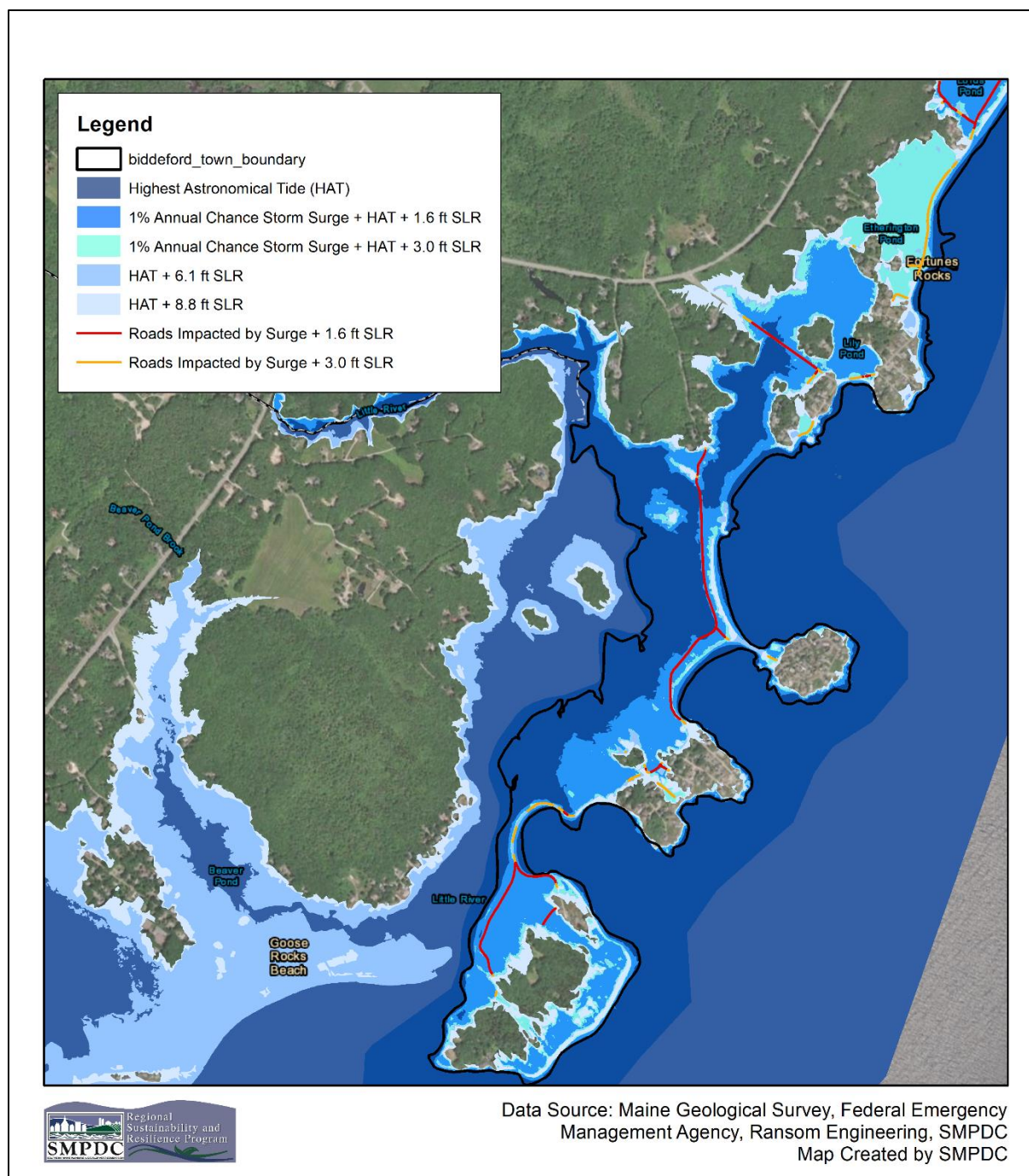
- There are three **tidal road crossings (culverts)** that are restrictions and vulnerable to sea level rise along the coast on Lilly Pond Road, Bridge Road, and Granite Point Road. There is also one on Pool Street near Tattle Corner.
- Some parcels around Biddeford Pool, including along Middle Beach, are served by public sewer, but parcels along Fortunes Rocks, Timber Point, the inland side of Biddeford Pool, Hills Beach, and the Saco River until almost to the downtown area do not appear to have public sewer. Septic systems in those areas could be vulnerable to failure due to rising groundwater.
- Based on an assessment by the Maine Geological Survey, coastal engineered structures (e.g., seawalls, bulkheads, jetties, etc.) in the following areas are vulnerable to overtopping by flooding from the modeled current 1% annual chance storm event, not including sea level rise.
 - Most rip-rap areas along Granite Point Road.
 - Most riprap in front of residential properties along Old Kings Highway.
 - The majority of structures along Fortunes Rocks Road.
 - Rip-rap along Bridge Road near its intersection with Mile Stretch and Fortunes Rocks Roads.
 - Most structures along the back marsh side of Mile Stretch Road and on the ocean side of residential properties.
 - The majority of structures along Ocean Avenue, Biddeford Pool, and the middle and southern portions of Hills Beach.

Infrastructure Type		Vulnerable to Surge + 1.6 ft SLR Scenario	Vulnerable to Surge + 3.0 ft SLR Scenario	Not vulnerable to 1.6 ft or 3.0 ft Scenarios
Storm and Sewer	Wastewater Treatment Facility	-	Yes	-
	Pump Stations	1 (Yates Street Pump Station)	1 (Yates Street Pump Station)	35
	Gravity Force Mains	13,121 ft	14,503 ft	628,158 ft
	Other storm and sewer infrastructure points (manholes, grates, etc.)	63	86	4,377

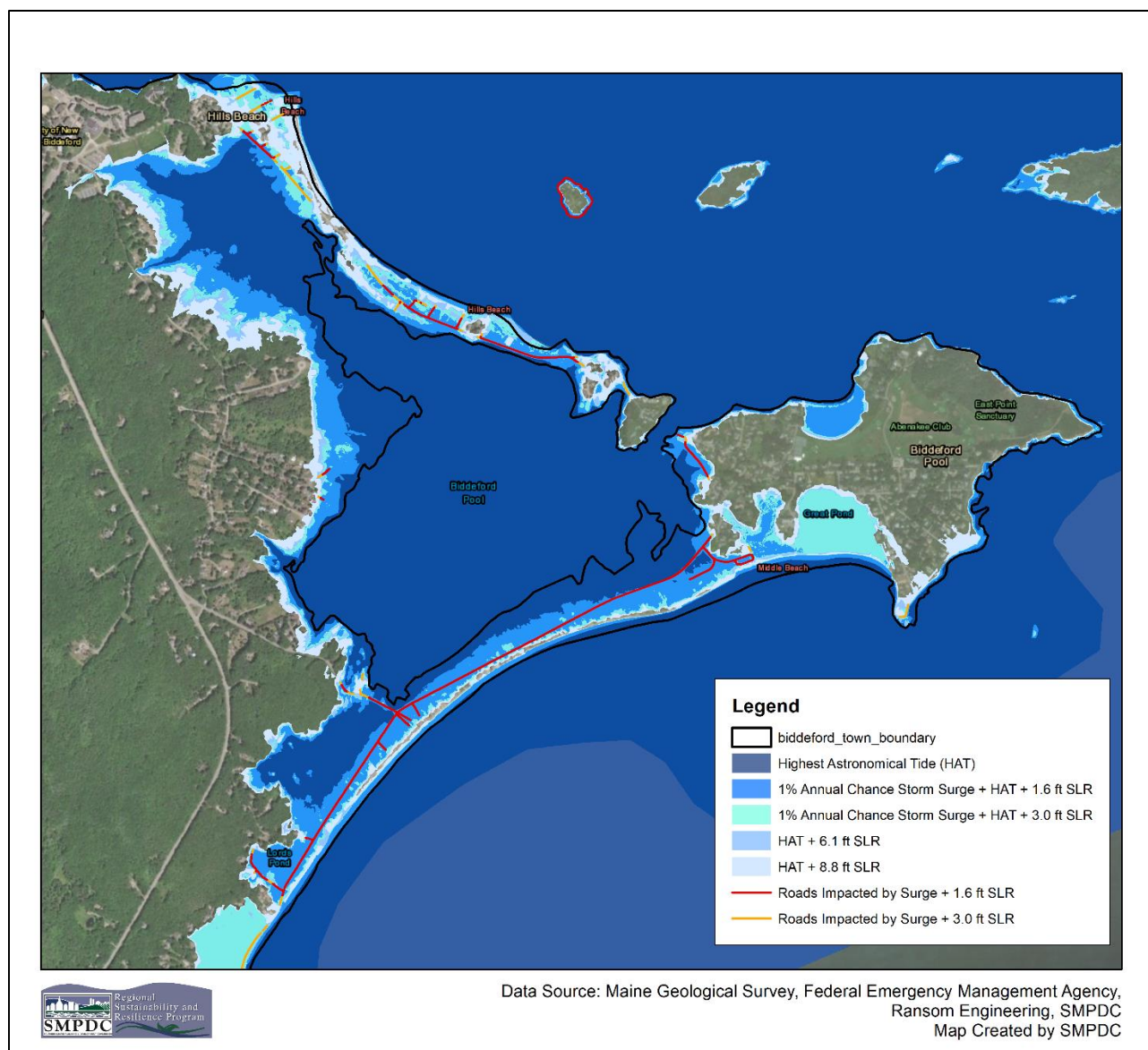
Figure 13. Storm and sewer infrastructure vulnerable to storm surge plus 1.6 feet and 3.0 feet of sea level rise. (SMPDC. 2022 coastal economic resilience assessment, phase 2. Unpublished)



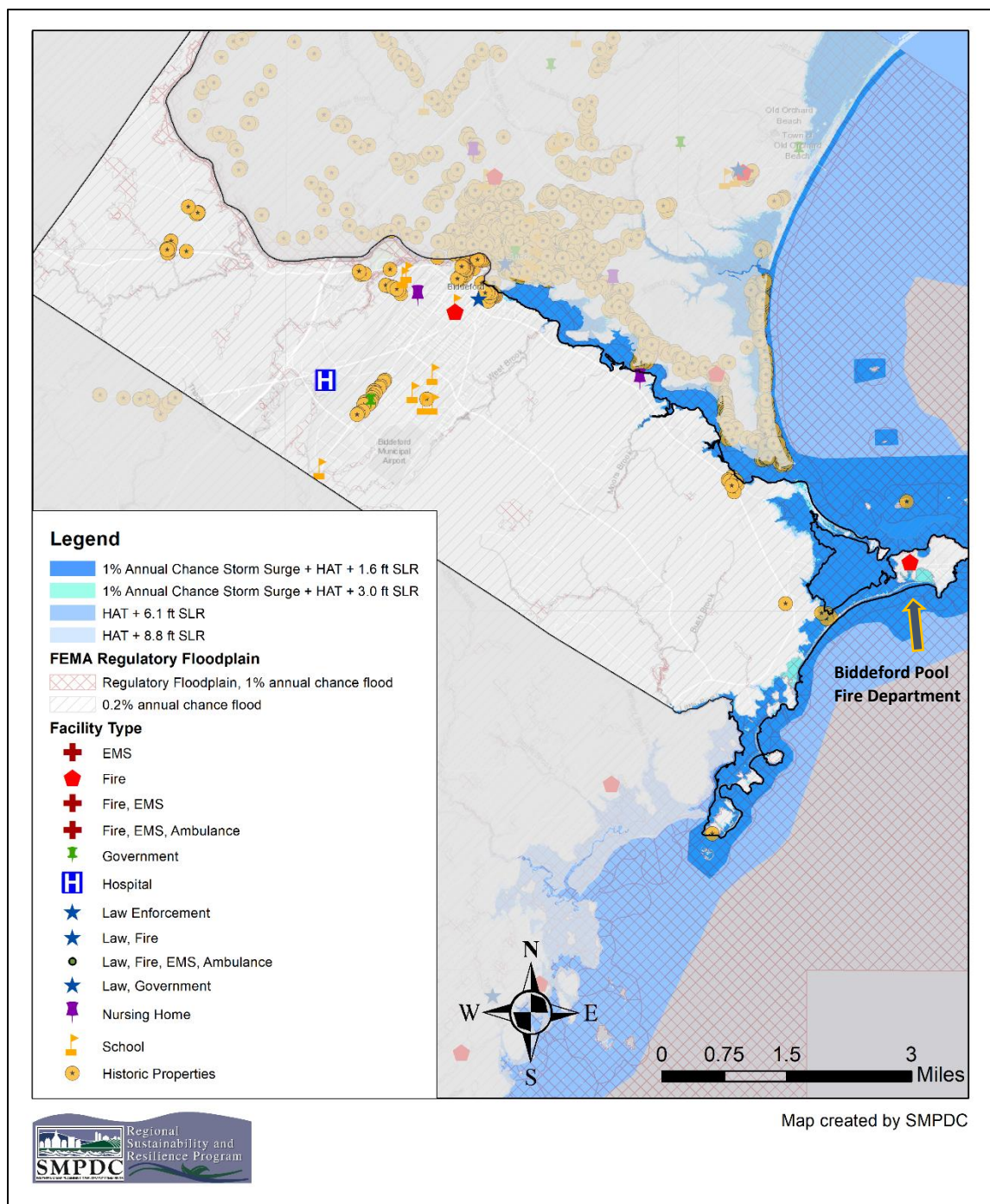
Map 23. Water, stormwater, and sewer infrastructure vulnerable to flooding. (Source: SMPDC. 2022 coastal economic resilience assessment, phase 2. Unpublished.)



Map 24. Roads impacted by storm surge plus sea level rise. (Source: SMPDC. 2022 coastal economic resilience assessment, phase 2. Unpublished.)



Map 25. Roads impacted by storm surge plus sea level rise. (Source: SMPDC. 2022 coastal economic resilience assessment, phase 2. Unpublished.)



Map 26. Mapped locations of historic properties, emergency management and public health facilities, and schools. Parcels are color-coded based on if they are projected to be directly impacted by flooding from the 1%-annual chance event (e.g., the FEMA regulatory floodplain), 1.6 feet of sea level rise, and/or 3.9 feet of sea level rise. (Source: SMPDC EDA disaster grant study, phase 2)

Road Name	Classification	Impacted by Storm Surge + 1.6 ft Sea Level Rise	Impacted by Storm Surge + 3.0 ft Sea Level Rise
Basket Is	Private	✓	✓
Beach Ave	Local	✓	✓
Beach House Ln	Private	✓	✓
Beach House Ln	Local	✓	✓
Beach Rose Way	Private	✓	✓
Brackett Point Rd	Local		✓
Breakwater Ave	Local		✓
Bridge Rd - Route 208	Secondary	✓	✓
Channel Cove Ln	Private	✓	✓
E Crescent Cove Ln	Local		✓
Edgewater Pl	Private	✓	✓
Elizabeth Rd	Local		✓
Elphis St	Local		✓
Fortunes Rocks Rd	Local	✓	✓
Gilbert Pl	Private	✓	✓
Golden Ave	Local	✓	✓
Granite Point Rd	Local	✓	✓
Granite Point Rd	Private	✓	✓
Heather Ln	Private	✓	✓
Heron Cv	Private	✓	✓
Hills Beach Rd	Local	✓	✓
Island View Dr	Local		✓
Juniper Ln	Private	✓	✓
Landing Way	Private	✓	✓
Leighton Point Ln	Private		✓
Lester B Orcutt Blvd	Local	✓	✓
Lily Pond Ave	Local		✓
Long Ave	Local	✓	✓
Maddox Pond Rd	Local	✓	✓
Mile Stretch Rd - Rte. 208	Secondary	✓	✓
Ocean Ave	Local		✓
Ocean Edge Ln	Private	✓	✓
Old Kings Hwy	Local		✓
Peter Pond Ln	Private	✓	✓
Pleasant Ave	Local	✓	✓
Private Way Ln	Private	✓	✓
Sand Dollar Hvn	Private	✓	✓
Sea Spray Dr	Private	✓	✓
Seabreeze Ave	Local	✓	✓
Seal Ln	Private	✓	✓
Sky Harbor Dr	Local	✓	✓
Surf Ave	Private	✓	✓
Thorndike Ave	Local	✓	✓
Timber Point Rd	Private	✓	✓
Yates St	Local	✓	✓

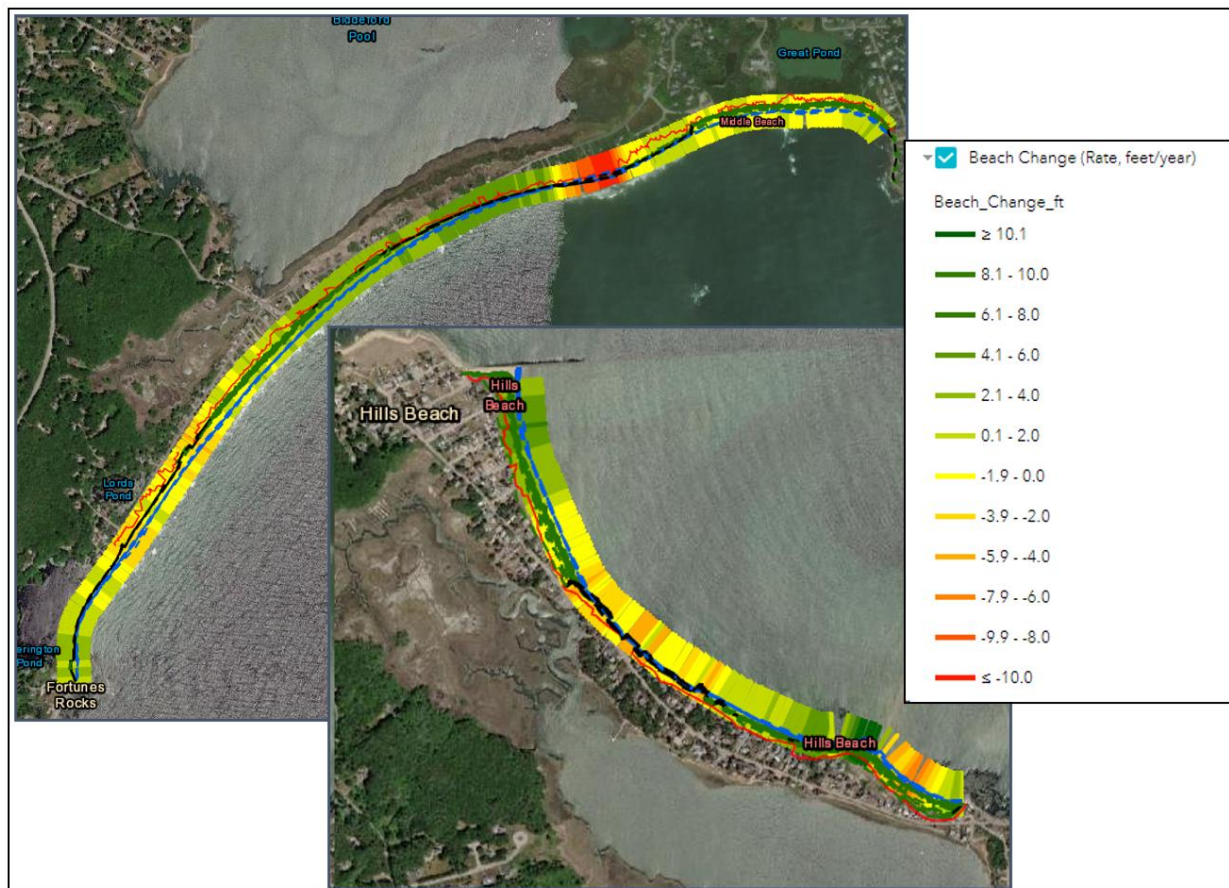
Figure 14. Roads vulnerable to storm surge plus 1.6 feet and 3.0 feet of sea level rise (Source: SMPDC. 2022 coastal economic resilience assessment, phase 2. Unpublished).

Impacts to the Natural Environment

Rising seas and coastal storms threaten local beaches and dune systems through erosion and flooding. Hardened coastal structures, like seawalls, roads, and homes, prevent beach systems from migrating inland as ocean levels increase. Additionally, how beaches will fare with increased sea level is related to sediment supply, both sources and volumes of the supply. Sand and gravel for beaches can come from rivers, eroding bluffs, the offshore seafloor, or marine shells. Shorelines that have been engineered to prevent erosion, protect property, and stabilize the shoreline offer reduced sediment supply to beaches.

- With 1.6 ft of sea level rise, Biddeford’s dry beach width (distance from the mean high water to seawall or dune edge) is projected to decrease by 7.9 acres, or by roughly 47% from existing conditions. With 3.9 feet of sea level rise, the dry beach width is projected to decrease by 86%³³ (Map 27).
- Sea level rise is expected to lead to loss of coastal habitat. Along Biddeford’s coast, loss of dry beach will impact local species, including piping plovers and other shorebirds that use the beach for nesting.
- Monitoring data from the Maine Geological Survey show that Fortunes Rocks Beach, most of Middle Beach, and most of Hills Beach have been relatively stable in terms of measured beach width over the past several years (2016 – 2020). However, the middle segment of Middle Beach and middle and southern segments of Hills Beach have experienced erosion. Sea level rise will likely exacerbate erosion in areas already experiencing it and lead to additional erosion along all beach areas.

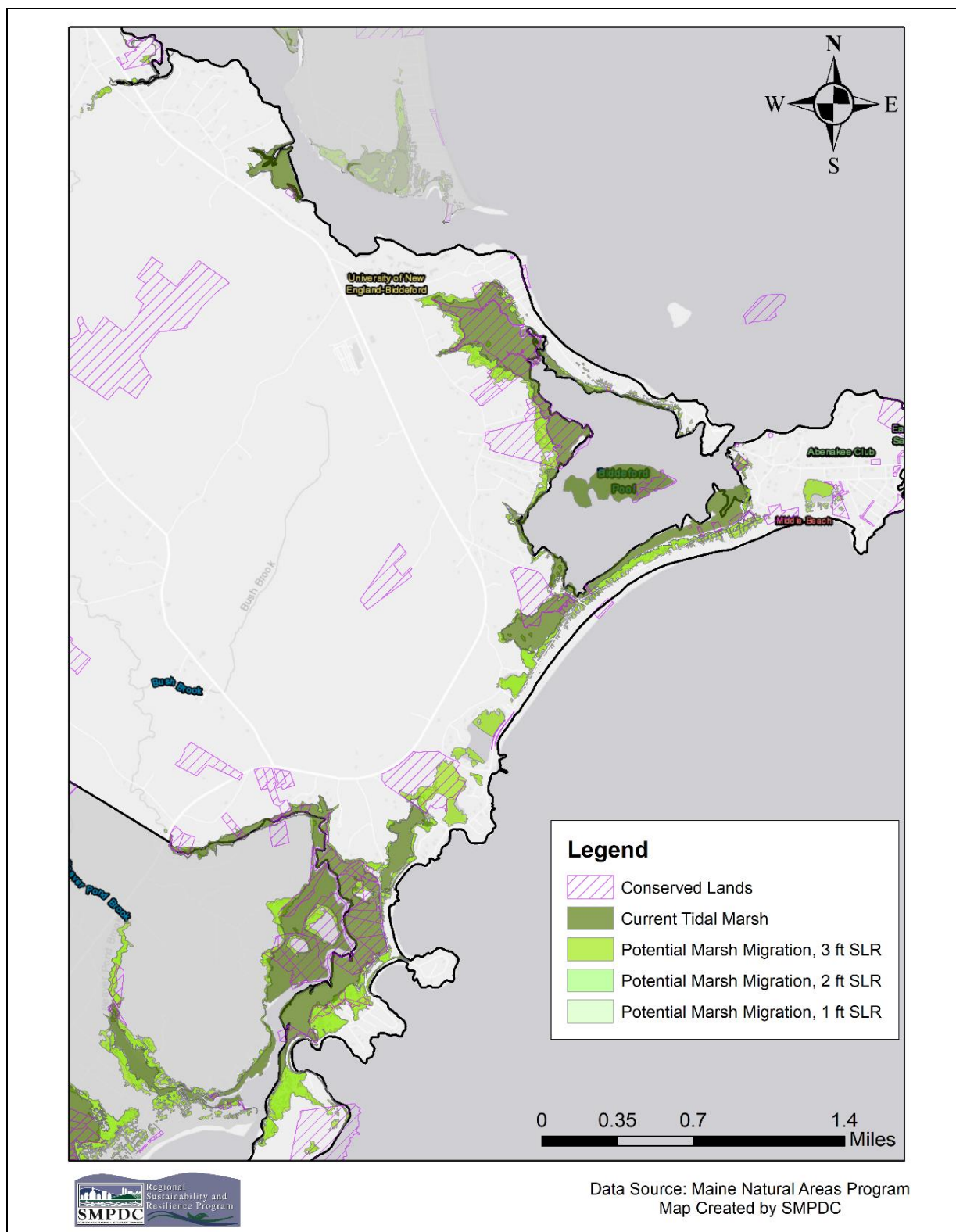
³³ Maine Geological survey. 2021. Unpublished analysis of the impact of sea level rise on dry beach width of Maine’s sandy beaches.



Map 27. Mapped shoreline change along Goose Rocks Beach. This map shows the rate of beach change, in feet per year, from data collected from 2016 through 2020. A positive value (green lines) represents a rate of beach growth, while a negative value (yellow/orange/red lines) represents a rate of beach loss. (Source: Maine Geological Survey. Maine Beach Mapping Program. Maine Beach Mapping viewer)

While sea level rise threatens inundation of the beach system, it also has the potential to facilitate the landward expansion, or migration, of tidal marshes. However, this landward migration can only occur if saltmarshes are healthy and there are not physical barriers, such as stonewalls, roads, or buildings, that inhibit marsh movement. The Maine Natural Areas Program (MNAP) has mapped areas that could support marsh migration with future sea level rise (Map 28). Protecting these areas will be crucial for ensuring the long-term viability of local tidal marshes, which provide tremendous natural benefits and services including wildlife habitat, flood control, and water quality protection.

- Areas along Biddeford Pool and Little River have been identified as being able to support future marsh migration. Some of those areas are adjacent to existing conserved lands, however, areas in the Granite Point area and Fortunes Rocks Beach could support migration and are not yet conserved.
- Several pocket areas along tidal portions of the Saco River have also been identified as being able to support future marsh migration.



Map 28. Existing conserved lands (purple) and areas that could support future migration of existing tidal marshes with future sea level rise. The areas are non-tidal lands within existing tidal estuaries that could be inundated and facilitate the development of new areas of tidal marsh if sea level rises by 1, 2, or 3.3 feet above current highest annual tide (HAT). (Source: Maine Natural Areas Program. Sea level rise scenarios are from the Maine Geological Survey.)

EXTREME TEMPERATURES & AIR QUALITY

Key Takeaways

- Maine's average annual temperature has increased by 3.2°F since 1895 and could warm an additional 2-4°F by 2050.
- Southern Maine is expected to experience roughly 4.5 times more 'extreme heat' days by the 2050s.
- Exposure to extreme heat is a significant public health concern and can be especially dangerous for older adults, infants, people with existing health conditions, and those who have limited access to air conditioning.
- Extreme heat will exacerbate the impacts of urban 'heat islands', the locations of which overlap with areas of socially vulnerable populations in Biddeford, such as in the downtown area.
- There are fewer days with below-freezing temperatures and snow cover, leading to an increase in pest outbreaks and prevalence of vector-borne diseases like Lyme disease.

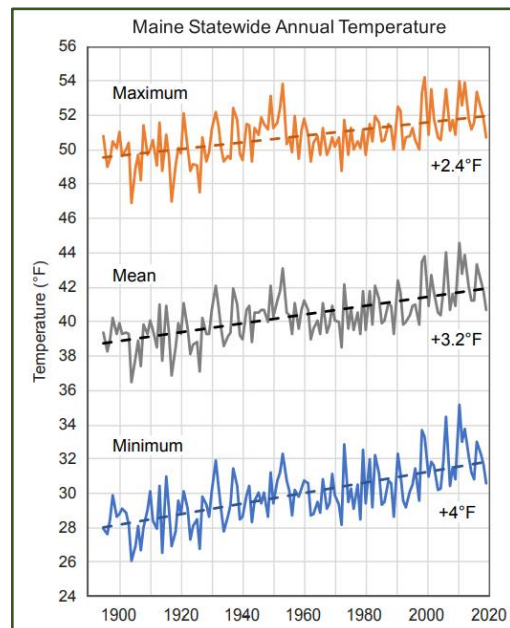


Figure 15. Maximum, mean, and minimum statewide annual temperatures from 1895 to 2019. (Source: MCC STS. 2020.)

Background Information, Trends, & Projections

Climate change is causing increased temperatures and more frequent extreme temperature occurrences. In Maine, the average annual statewide temperature has increased by 3.2°F since 1895³⁴ (Figure 15). Winters are warming faster than other seasons, and coastal areas have warmed more than the interior of the State. Climate models project that Maine could warm an additional 2 to 4°F by 2050 and up to 10 °F by 2100 depending on global greenhouse gas emissions. Extreme heat days are expected to be 2 to 4 times more frequent in Maine by 2050, increasing the likelihood of heatwaves. Southern Maine is expected to experience roughly 3 times more 'extreme heat' days, where the heat index (a combination of temperature and relative humidity that approximates the 'felt' temperature) exceeds 95°F, as the early 2000s (Map 29)³⁵. In addition to extreme heat,

³⁴ MCC STS. 2020. Scientific Assessment of Climate Change and Its Effects in Maine. A Report by the Scientific and Technical Subcommittee (STS) of the Maine Climate Council (MCC). Augusta, Maine. 370 pp.

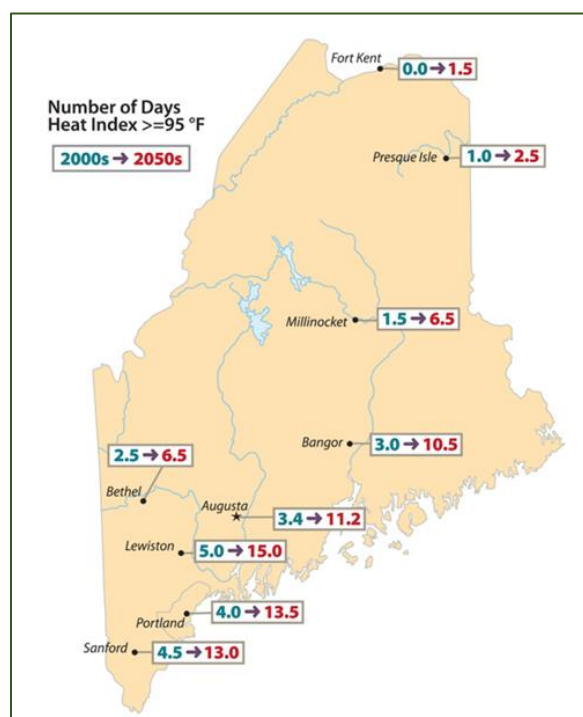
³⁵ Fernandez, I.J., Schmitt, C.V., Birkel, S.D., Stancioff, E., Pershing, A.J., Kelley, J.T., Runge, J.A., Jacobson, G.L. & Mayewski, P.A. (2015). Maine's Climate Future: 2015 Update. Orono, ME: University of Maine.

there is research showing that more short-term temperature variability and volatility may be happening as a result of climate change.

Five of the ten warmest years on record have occurred within the past ten years, based on average annual temperatures from National Weather Service (NWS) data collected between 1989 and January of 2023 in Kennebunkport, the NWS data collection station closest to Biddeford (Figure 16). The warmest average monthly temperatures for the summer months (June, July, and August) have also occurred within the past ten years and have been 3.1 – 4.3°F warmer than the monthly mean temperature (Figure 17). 2023 was the warmest January on record, with an average temperature of 31.9°, 8.5° warmer than the January mean temperature.

	Year	Average Annual Temperature (°F)
1	1989	49.9°
2	1998	49.0°
3	2021	47.8°
4	2010	47.7°
5	2012	47.6°
6	2020	47.2°
7	1999	47.0°
8	2006	47.0°
9	2022	46.8°
10	2016	46.7°
1989-2023 Average		45.3°

Figure 16. The top ten warmest years based on average annual air temperatures measured in Kennebunkport, 1989 – January 2023. (Source: National Weather Service).



Map 29. Average number of days when the heat index is greater than or equal to 95°F at selected sites for 2000 – 2004 and 2050 – 2054. Predicted values derived from a 48-km downscale simulation of one ensemble member of the CCSM3 model for the IPCC A2 emissions scenario. Source: Fernandez et al. (2015). (Figure from MCC STS. 2020.)

Month	Year	Average Temperature (°F)	Mean Temperature (°F), 1989 - 2022	Difference Between Mean and Average of Warmest Month
June	2021	65.7°	61.6°	+4.1°
July	2013	70.5°	67.4°	+3.1°
August	2018	70.4°	66.1°	+4.3°

Figure 17. The warmest average monthly temperatures of the three summer months and years in which they occurred compared with the mean monthly temperatures for those months measured in Kennebunkport, 1989 – January 2023. (Source: National Weather Service.)

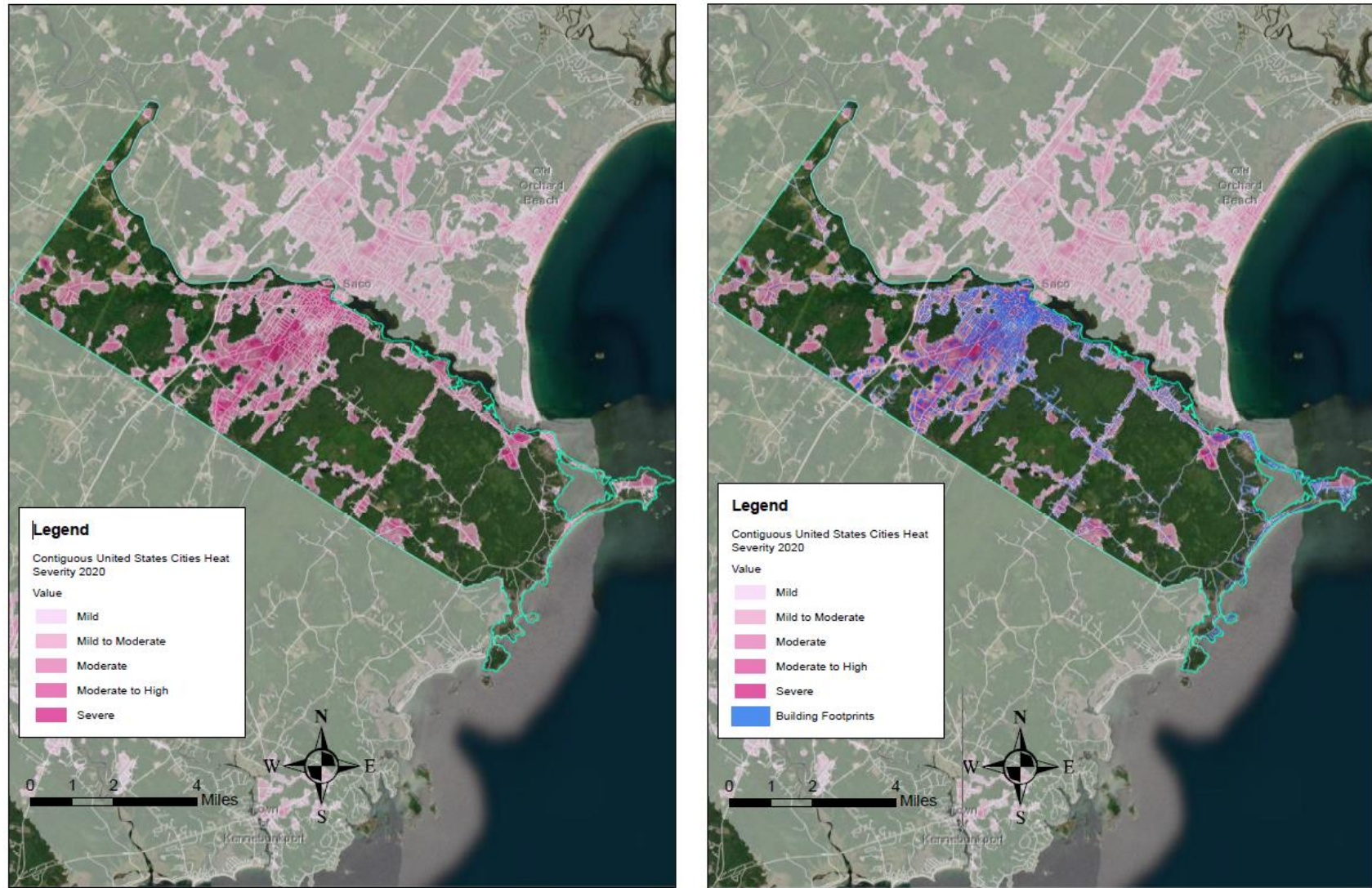
Urban Heat Islands

Extreme heat days in Maine will exacerbate the severity and impacts of “heat islands”, or areas with a lot of impervious surfaces, such as buildings and pavement, that absorb and re-emit heat. The Trust for Public Land notes that extreme heat exacerbated by urban heat islands can lead to increased respiratory difficulties, heat exhaustion, and heat stroke.

The two maps below (Map 30) show areas in Biddeford that are hotter than the average temperature for the community as a whole. The map on the right shows the location of building footprints in relation to heat islands. The maps show the relative heat severity measured on a scale of 1 to 5, with 1 being a relatively mild heat area (slightly above the mean for the city), and 5 being a severe heat area (significantly above the mean for the city). (*Heat island temperature data: 30-meter resolution based on data derived from Landsat 8 imagery band 10 (ground-level thermal sensor) from the summers of 2019 and 2020.*)

In Biddeford, areas in the downtown, along Route 208, Guinea Road, East Point/Biddeford Pool, and in the northwestern portion of the city are mapped as having elevated ground temperatures in relation to the rest of the community. The downtown and Biddeford Pool areas that are mapped as moderate to severe heat severity also have elevated social vulnerability and vulnerabilities to flood hazards. The northwestern portion of the city does not have a high concentration of buildings but has moderate to severe heat island severity. Knowing where areas of high heat are located can inform mitigation and adaptation strategies.

Urban Heat Island Severity



Map 30. Urban heat island severity (left) overlaid with building footprints (right). A community cooling center is located at Seeds of Hope Neighborhood Center in downtown Biddeford. Heat island severity data source: Trust for Public Land. Map created by SMDPC

Biddeford – August 2023

Public Health Impacts

Extreme heat is one of the most significant impacts of climate change on human health and is the leading cause of weather-related deaths across the United States. Exposure to extreme heat has been linked with a wide range of health issues, including heatstroke, heat exhaustion, impacts on kidney function, dehydration, fetal health, mental health, and exacerbation of pre-existing health conditions. Extreme heat is also linked with increased deaths and emergency department visits. From 2011 to 2015 and 2017 to 2019, York County had the second highest number of annual emergency department visits for heat-related illness across Maine, with Cumberland County seeing the highest numbers³⁶.

Figure 18 shows peak emergency department visits for heat-related illnesses to hospitals in York County between 2018 and 2023, the years for which monthly data is available.

Residents of cooler climates, like Maine, are less physiologically adapted to extreme heat exposure, and experience disproportionate health effects on hot days when compared to residents of warmer climates. Additionally, the prevalence of air conditioning, one of the most effective tools for preventing heat illness, is significantly lower in Maine than in the rest of the region and the country³⁷. Certain populations, including older adults, infants, pregnant women, and people who have chronic diseases or who are sick already may feel much worse or have serious problems in extreme heat. Further, people with limited access to air conditioning, outdoor laborers, and unhoused populations are also more vulnerable to the impacts of extreme heat. A survey conducted by the Maine Behavior Risk Factor Surveillance System found that in 2014, 70.8% of homes in York County had some form of air conditioning, the highest percentage of all Maine counties. However, as noted above, York County also had the second highest number of heat illness emergency department visits.

³⁶ Maine Health Data Organization (MHDO). Data analyzed and display prepared by the Environmental Public Health Tracking Program. Data updated: 06/2021.

³⁷ MCC STS. 2020. Scientific Assessment of Climate Change and Its Effects in Maine. A Report by the Scientific and Technical Subcommittee (STS) of the Maine Climate Council (MCC). Augusta, Maine. 370 pp.

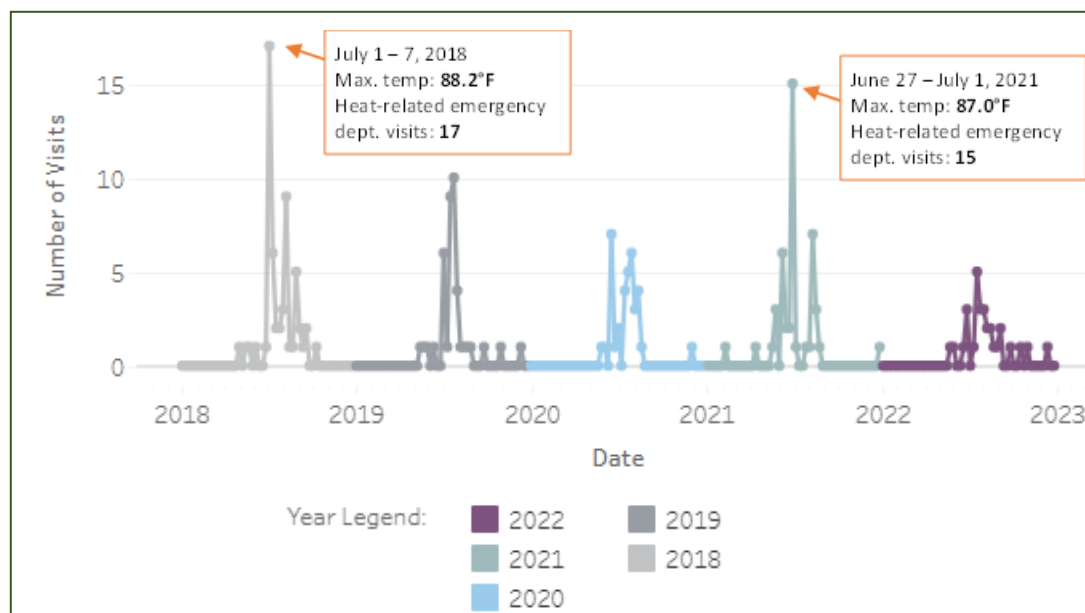


Figure 18. Number of heat illness visits to emergency departments in York County from 2018 to 2023. (Source: Maine Center for Disease Control and Prevention, Maine Tracking Network.)

Climate change can impact air quality and lead to worsening air pollution. Atmospheric warming associated with climate change has the potential to increase ground-level ozone in many regions, which may cause public health issues and present challenges for compliance with the ozone standards in the future. The impact of climate change on other air pollutants, such as particulate matter, is less certain, but research is underway to address these uncertainties.³⁸ Figure 19 shows the number of days in York County with an 8-hour average ozone concentration that exceeded the National Ambient Air Quality Standard of 0.070 ppm, established December 28, 2015. Previous standards were set at .075 ppm from 2008-2015 and .080 prior to 2008. Research for this assessment could find no cause of the relatively high number of exceedances between 2001 and 2007. An analysis by the Maine Department of Environmental Protection affirmatively demonstrates that Maine emissions are insignificant contributors to non-attainment of ozone for the 8-hour ozone air quality standards³⁹. Regardless of the cause, individuals with existing health conditions, older populations, and children are especially vulnerable to poor air quality. Residents of Biddeford's downtown area may be especially vulnerable to poor air quality due to high rates of asthma.

³⁸ US Environmental Protection Agency. Air Quality and Climate Change Research webpage.

³⁹ State of Maine Clean Air Act Section 176A(a)(2) Petition. 2020.

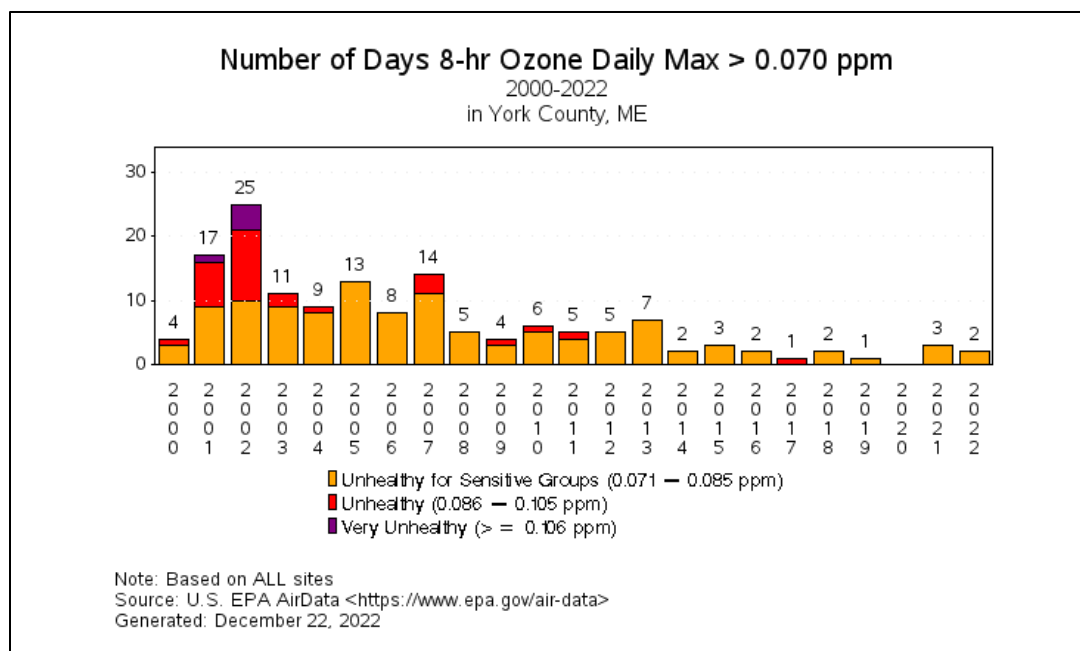


Figure 19. Number of days during which the 8-hour average ozone concentration exceeded national air quality standards. (Source: US EPA AirData portal)

The prevalence of tickborne diseases, including Lyme, anaplasmosis, and babesiosis, has increased in York County in recent years. Figure 20 shows that rates of all three diseases have increased since 2001. Figure 21 shows the incidence rate (per 100,000 people) of confirmed and probable cases of tickborne disease in Biddeford. Between 2016 and 2020, Biddeford had the second lowest rate of anaplasmosis and fourth lowest rate of Lyme of all York County communities.

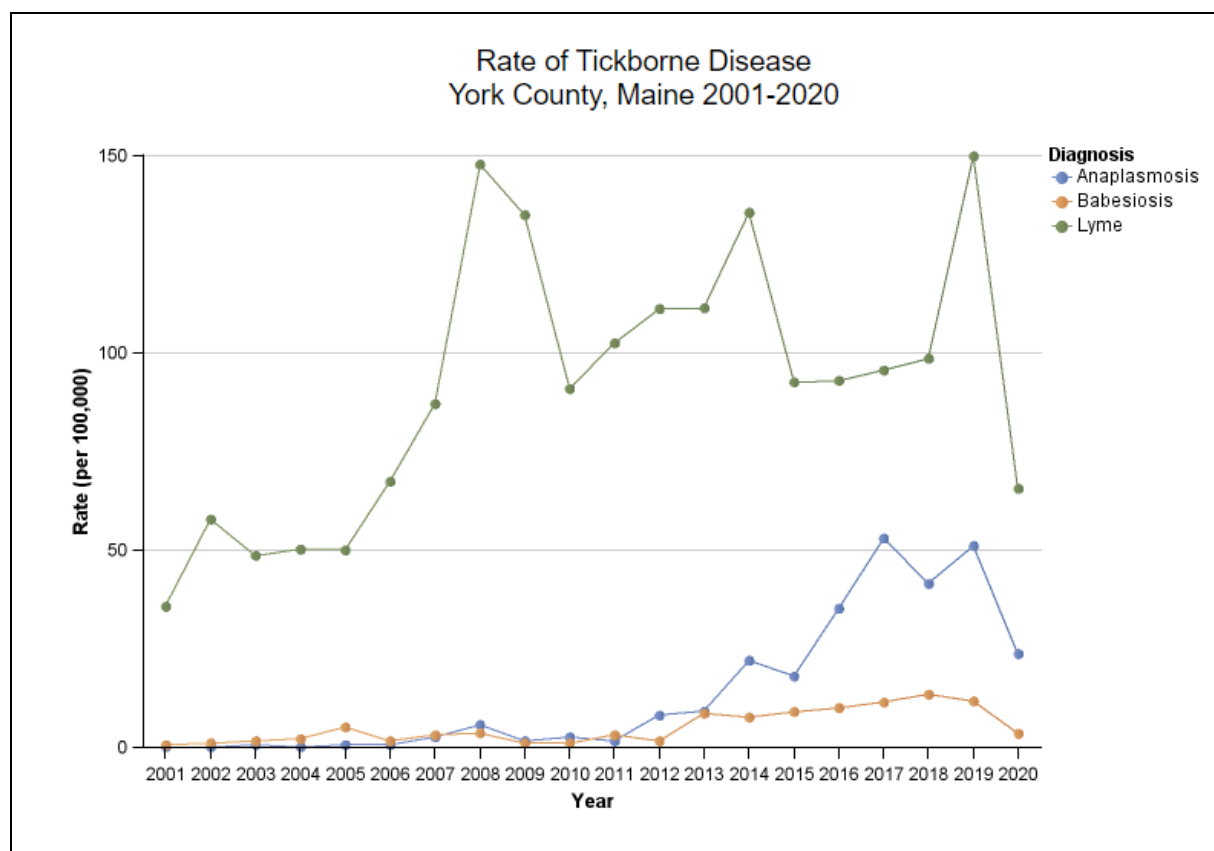


Figure 20. Annual incidence rate (per 100,000 people) of confirmed and probable cases of tickborne diseases of the population in York County. Maine CDC's Infectious Disease Program obtained these data through notifiable conditions surveillance based upon reports from healthcare providers, laboratories, and other healthcare partners. (Data Source: Maine CDC's Infectious Disease Program collected and analyzed population data from the U.S. Census Bureau to calculate state and county rates of tickborne disease. Maine CDC used population data from Maine CDC Data, Research, and Vital Statistics (DRVS) to calculate town-level rates of tickborne disease. The Maine Environmental Public Health Tracking Program prepared the data display. Data updated: 05/2021. Display updated: 05/2021.

Rate and Number of Tickborne Diseases in Biddeford, 2016 - 2020			
	Anaplasmosis	Babesiosis	Lyme
Confirmed and probable cases	9	3	47
Rate (per 100,000 people)	8.3	2.8	43.1

Figure 21. Rate and number of confirmed and probable cases of tick-borne disease in Biddeford, 2016 -2020. (Source: Maine Center for Disease Control and Prevention. Infection Disease Program. Maine Tracking Network Data Portal.)

Impacts to the Natural Environment

Increasing and shifting temperatures will impact the natural environment and Maine's wildlife and vegetation. Shorter winters, less snow, a rapid expansion of pests (e.g., winter ticks), presence of parasites previously only found further south, heat stress, more frequent and higher flooding of tidal marshes, invasive species, and changes in available prey species all threaten local species and natural areas. Increasing temperatures impact biodiversity and affect ranges where species can live. Scientists predict that 34%–58% of

species will go extinct given current climate change scenarios if they are unable to disperse to new locations, while 11–33% will still go extinct even if they can disperse to future areas that are within their current climatic niche. Rising temperature and shorter winters will impact Biddeford’s natural areas, vegetation, and wildlife, in addition to how the community interacts with those areas and species.

While Maine’s growing season has lengthened overall due to warming temperatures, some years have seen killing frosts in late spring and early fall. It is uncertain whether such events will become more or less frequent in the future, but the trend of longer growing seasons and warmer falls is expected to continue. Climate model projections indicate that in the future, it is likely that increased evaporation will dry surface soil layers, particularly in the warm season⁴⁰. These changes will impact local agricultural activities as well as home gardeners.

DROUGHT & WILDFIRES

Key Takeaways

- Despite wetter conditions overall, changing precipitation patterns caused by climate change have contributed to the emergence of drought conditions in southern Maine in recent years.
 - There have been 4 periods of severe to extreme drought in York County since 2000, 3 of which have occurred in the last 7 years.
- Average annual snowfall across the state has decreased about 2 inches since 1895 because more precipitation is falling as rain rather than snow. Lower spring snowpack reduces aquifer recharge, contributing to the emergence of drought.
 - Historic snowfall data near Biddeford are limited but align with the statewide trend of decreasing annual snowfall amounts.
- Communities supplied by groundwater wells, rivers, or smaller lakes are at greater risk of water quantity and quality impacts from drought.
 - Streamflow levels in the Saco River, Biddeford's sole public water source, were historically low during the recent droughts.
 - There are 470 private wells in Biddeford and groundwater levels were historically low during all of the most recent droughts.
 - During the 2020 and 2022 droughts 45 and 15 dry wells were reported in York County respectively.

⁴⁰ MCC STS. 2020. Scientific Assessment of Climate Change and Its Effects in Maine. A Report by the Scientific and Technical Subcommittee (STS) of the Maine Climate Council (MCC). Augusta, Maine. 370 pp.

- Wildfire risk may increase with more frequent, severe, and intense droughts, and though the likelihood of wildfires may remain low, such an event could have major impacts on the community.
 - Wildfires occurred in Biddeford in 2002 and 2020 driven by drought conditions in those years.
 - Over the last several decades, Biddeford has been a hotspot for wildfire occurrences compared to the rest of the county.

Background Info, Trends, & Projections

Annual precipitation in York County has increased 6.9 inches since 1895 (see EXTREME STORMS & PRECIPITATION) and is expected to continue to increase with climate change. Despite wetter conditions overall, changing precipitation patterns caused by climate change have contributed to the emergence of drought conditions in southern Maine in recent years.⁴¹ During the winter, precipitation is increasingly falling as rain rather than snow. Average annual snowfall across the state has decreased about 2 inches since 1895, and reduced snowpack depth has been even more pronounced in southern, coastal areas.⁴² Spring snowmelt recharges freshwater aquifers, so less snowpack in the spring diminishes spring recharge and results in a lower water table. Low rainfall during the spring and summer along with higher-than-average temperatures can further deplete the water table, increasing the risk of summer and fall droughts.⁴³

In the last few years Maine has experienced some of the driest periods in over a century. The driest May to September period since 1895 occurred during the 2020 drought, and September 2020 was the driest month since 1895.⁴⁴ In York County, there have been four periods of severe to extreme drought since 2000, which occurred during the summer and fall months of 2001-2002, 2016, 2020, and 2022. There was also an extended period of moderate drought in 2015 (Figure 22).

- 2001-2002: 73%-100% of the county was in a severe drought for 28 weeks from the end of October to May 2002
- 2016: 67%-100% of the county was in a severe drought for 22 weeks from August to December, and 95% of the county was in an extreme drought for 4 weeks from the end of September to mid-October
- 2020: 74%-100% of the county was in a severe drought for 12 weeks from September to December, and 70%-76% of the county was in an extreme drought for 6 weeks from late September to the end of October
- 2022: 66% of the county was in a severe drought for 4 weeks in August

⁴¹ ME Drought Task Force Report, 10/6/2022: <https://www.maine.gov/mema/hazards/drought-task-force>

⁴² University of Maine, Maine's Climate Future, 2020: <https://climatechange.umaine.edu/climate-matters/maines-climate-future/>

⁴³ ME Drought Task Force Report, 10/6/2022: <https://www.maine.gov/mema/hazards/drought-task-force>

⁴⁴ ME Climate Council, Maine Climate Science Update 2021: <http://climatecouncil.maine.gov/reports>

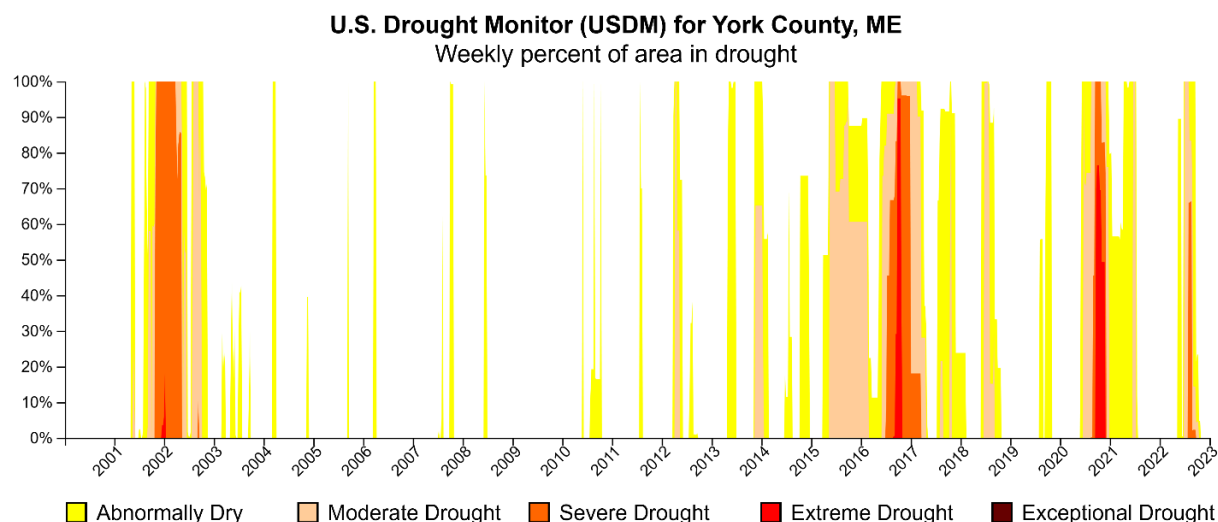


Figure 22. Drought conditions in York County from 2000 to 2022. Four severe to extreme droughts have occurred over the last 20 years and have been more frequent in the past decade. Data source: [U.S Drought Monitor](#).

There is limited data for snowfall and snowpack depth in Biddeford. From 1994 to 2017, snowpack depth was recorded at the Tannery Waste Pits site in Saco and reported to the Maine Geological Survey as part of the Maine Cooperative Snow Survey (Figure 23). Historically, March was the snowiest month in this area. Though data are limited in more recent years, a snowpack depth of 0 inches was reported in February 2012 and April 2017.

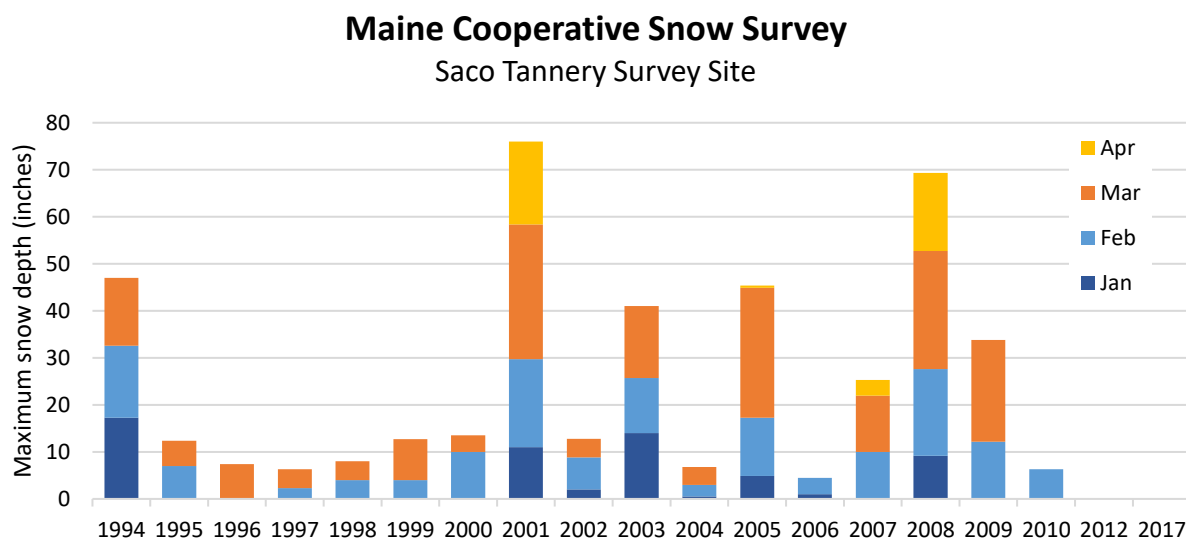


Figure 23. Maximum snow depth at Saco Tannery Survey Site, 1994-2017. Data source: Maine Geological Survey Cooperative Snow Survey

Combined snowfall amounts in Biddeford during the winters of 2020-21 and 2021-22 were about 2-4 feet less than the previous 30 years, based on data from the Maine Drought Task Force. The snowfall deficit over these two winters resulted in reduced spring snowpack

depth and aquifer recharge and contributed to the emergence of a summer and fall drought in 2022.⁴⁵ As future precipitation patterns in southern Maine continue to shift towards more rain and less snow, the risk of drought will likely increase.

Water Supply Impacts

Intense and prolonged droughts have the potential to diminish surface and groundwater supplies and degrade water quality.⁴⁶ Communities supplied by groundwater wells, rivers, or smaller lakes are at greater risk of water quantity and quality impacts from drought.⁴⁷ The City of Biddeford is serviced by the Biddeford and Saco Division of the Maine Water Company, and the Saco River is the sole source of Biddeford's public water supply.⁴⁸

The United States Geological Survey (USGS) monitors daily streamflow conditions in the Saco River. Since 2000, the lowest recorded streamflows occurred in September 2002, October 2016, and September 2020, coinciding with the three most prolonged and intense droughts in the region.⁴⁹

To date, it does not appear that the Biddeford and Saco Division of the Maine Water Company has experienced significant water quality or quantity issues because of drought.⁵⁰ However, the Maine CDC Drinking Water Program received reports of low water quantity from public water suppliers during the 2022 summer drought.⁵¹ Additionally in the summer of 2022, the public water supply in Berwick, sourced by the Salmon Falls River, contained elevated levels of manganese due to low water levels, making it unsafe for children to drink.⁵² In the future, more frequent, prolonged, or intense droughts have the potential to cause similar types of issues with Biddeford's public water supply.

Drought can also impact water quantity and quality in private wells. There are a total of 470 private wells in Biddeford (259 wells have location data and are displayed in Map 31), and 93% of these wells are for domestic use.

⁴⁵ ME Drought Task Force Report, 10/6/2022: <https://www.maine.gov/mema/hazards/drought-task-force>

⁴⁶ ME Climate Council, Maine Climate Science Update 2021: <http://climatecouncil.maine.gov/reports>

⁴⁷ Casco Bay Estuary Partnership, Climate Trends in Casco Bay, 2015:

<https://www.cascobayestuary.org/publication/climate-trends-in-the-casco-bay-region/>

⁴⁸ Maine Water Company, Biddeford and Saco 2021 Water Quality Report:

<https://www.mainewater.com/water-quality/water-quality-report>

⁴⁹ USGS Streamflow monitoring data: <https://waterdata.usgs.gov/monitoring-location/01066000/#parameterCode=00065&period=P7D>

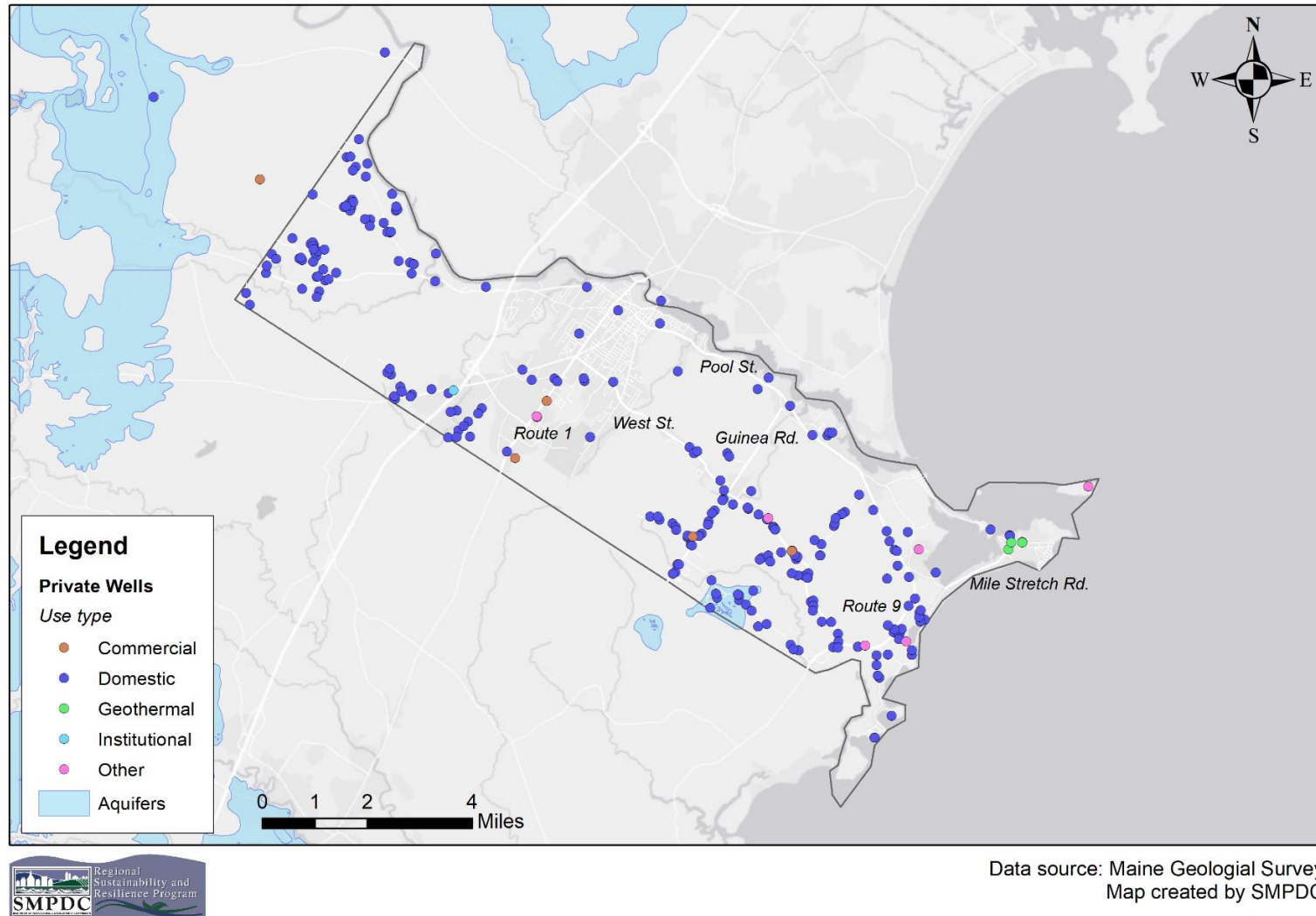
⁵⁰ EPA Safe Drinking Water Information System:

https://ordspub.epa.gov/ords/sfdw/f?p=SDWIS_FED_REPORTS_PUBLIC:PWS_SEARCH::::PWSID:ME0090170

⁵¹ ME Drought Task Force Report, 8/4/2022: <https://www.maine.gov/mema/hazards/drought-task-force>

⁵² Maine Public, 8/4/2022: <https://www.mainepublic.org/environment-and-outdoors/2022-08-04/berwick-issues-drinking-water-advisory-due-to-ongoing-drought-conditions>

Location of Aquifers and Private Wells Biddeford



Map 31. Location of aquifers and private wells in Biddeford, and well use type. Data source: Maine Geological Survey

Biddeford – August 2023

The USGS monitors groundwater levels in York County at an index well in Sanford (Figure 24). Since 2000, the lowest recorded groundwater levels occurred in November 2002, October 2015, and October 2016, coinciding with the 2002 and 2016 severe droughts and the 2015 moderate drought. Groundwater levels were also low in October 2020, coinciding with the 2020 drought.

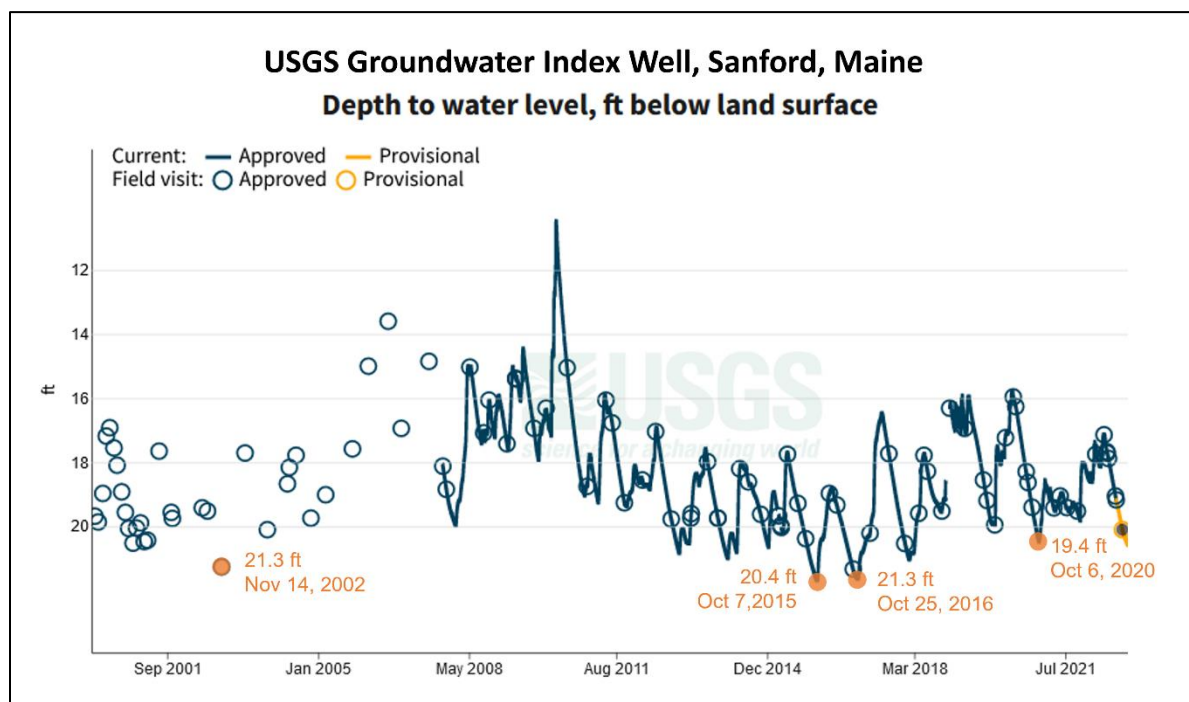


Figure 24. Groundwater levels in York County measured at an index well in Sanford, 2001-2021. Data source. United States Geological Survey

Since 2020, the Maine Drought Task Force has collected data about wells that run dry due to drought (Figure 25). In 2020, 45 wells in York County ran dry compared to 2 in 2021, and 15 in 2022. Though these data are limited, they correlate with the intensity of the 2020 drought compared to the 2022 drought. In the future, more frequent, prolonged, or intense droughts could pose a risk to the hundreds of homeowners and businesses in Biddeford who rely on groundwater wells as their water source.

Maine Dry Well Survey			
Year	2020	2021	2022
York County	45	2	15

Figure 25. Number of dry wells in York County in 2020, 2021, and 2022. Data source: Maine Emergency Management Agency

Impacts to the Natural Environment

Some of the environmental impacts of drought are listed in Figure 26.

Damage to animal species	Damage to plant communities
• lack of feed and drinking water • disease • loss of biodiversity • migration or concentration • degradation of fish and wildlife habitats	• loss of biodiversity • loss of trees from urban landscapes and wooded conservation areas • Increased number and severity of fires • Reduced soil quality

Figure 26. Environmental impacts of drought. Data source: 2018 York County Hazard Mitigation Plan, Pennsylvania

Although wildfire risk may seem small in Maine compared to the western U.S., wildfires do occur and are often associated with periods of drought. In 1947, drought induced wildfires burned over 200,000 acres across the state.⁵³ The Maine Drought Task Force reported a higher number of wildfires in 2020, compared to 2021 and 2022, coinciding with the long, intense drought that summer and fall (Figure 27).⁵⁴

Maine Wildfire Occurrences			
Year	2020	2021	2022
Annual total	1,154	650	624

Figure 27. Number of wildfires statewide in 2020, 2021, and 2022. Data source: Maine Drought Task Force 10/6/2022 Report

In Biddeford specifically, increased wildfire frequency and severity was associated with the 2002 and 2020 droughts. There were two large wildfires during the summer of 2002 which destroyed about 10 acres.⁵⁵ More recently, in April 2020 a large wildfire burned about 20 acres of wooded area and took 3 hours to get under control.⁵⁶ Over the last several decades, Biddeford has been a hotspot for wildfire occurrences compared to the rest of the county (Map 32).⁵⁷ In the future, more frequent, prolonged, or intense droughts have the potential to increase the risk of wildfires, posing a threat to Biddeford's natural environment and public safety.

⁵³ York County Emergency Management Agency, Hazard Mitigation Plan, 2022:

<https://www.yorkcountymaine.gov/emergency-management>

⁵⁴ ME Drought Task Force Report, 10/6/2022: <https://www.maine.gov/mema/hazards/drought-task-force>

⁵⁵ York County Emergency Management Agency, Hazard Mitigation Plan, 2022:

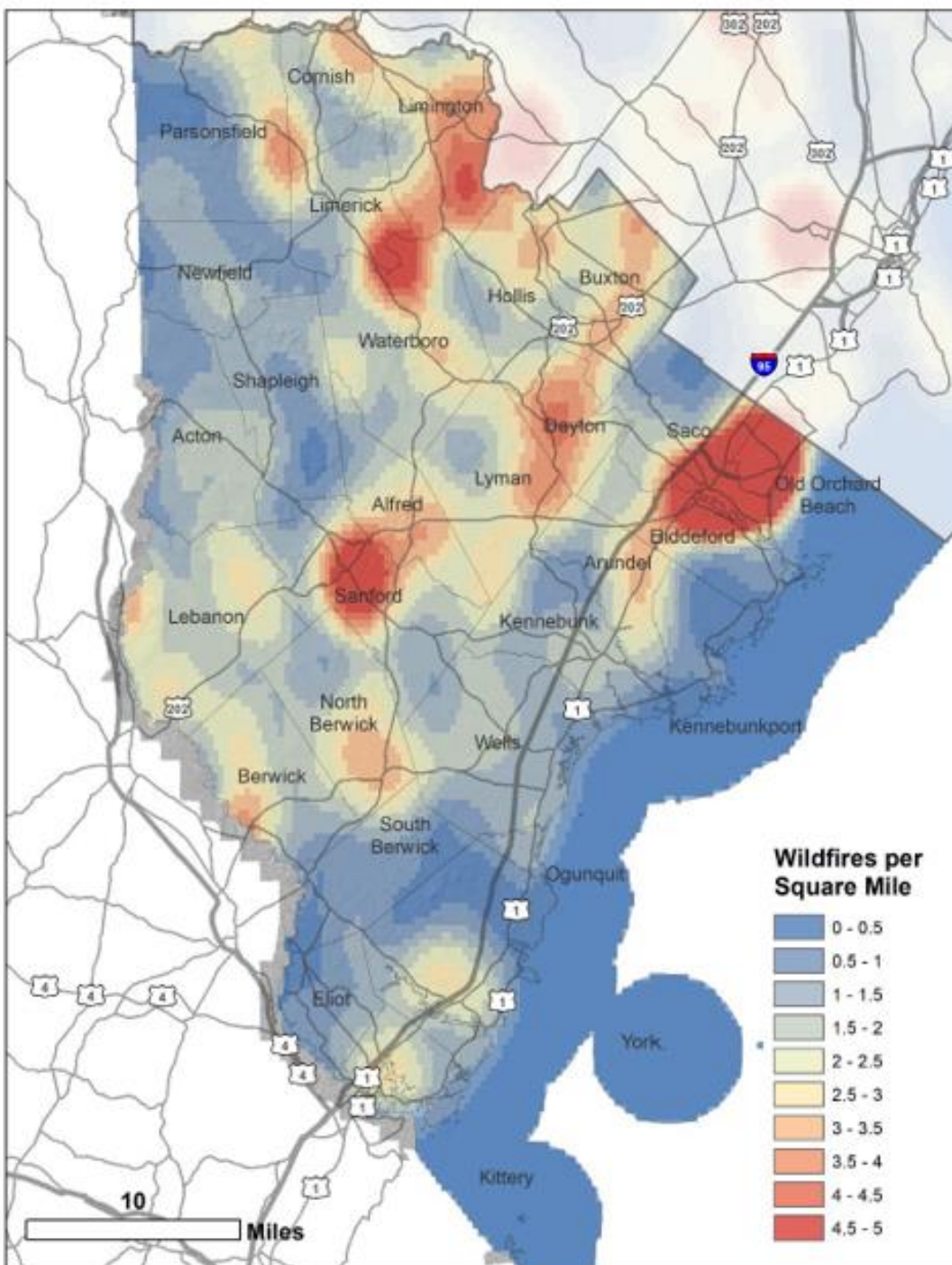
<https://www.yorkcountymaine.gov/emergency-management>

⁵⁶ Portland Press Herald: <https://www.pressherald.com/2020/04/06/wildfires-rage-across-maine-on-monday/>

⁵⁷ York County Emergency Management Agency, Hazard Mitigation Plan, 2022:

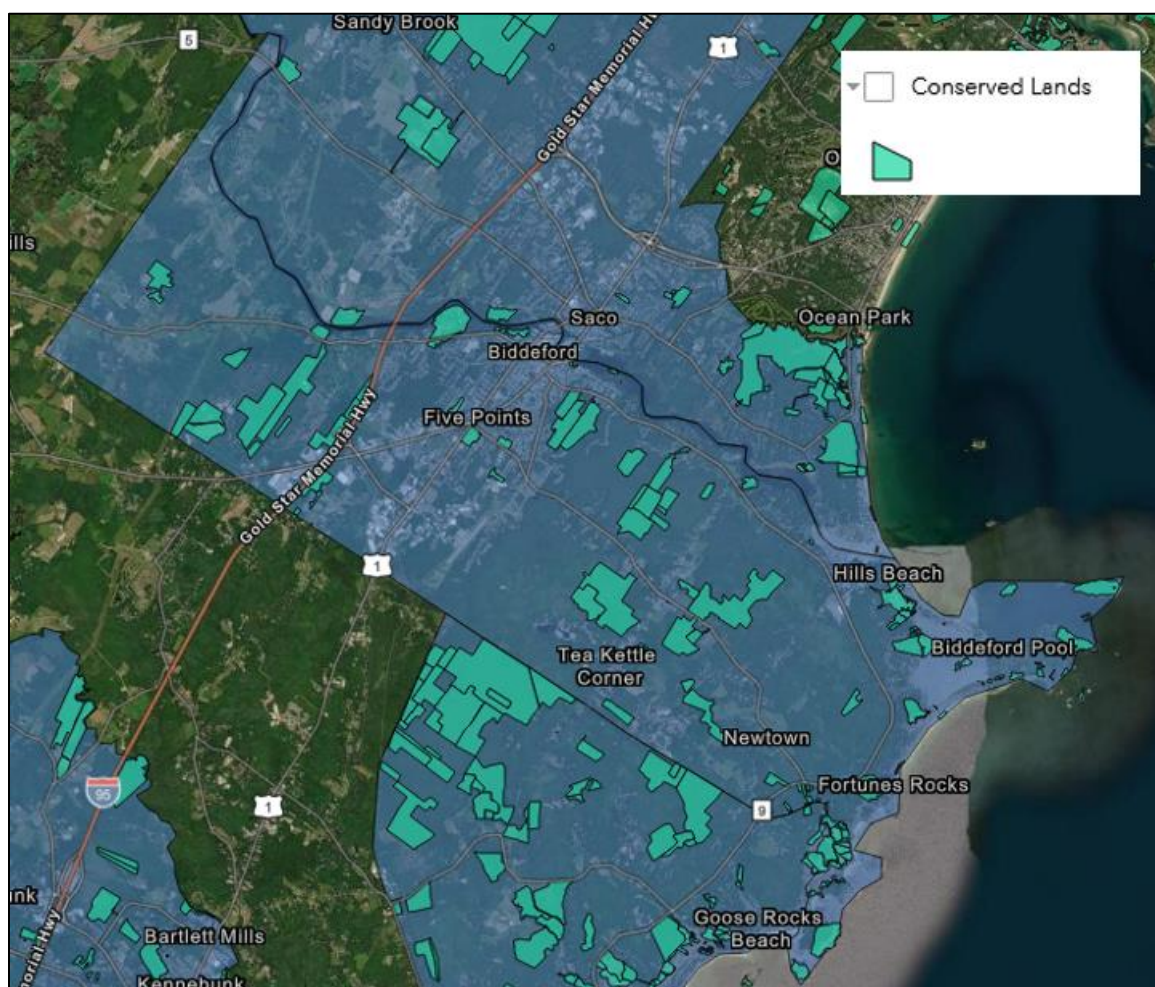
<https://www.yorkcountymaine.gov/emergency-management>

Wildfire Occurrences in York County 1992-2018



Map 32. Wildfire occurrence in York County per square mile, 1992-2018. Data source: York County Emergency Management Agency, Hazard Mitigation Plan, 2022: <https://www.yorkcountymaine.gov/emergency-management>

The Maine Natural Areas Program inventories land parcels owned by federal, state, municipal, and non-profit entities that have conservation easements. There are several pockets of conserved land in Biddeford (Map 33). These conserved areas are managed by the City, Saco Valley Land Trust, Maine Coast Heritage Trust, Blandings Park Wildlife Sanctuary, and the USFWS Rachel Carson National Wildlife Refuge. The richest habitat areas are in the forested Blandings Park Wildlife Sanctuary near Tattle Corner, and the marsh habitats near Hills Beach and Fortunes Rocks that are part of the National Wildlife Refuge. In the future, more frequent, prolonged, or intense droughts have the potential to damage these critical habitat areas.



Map 33. Conserved lands in Biddeford are indicated by the green polygons. Data source: Maine Natural Areas Program. Map source: Climate Ready Coast Southern Maine

Agricultural Impacts

Drought can impact agricultural operations due to shifts in the growing season, crop losses, and increased costs associated with irrigation. During the 2022 drought, the Maine Drought Task Force reported that farmers had to irrigate their crops, increasing their

operational costs.⁵⁸ In both 2020 and 2022, the Farm Services Administration issued emergency declarations for York County as a result of prolonged, severe drought conditions.⁵⁹ Even if farmers have irrigation systems, water supply can still be an issue. The Maine Department of Environmental Protection restricts irrigation withdrawals when stream and river levels fall below a certain threshold.⁶⁰

Biddeford is known for its vibrant downtown and historic textile industry, but the City has a strong agricultural heritage as well. At least half of Biddeford is zoned for rural farm use and a number of operating farms grow vegetables and raise animals like alpacas and goats. In 2018, Engine, a local community development organization, launched a local foods initiative to create opportunities for local farms and increase access to healthy, local foods for disadvantaged groups. In the future, more frequent, prolonged, or intense droughts have the potential to reduce local farmers' production, increase their costs, and disrupt the local food system and economy.

CHANGING MARINE CONDITIONS

Key Takeaways

- In the last 40 years, ocean temperatures have risen faster in the Gulf of Maine than almost anywhere else in the world. Ocean temperatures will likely rise 1.5°F by 2050, and Maine's marine ecosystem will resemble present day conditions in southern New England.
 - There is limited commercial fishing and aquaculture activity in Biddeford, however the individuals who rely on these industries are vulnerable to the economic impacts of changing marine conditions.
- Ocean and coastal acidification are expected to worsen due to higher amounts of carbon dioxide in the atmosphere and more frequent precipitation events.
- The dynamics of harmful algal blooms (HABs) in Maine have shifted in recent years and could continue to change in the future, posing new threats to public health.
- Eelgrass is an important nursery habitat for commercially important species and is an indicator species for overall ecosystem health.
 - Eelgrass habitat is present in Biddeford at the mouth of the Biddeford Pool and around the Beach Island rock outcropping.

⁵⁸ ME Drought Task Force Report, 8/4/2022: <https://www.maine.gov/mema/hazards/drought-task-force>

⁵⁹ Cumberland County Emergency Management Agency, Hazard Mitigation Plan, 2022: <https://www.cumberlandcounty.org/231/Hazard-Mitigation>

⁶⁰ Maine DEP Press Release: <https://www.maine.gov/dep/news/news.html?id=8535391>

- Between 2010 and 2021, the extent and density of the eelgrass bed at the mouth of the Biddeford Pool diminished suggesting a decline in water quality, potentially because of increased stormwater runoff.
- Invasive European green crabs may have contributed to the decline in eelgrass habitat.
- The eelgrass bed around Beach Island expanded in the last decade, potentially due to improved water quality because of better stormwater management practices or other ecosystem drivers.
- In the future, more frequent and intense precipitation and increasing invasive species have the potential to decimate eelgrass habitat, reducing the localized carbon sink and coastal resilience benefits.

Background Info, Trends, & Projections

Southern Maine is located in the Gulf of Maine which stretches from Cape Cod to Nova Scotia. Since 1982, ocean temperatures in the Gulf of Maine have risen 96% faster than the rest of the world's oceans due to rising air temperatures and shifting ocean currents caused by climate change.⁶¹ Marine species ranges are shifting northward following colder ocean temperatures. Lobster stocks in Long Island Sound and southern New England have collapsed, and as ocean temperatures continue to warm, Maine's lobster resource could be facing a similar future. Warming waters have also allowed invasive species like European green crabs, Asian shore crabs, and tunicates to proliferate. Future projections indicate that by 2050 ocean temperatures in Maine will likely rise 1.5°F, and the marine ecosystem will resemble present day conditions in southern New England.⁶²

The oceans are also becoming more acidic. As carbon dioxide builds up in the atmosphere from the burning of fossil fuels, some of that carbon dioxide is absorbed into the ocean. Dissolved carbon dioxide changes the chemical conditions of the water, making it more acidic. In coastal areas, ocean acidification is exacerbated by nutrient rich runoff which can trigger algal blooms. As the blooms die off and decay, the water becomes more acidic. Ocean and coastal acidification primarily impact shellfish species like scallops, oysters, clams, and mussels, all of which are commercially harvested in Maine. Both ocean and coastal acidification are expected to worsen in the future with increasing fossil fuel emissions and increasing and intensifying rainfall events.⁶³

It is also hypothesized that warming waters and shifting currents due to climate change are changing the dynamics of harmful algal blooms (HABs) in Maine. Every summer Maine experiences a "red tide" when a toxin producing phytoplankton species blooms. Shellfish

⁶¹ <https://www.gmri.org/stories/gulf-of-maine-warming-update-summer-2021/>

⁶² University of Maine, Maine's Climate Future, 2020: <https://climatechange.umaine.edu/climate-matters/maines-climate-future/>

⁶³ ME Climate Council, Scientific Assessment of Climate Change and Its Effects in Maine, 2020: <http://climatecouncil.maine.gov/reports>

become contaminated with the toxin and, when eaten, can cause Paralytic Shellfish Poisoning. In recent years, Maine has experienced blooms of new HAB species that have different impacts on human health and the ecosystem. Currently, it is unclear how HAB dynamics may shift with climate change, but coastal Maine communities face an uncertain future regarding the public health, economic, and ecosystem impacts of HABs.

Habitat Shifts and Carbon Sinks

Eelgrass beds are critical marine habitat for commercially important species such as fish and shellfish. It is also vital to estuarine ecosystem functions because it provides nursery habitat for many species. Eelgrass is sensitive to sediment loading and pollutants often caused by poor stormwater and wastewater management. Invasive species including the European green crab and various tunicate species can decimate eelgrass habitat, uprooting plants and smothering growth. As a result, eelgrass habitat loss is generally indicative of poor watershed management practices and declining ecosystem health.⁶⁴

Eelgrass habitat in southern Maine was most recently surveyed in 2021 by the Maine Department of Environmental Protection and was previously surveyed in 2010 by the Maine Department of Marine Resources. Based on these two surveys, eelgrass habitat is present in Biddeford at the mouth of the Biddeford Pool and around the Beach Island rock outcropping (Map 34). Between 2010 and 2021, the extent and density of the eelgrass bed at the mouth of the Biddeford Pool diminished. The area directly northeast of the outflow channel was especially impacted. Conversely, the extent and density of the eelgrass bed around Beach Island increased over this time period.

These changes suggest that water quality in the Biddeford Pool may have declined over the last decade, potentially due to increasing stormwater runoff or declining stormwater management practices. Invasive European green crabs may have also contributed to this habitat loss. Substantial eelgrass habitat losses were observed in Casco Bay between 2012 and 2013 coinciding with a rapid increase in the green crab population.⁶⁵ The status of the green crab population in southern Maine is not as well understood but their impact is likely a compounding factor. On the southeast side of the Pool, stormwater management practices may have improved, improving water quality and allowing the Beach Island eelgrass bed to flourish. This habitat growth could also be the result of other ecosystem drivers such as a lack of green crabs.

In the future, extreme precipitation events are expected to become more frequent and intense which will likely present new and increasing stormwater and wastewater management challenges, potentially threatening the health of Biddeford's eelgrass beds. The Biddeford Pool also has a high degree of impervious surfaces (see Extreme Storms &

⁶⁴ Piscataqua Region Estuaries Partnership: <https://preestuaries.org/eelgrass/>

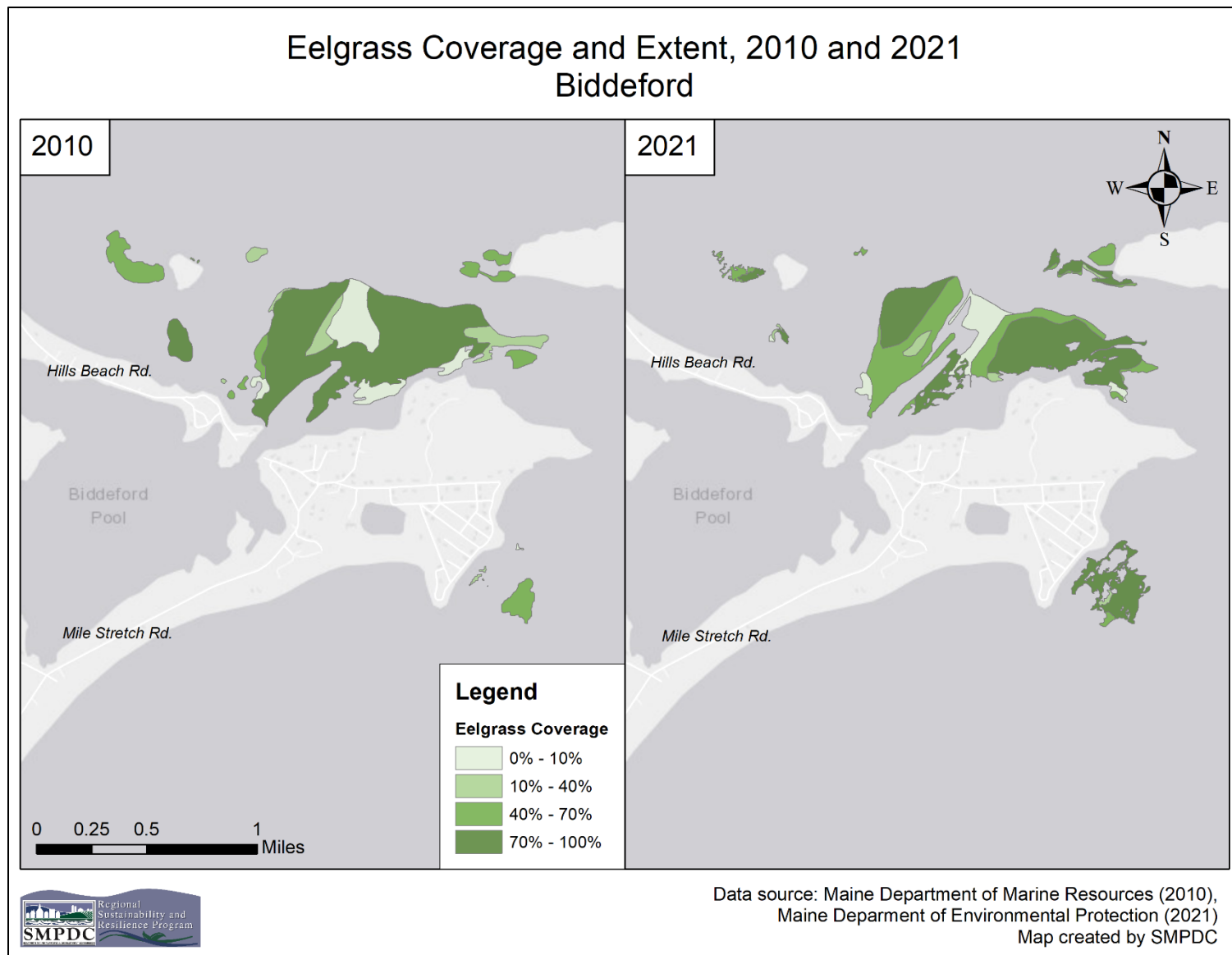
⁶⁵ Casco Bay Estuary Partnership, Eelgrass Beds Decline as Green Crab Numbers Explode, 2015: https://www.cascobayestuary.org/wp-content/uploads/2015/10/Indicator_Eelgrass.pdf

Precipitation Map 20), which increases runoff during heavy rainfall events, further stressing eelgrass habitat. Additionally, warming ocean temperatures favor green crab population growth which may contribute to future eelgrass habitat loss.⁶⁶

There is evidence that eelgrass beds can serve as carbon sinks, absorbing carbon dioxide from the water and locally reducing the influence of ocean and coastal acidification. The vegetation also stabilizes sediments and reduces wave action which has the potential to buffer coastlines against intense coastal storms. For these reasons, eelgrass habitat is not only important for the role it plays in ecosystem functions, but also for the climate mitigation and resilience benefits it provides. These valuable ecosystem services emphasize the importance of protecting this vulnerable habitat.⁶⁷

⁶⁶ ME Climate Council, Scientific Assessment of Climate Change and Its Effects in Maine, 2020: <http://climatecouncil.maine.gov/reports>

⁶⁷ ME Climate Council, Scientific Assessment of Climate Change and Its Effects in Maine, 2020: <http://climatecouncil.maine.gov/reports>



Map 34. Distribution and coverage of eelgrass habitat in Biddeford in 2010 and 2021 based on surveys conducted by the Maine Department of Marine Resources and the Maine Department of Environmental Protection. These data indicate the location of potential carbon sinks as well as marine ecosystem shifts over time.

Biddeford – August 2023

Economic Impacts

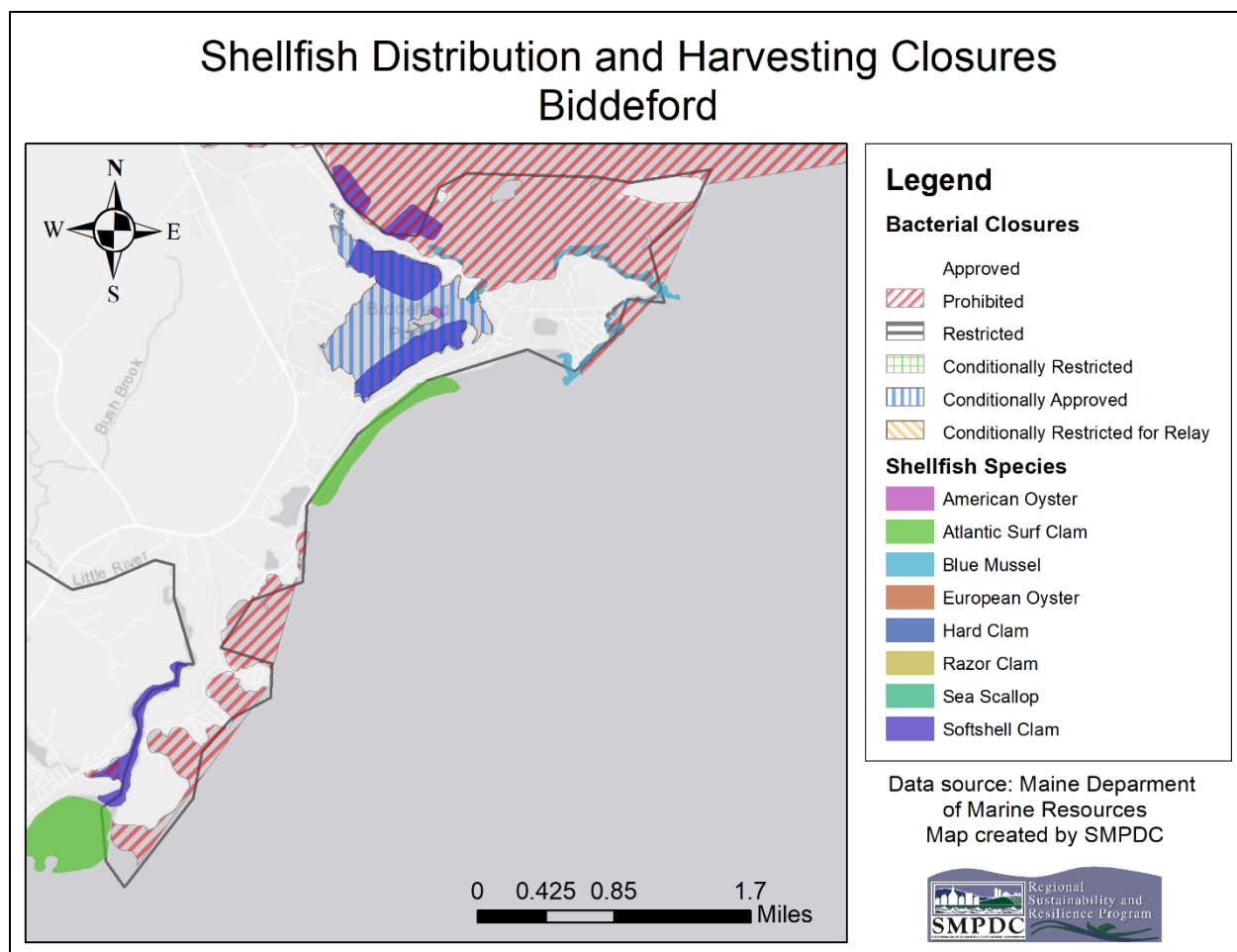
In 2022, there were a total of 36 commercial fishing licenses held in Biddeford and 74 non-commercial licenses⁶⁸ (Figure 28). The majority of these licenses are for harvesting lobster and crab, or fish. Individuals who rely on these fisheries for their livelihoods, especially lobster, may experience economic impacts as species' ranges shift with climate change. Recreational fishing opportunities for non-commercial license holders may also be impacted, representing a significant cultural loss for the community.

Commercial and Non-Commercial Fishing Licenses	
Commercial	Number of Licenses
Lobster/crab	13
Fishing	12
Shellfish	6
Green crab	3
Elver	1
Scallop dragger	1
<i>Total</i>	<i>36</i>
Non-Commercial	
Saltwater fishing	43
Lobster/crab	30
Menhaden	1
<i>Total</i>	<i>74</i>

Figure 28. Commercial and non-commercial fishing licenses in Biddeford. Data source: Maine Department of Marine Resources

In 2010, the Maine Department of Marine Resources (DMR) conducted a survey of shellfish habitat across the state. Based on that survey, there are several pockets of softshell clams, blue mussels, and surf clams in Biddeford (Map 35). However, shellfish harvesting is prohibited along much of Biddeford's coastline because of poor water quality. Fortunes Rocks Beach is open for harvesting and the Pool is conditionally approved, which means DMR will allow harvesting under certain conditions. As a result, wild shellfish harvesting is limited in Biddeford and there are only a handful of commercial license holders. The community is therefore less economically vulnerable to the impacts of climate change on shellfish species. However, warmer waters and ocean acidification have the potential to impact these species which are a critical part of the marine ecosystem.

⁶⁸ Maine Department of Marine Resources. 2022 fishing license data.



Map 35. Distribution of shellfish species based on a survey conducted by the Maine Department of Marine Resources in 2010. Areas that are prohibited or restricted for shellfish harvesting based on poor water quality from bacterial contamination are also indicated. Data source: Maine Department of Marine Resources

In the last decade, aquaculture has exploded in Maine, particularly in southern Maine where the impacts of the declining lobster fishery have been felt more acutely. Aquaculture is viewed as a more climate resilient alternative to wild harvest fisheries like lobster. Currently, aquaculture activity is sparse in Biddeford. Shellfish aquaculture is likely limited by the harvesting closures along Biddeford's coastline. The University of New England holds the only Limited Purpose Application License in Biddeford waters. Their kelp farm is located off Woods Island and is for scientific and educational purposes. Two of the state's few farmed seaweed processors are based in Biddeford. Their businesses could be impacted by shifting marine conditions across Maine, as well as the impacts of climate hazards on their facilities and operations.

BIDDEFORD

BASELINE GREENHOUSE GAS EMISSIONS & 2030 FORECAST

2019 BASELINE GREENHOUSE GAS INVENTORY

One of the first steps in developing emissions reduction goals, targets, and strategies is selecting a baseline year against which future greenhouse gas (GHG) emissions will be compared. For this climate action planning process, 2019 will serve as the baseline year. The baseline GHG inventory identifies the major sources of emissions in Biddeford, enabling the city to identify areas to focus emission reduction efforts, establish goals and track progress towards those goals, and facilitate decision-making about future policies and strategies.

Key Terms

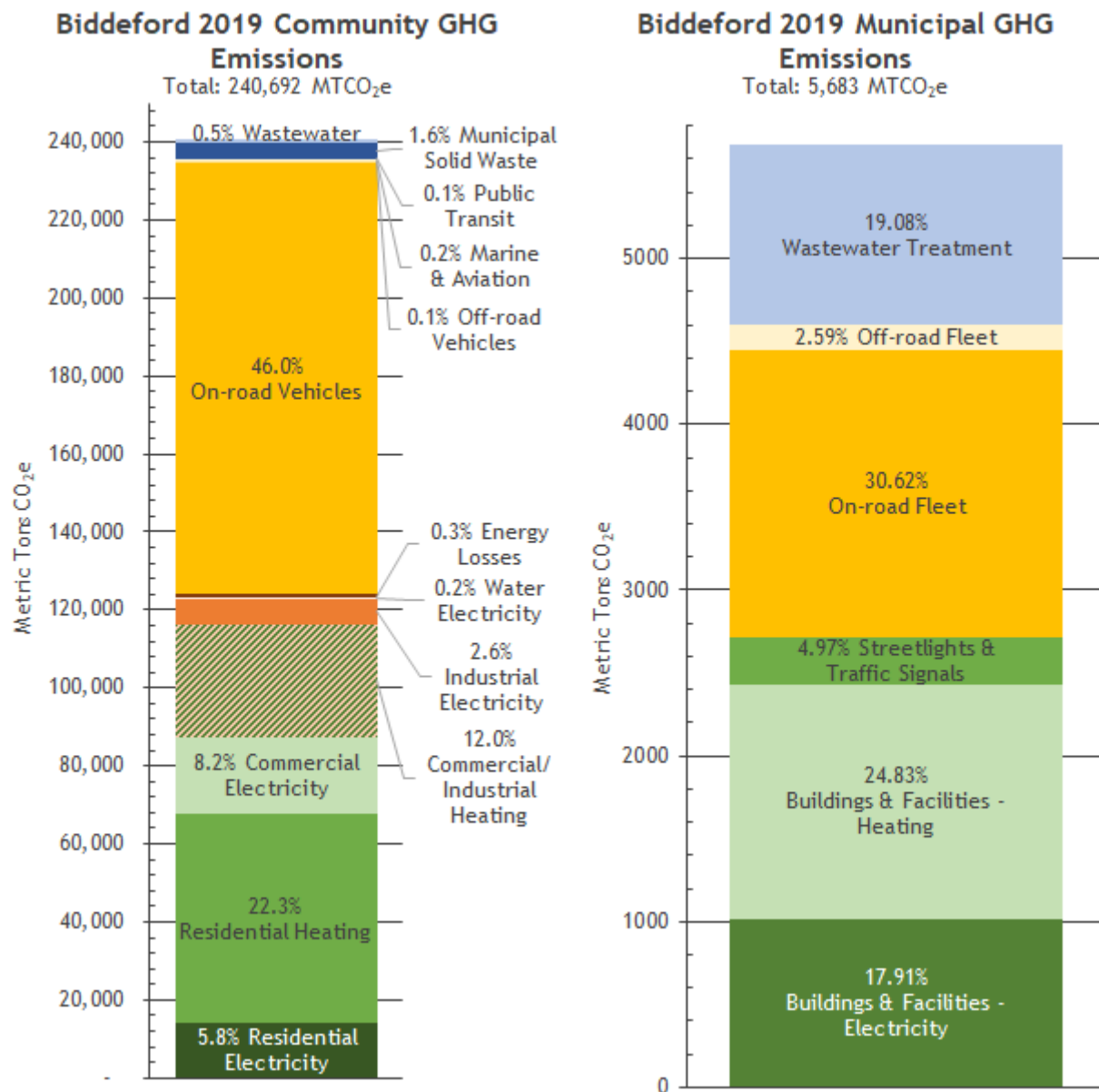
- *Community-wide GHG Inventory:* Accounts for GHG emissions produced by Biddeford's residents, workforce, visitors, and the economy. Municipal emissions are included in the community-wide inventory.
- *Municipal GHG Inventory:* Accounts for GHG emissions produced by the City of Biddeford's municipal operations which include municipal buildings, vehicles, and employee activities. Municipal GHG emissions are a component of community-wide emissions.
- *MTCO_{2e}:* Metric tons (MT) of carbon dioxide equivalent (CO_{2e}) is a metric used to compare the emissions from various GHGs based on their global-warming potential, by converting amounts of other GHGs to the equivalent amount of carbon dioxide with the same global warming potential.

Emissions Sources

In Biddeford, GHG emissions are produced by four sectors, each of which can be broken down into specific subsectors.

- *Transportation:* Includes emissions from all on-road transportation sources, including passenger vehicles, commercial vehicles, and public transit. It also includes emissions from off-road transportation, marine vessels, and aviation.

- **Heating & Electricity - Industrial:** Includes emissions from the generation of electricity that is used to power manufacturing, industrial, and municipal water facilities, the burning of fossil fuels used to heat those facilities, as well as energy losses associated with electricity distribution.
- **Heating & Electricity - Residential & Commercial:** Includes emissions from the generation of electricity that is used to power commercial and residential buildings and the burning of fossil fuels used to heat those buildings.
- **Waste:** Includes emissions from septic tanks, the Biddeford Wastewater Treatment Plant, and the incineration of all trash generated by residential and commercial activity in the community that is sent to the EcoMaine waste-to-energy plant.



KEY TAKEAWAYS FROM THE GHG INVENTORY

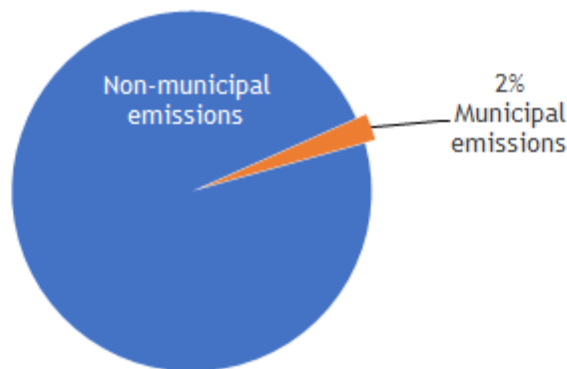
Community-wide emissions trends

- The largest source (46%) of estimated community-wide GHG emissions is on-road fuel use from passenger and commercial vehicles.
- The second largest source (22.3%) of estimated community-wide emissions is heating residential buildings, 80% of these emissions are produced by burning fuel oil to heat homes and the remaining 20% are produced by burning propane, kerosene, natural gas, and wood.

Municipal emissions trends

- Municipal GHG emissions are a small subset of community-wide emissions, accounting for 2% of estimated community-wide emissions.
- Strategies focused on reducing municipal emissions will have less impact than those focused on community-wide emissions, however, balancing feasibility and impact is an important part of strategy prioritization.
- There is great value in municipalities leading by example and adopting emissions reduction strategies that address the largest sources of municipal emissions (i.e. wastewater treatment, vehicle fleet, or building energy).
- 42.74% of estimated municipal emissions are produced by heat and electricity consumption in municipal buildings and facilities.

Breakdown of Biddeford Community-wide Emissions



BUSINESS AS USUAL GHG EMISSIONS FORECAST

ICLEI USA developed the Business as Usual (BAU) forecast by projecting community-wide emissions in 2030 based on the 2019 baseline inventory and anticipated demographic and economic changes. The BAU forecast provides the basis for developing goals, strategies, and targets addressing emissions reductions. The forecast was developed for the primary sectors in the GHG inventory which include heating and electricity from the residential, commercial, and industrial sectors as well as transportation.

Indicators for greenhouse gas emissions forecasting

For the purposes of ICLEI USA's initial analysis, 2030 community-wide and municipal emissions were estimated based on the following indicators. If Biddeford is interested and has access to more localized data sources, ICLEI USA can refine the forecast further.

- ICLEI USA used the projected **annual population growth rate of 0.55% for Biddeford** to estimate emissions trends in the residential, commercial and transportation sectors.
- Municipal GHG emissions will likely fall by 2030 due to more renewable energy on the electricity grid and more rigorous fuel efficiency standards for vehicles.
- GHG emissions from the New England electricity grid are expected to fall by 2030 because the states have adopted ambitious renewable energy targets and **Renewable Portfolio Standards (RPS)**¹. ICLEI USA used Maine's RPS requirements to estimate 2030 electricity emissions.
- Emissions from vehicle fuel use are projected to decline as a result of the **Federal Corporate Average Fuel Economy (CAFE) standards** adopted by the Biden Administration, which will increase fuel efficiency 8% annually for model years 2024-2025 and 10% for model year 2026.

Changes in emissions through 2030

Without taking any additional action at the community or municipal level, **Biddeford's community-wide GHG emissions are expected to fall 23% by 2030** driven by 1) increasing renewable energy sources on the electricity grid as a result of state targets and RPSs, and 2) decreasing transportation emissions due to CAFE fuel efficiency standards and electric vehicle

¹ **Renewable Portfolio Standard (RPS)** is a state legislative mandate to increase production of electricity from renewable sources such as wind, solar, biomass and other alternatives to fossil and nuclear electric generation. Maine, Massachusetts, Vermont, Rhode Island, and Connecticut have all made commitments requiring that electricity suppliers produce 60%-100% of electricity from renewable sources by 2030.

expansion. Market forces are also expected to contribute to an overall decline in GHG emissions globally. Emissions from the burning of fossil fuels to heat buildings in the residential and commercial sectors will likely stay relatively flat, with some efficiency improvements keeping pace with population growth.

OVERVIEW OF CLIMATE GOALS & EMISSIONS TARGETS

Having established baseline emissions and projected BAU 2030 emissions, the next step is to identify specific goals and emissions reduction targets to include in the Climate Action Plan. Climate goals and emissions reduction targets provide a tangible objective to guide climate action and a benchmark to track progress. Goals and targets should have clear baseline and target dates. For example, the target could be a 60% reduction in emissions by 2030 compared to the 2019 baseline. Goals can reference carbon neutrality,² climate neutrality,³ or net-zero.⁴ Goals and targets can also specifically address the types of GHG gases (e.g. carbon dioxide, methane, etc.) or the sources of emissions (e.g. transportation or residential energy).

Globally, 195 countries, including the U.S., signed the Paris Agreement, committing to keep the rise in global temperatures below 2.7°F (1.5°C). The United Nations Intergovernmental Panel on Climate Change (IPCC) estimates that we must reduce global emissions by 50% by 2030 and achieve climate neutrality by 2050 to reach this goal. The U.S. and Maine have set national and state-wide climate goals and emissions reduction targets in an effort to uphold our Paris Agreement commitment.

National targets

- Paris Agreement commitment to keep the rise in global temperatures below 2.7°F (1.5°C)
- Reduce GHG emissions to 50% below 2005 levels by 2030

Maine targets

- 80% of electricity produced by renewables by 2030 (Maine RPS)
- 100% of electricity produced by renewables by 2050 (Maine RPS)

² **Carbon neutrality** is the net balance between activities that emit carbon dioxide and carbon sinks that absorb carbon dioxide from the atmosphere (e.g. soil formation, forests, eelgrass beds, saltmarshes).

³ **Climate neutrality** refers to the emission and mitigation of all greenhouse gases (GHGs) – not just carbon dioxide. Much like carbon neutrality, climate neutrality can be achieved by emitting GHGs at an equal rate to their removal from the atmosphere.

⁴ **Net-zero** means cutting greenhouse gas emissions to as close to zero as possible, with any remaining emissions counterbalanced by carbon sinks such as soil formation, forests, and saltmarshes.

- Achieve carbon neutrality by 2045
- Reduce overall GHG emissions to 45% below 1990 levels by 2030 and 80% by 2050

Meeting national and state climate goals and reduction targets requires municipal and community action. Additionally, equitably reducing global emissions by 50% requires high-emitting, wealthy nations like the U.S. to reduce their emissions by more than 50%. ICLEI USA projects that U.S. industries, communities, and individuals need to reduce GHG emissions by 60-65% to equitably achieve the Paris Agreement goals. ICLEI USA analyzed 138 community GHG Inventories, demonstrating that it is possible for most U.S. communities to reduce per-capita emissions by 63% or more by 2030.⁵

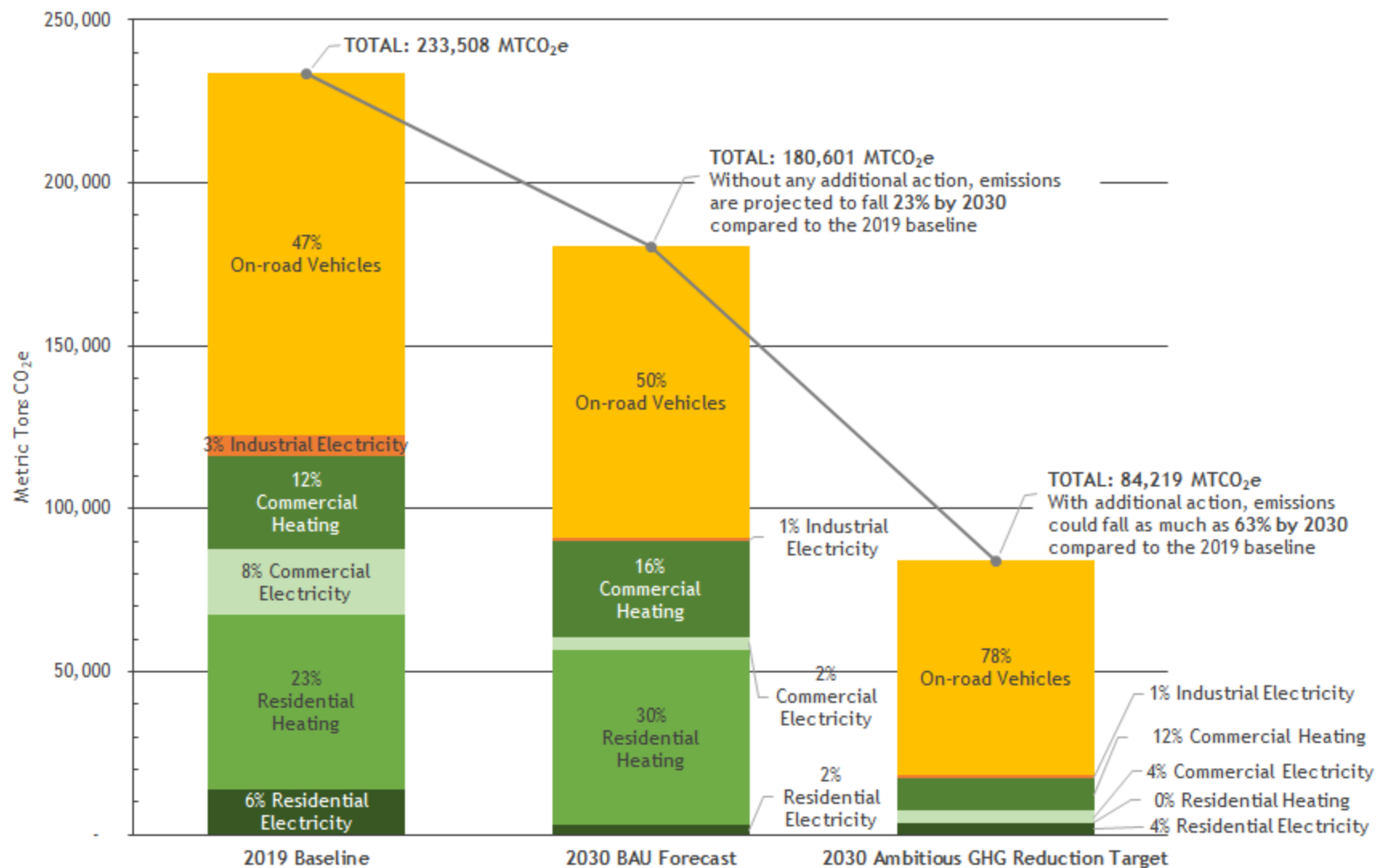
To go above and beyond existing commitments, *ICLEI USA suggests that Biddeford could reduce community-wide GHG emissions 63% by 2030 by implementing ambitious but realistic emissions reduction strategies.* Such an ambitious emissions reduction is achievable for Southern Maine communities. According to ICLEI USA's high-level analysis, a 63% reduction in emissions by 2030 could be met by:

- Reducing vehicle miles traveled (VMT) by 5%
- Increasing Electric Vehicle (EV) VMT to 22.5% of total VMT
- Increasing commercial and residential building energy efficiency for new and renovated buildings
- Increasing current residential and commercial building energy efficiency
- The electrification of current and new commercial and residential buildings

A more detailed analysis is presented in the *High Impact Action Analysis Summary Report*.

⁵ [Analysis of U.S. Local Government Science-Based Targets and Pathways to Achieve Them in the Race to Zero](#)

Biddeford Primary Sectors 2030 GHG Emissions Forecast Under the Business as Usual (BAU) and Ambitious GHG Reduction Target Scenarios



MUNICIPAL STRATEGIES FOR REDUCING GHG EMISSIONS

Once goals and targets are established, the next step is to begin to identify strategies to reduce emissions. There are many strategies Biddeford can use to reduce GHG emissions. The challenge is not figuring out what to do, but rather accelerating the change already taking place globally, nationally, and regionally to bring benefits to Biddeford. Below are examples of strategies that are being employed in Maine and other communities to meet ambitious climate goals.

Reducing vehicle miles traveled (VMT) - By promoting and facilitating transit systems as well as bicycle and pedestrian networks

- *Encourage residents and visitors to walk and bike.*
 - Regional employment hubs like Biddeford can collaborate with employers and transit systems to provide alternative transportation options. The city can also encourage employers to participate in regional initiatives like the biannual [Way 2 Go Maine](#) commuting challenge.
- *Adopt and implement a [Complete Streets Policy](#) and/or land use and development policies that reduce the need for driving and encourage the use of public transit, cycling, and walking.*
 - The City of Portsmouth has a [Complete Streets program](#) for all road upgrades.

Electric vehicles (EV) - Support the electrification of the transportation system

- *Lead by example by electrifying the public fleet*
 - Beginning in 2035, [75% of school bus acquisitions by municipalities must be electric or zero emission school buses](#). Today, Maine municipalities can participate in the [EPA Clean School Bus Program](#). In 2022, Wells-Ogunquit, Dayton, and RSU 57 received a total of seventeen school bus rebates. Each school system is eligible for rebates up to \$375,000 per electric bus and \$20,000 of charging infrastructure per bus.
- *Adopt ordinances to require or encourage EV charging infrastructure, including at multifamily dwellings, businesses, and public parking areas.*
 - SMPDC's [Municipal Electric Vehicle Readiness Toolkit](#) includes a Model EV Infrastructure Ordinance that municipalities can adapt to meet their community's needs.

Energy efficiency - Encourage and promote energy efficiency for residents and businesses

- *Support community weatherization programs to improve residential energy efficiency, particularly for low-income and vulnerable residents.*
 - Community groups and nonprofits like [WindowDressers](#) and [York County Community Action](#) offer programs to help homeowners increase energy efficiency.
- *Adopt 'stretch codes' setting higher standards for energy efficiency than IECC or MUBEC*
 - Adopting municipal regulations such as the [State of Maine Energy Stretch Code \(IECC 2021\)](#) can help drive residential and commercial energy efficiency. The [Cities of Portland and South Portland](#) have both adopted the Maine Energy Stretch Code.

Electrify heating - Help residents and businesses reduce fuel oil dependence and high energy costs

- *Encourage the adoption of heat pumps to reduce fossil fuel use in homes in businesses*
 - Efficiency Maine provides rebates for [heat pump](#) and [heat pump water heater](#) installation. Municipalities can educate residents and businesses about these opportunities, offer their own rebate programs ([like South Portland](#)), or implement a community bulk purchasing program with a vendor (such as [Portland's Electrify Everything Campaign](#)).

Renewable energy - Enable and support development of and access to zero carbon energy

- *Adopt codes and permitting practices that support and incentivize renewable energy systems in the community*
 - The Town of Topsham joined [SolSmart](#), a technical assistance program that helps local governments make it faster, easier, and more affordable for residents and businesses to go solar. The town created an online permitting checklist and reviewed local zoning codes to identify restrictions that prohibit solar PV development.
 - [SolarAPP](#) (Solar Automated Permit Processing) is a no-cost software system from the National Renewable Energy Laboratory (NREL) to streamline rooftop solar permits. The city of San Jose, California increased approved permits by 600% when they switched to SolarAPP.
- *Develop renewable energy capacity targeting underutilized public properties*

- The City of Sanford is using EPA Brownfields funds to clean up the [site of a circuit board recycling facility](#). Once decontaminated, the site will be turned into a solar farm.
- *Provide access to [Community solar](#) for businesses, and residents to reduce their monthly electricity bill and support more solar on the New England electricity grid.*
 - The solar energy generated by the City of Sanford's Brownfield solar farm will be applied to the [Virtual Sanford Renewable Energy Corridor](#). Energy that is created will be slated for use by developers in the downtown mill district, providing an additional incentive for redevelopment.

Reduce emissions AND increase community resilience

- Implement [solar + storage](#) located at key locations (community centers, schools, police and fire departments) to provide resilience to storms and emergency events that cause power outages.
- Increased energy efficiency in homes, particularly those of the most vulnerable residents, increases public health and residents' resilience to power outages, heat waves, and cold spells.
- Focus mixed use and transit-oriented development in zones away from vulnerable areas to both reduce vehicle miles traveled and promote adaptation, especially when combined with conservation of ecosystems that increase resilience to flooding and sea level rise such as saltmarshes.

BIDDEFORD COMPLETE STRATEGY MATRIX

BIDDEFORD CLIMATE ACTION PLAN

OCTOBER 2023



BUILDINGS AND ENERGY

- ★ = Priority action – Identified through public engagement
- = Associated goal/action in Comprehensive Plan
- = Potential regional action

Timeframe: Short = 1-2 years, Medium = 3-4 years, Long = 5+ years
Cost: \$ = Low, \$\$ = Moderate, \$\$\$ = High

Action Description	Equity Considerations	Co-Benefits											Cost	Timeframe	Metrics	
		Cost Savings	Support Local Economy	Municipal Revenue	Water Conservation	Education & Awareness	Mobility Improvement	Smart Growth	Water & Air Quality	Greenspace & Recreation	Job Creation	Community (re)development				
Building Electrification																
B1. Renewable Energy <i>Encourage and incentivize small scale renewable energy installation, such as rooftop solar panels.</i>																
★	To encourage the development of rooftop and small scale solar in the community, municipalities can work to reduce the barriers to solar energy (such as prohibitive or unclear ordinances) and to accelerate the development of local solar energy markets (by streamlining the permitting process).	Efforts to promote roof-top solar tend to be targeted toward wealthier homeowners. Communities that prioritize distributed solar generation should consider how their efforts could cater to lower income homeowners and renters by connecting low-income homeowners to programs with reduced upfront costs and by promoting solar development on multi-unit dwellings.	●	●			●					●		\$	Medium	Permits issued for rooftop solar installations at residential buildings; Renewable Energy Ratio (ratio of energy provided from renewable sources as a percentage of total energy used in a facility)
B2. Building Electrification <i>Shift existing buildings & new construction to all-electric heating and appliances.</i>																
●	Create a program to shift single family homes and larger buildings from fossil fuel heating to all-electric heating and cooling via air-source and ground-source heat pumps, aligning with the LD166 goal of installing 100,000 new heat pumps in the state within 5 years and in an effort to get ahead of conversions to natural gas.	A local or regional electrification incentive program could prioritize low income homeowners, multi-unit rental properties, and homes using fuel oil and provide significant technical assistance to program participants to reduce barriers to heat pump adoption.	●	●			●			●		●		\$\$	Medium	Percent of residential buildings using heating oil, gas, or coal Target: Electrify 15% of existing housing units using heating oil and propane per year.

★ = Priority action

● = Associated goal/action in Comprehensive Plan

● = Potential regional action

Timeframe: Short = 1-2 years, Medium = 3-4 years, Long = 5+ years

Cost: \$ = Low, \$\$ = Moderate, \$\$\$ = High

Action Description	Equity Considerations	Co-Benefits										Cost	Time Frame	Metrics		
		Cost Savings	Support Local Economy	Municipal Revenue	Water Conservation	Education & Awareness	Mobility Improvement	Smart Growth	Water & Air Quality	Greenspace & Recreation	Job Creation				Community (re)development	
Building Energy Efficiency																
B3. Energy Efficiency Increase efficiency of large buildings and rental properties through local ordinances and standards: standards to increase efficiency over time, programs to track and disclose energy consumption, and efficiency standards for rentals.																
★	Efficiency standards for rentals ensure that landlords upgrade the efficiency of their residential properties as a prerequisite for renting a property. Rental buildings consume, on average, 20 percent more energy per square foot than owner-occupied buildings. Much of this disparity stems from the so-called “split incentive problem.” Landlords have little incentive to improve home efficiency when they do not pay energy bills, and tenants have little incentive to make improvements to a home when they may not be present to reap the full benefits of that investment. In addition, these poorly- performing homes are disproportionately occupied by low-income residents, people of color, and other underserved communities—the constituents who can least afford to pay exorbitant energy bills.	Many policies to address home energy efficiency have helped only a small fraction of homes nationwide and often disproportionately benefit white people and wealthy people. However, rental efficiency standards can help improve quality of life and affordability for renters. By reducing home energy costs, particularly for the worst-performing rental units, these standards can mitigate unfair burdens for a city’s most vulnerable residents.	●				●			●		●		\$\$	Medium	Target: Perform energy efficiency retrofits to 15% of existing commercial square footage per year.
B4. Maine 'Stretch Code' Adoption Adopt the most up-to-date building codes (also known as "stretch codes") to help new buildings to be more efficient.																
●	Adopting the Maine “Stretch” Code is one way municipalities can require new buildings to be more energy efficient. A stretch energy code is an alternative to the base energy code (in Maine, MUBEC) to achieve greater energy efficiency and cost-effectiveness in new buildings. The state of Maine has adopted IECC 2021 as the official Stretch code for Maine communities. Stretch codes only help new buildings be more efficient, not already built ones.	While there are upfront costs associated with higher energy efficiency buildings, these costs are compensated by lower energy use and energy expenditures. More energy efficient homes are also healthier homes, with better air quality and moisture control.		●						●		●		\$\$	Short	IECC Code in Use

★ = Priority action – Identified through public engagement

● = Associated goal/action in Comprehensive Plan

● = Potential regional action

Timeframe: Short = 1-2 years, Medium = 3-4 years, Long = 5+ years

Cost: \$ = Low, \$\$ = Moderate, \$\$\$ = High

Action Description	Equity Considerations	Co-Benefits										Cost	Time Frame	Metrics	
		Cost Savings	Support Local Economy	Municipal Revenue	Water Conservation	Education & Awareness	Mobility Improvement	Smart Growth	Water & Air Quality	Greenspace & Recreation	Job Creation				Community (re)development
Building Energy Efficiency (continued)															
B5. Building Weatherization Create a program to help single family homes increase energy efficiency through weatherization efforts, such as improved insulation, sealing leaks, or improved ventilation.															
	The Inflation Reduction Act of 2022 provides significant new federal tax credits and deductions to help Americans to make their homes and buildings more energy-efficient to help reduce energy costs while reducing demand as we transition to cleaner energy sources. New federal income tax credits are available through 2032 providing up to \$3,200 annually to lower the cost of energy efficient home upgrades by up to 30 percent. A local or regional weatherization program could provide awareness, education, and technical assistance to homeowners about these and Efficiency Maine incentives.	Because many weatherization incentives are targeted towards homeowners, weatherization programs have the possibility of leaving out renters or non-tax payers from the program benefits. Weatherization programs should be designed to support these community members as well (either through non tax-based funding or programs targeting multi-unit dwellings). They should also be designed to work with York County Community Action's low income weatherization program.											\$	Medium	Number of efficiency audits conducted; Number of Biddeford applicants for YCCAC Weatherization Program; Target: Perform energy efficiency retrofits to 15% of existing housing stock using heating oil, propane, and electricity for heating per year. .
B6. Municipal Energy Efficiency Increase municipal energy efficiency through energy audits, renewable energy installation, and energy efficiency measures for all city owned properties and buildings.															
	Maine municipalities are often faced with budget pressures and high operating costs to maintain older municipal buildings that house town offices, public works garages, fire stations, and wastewater treatment facilities. Energy efficiency is a great way for municipalities to save energy and money, and improve comfort, safety, and maintenance costs. There are many sources of funding for municipal energy efficiency improvements including Efficiency Maine, the Community Resilience Partnership (CRP) grants, and new federal funding.	Municipal energy efficiency measures may support equity by ensuring that energy efficiency improvements target buildings that provide public services to vulnerable community members (i.e. community centers, schools, senior centers, warming/cooling centers).											\$\$	Medium	Number of energy audits conducted; Number of rooftop solar installations; Annual expenditures for energy

- ★ = Priority action – Identified through public engagement
 ● = Associated goal/action in Comprehensive Plan
 ● = Potential regional action

Timeframe: Short = 1-2 years, Medium = 3-4 years, Long = 5+ years
 Cost: \$ = Low, \$\$ = Moderate, \$\$\$ = High

Action Description	Equity Considerations	Co-Benefits										Cost	Time Frame	Metrics	
		Cost Savings	Support Local Economy	Municipal Revenue	Water Conservation	Education & Awareness	Mobility Improvement	Smart Growth	Water & Air Quality	Greenspace & Recreation	Job Creation				Community (re)development
Building Resilience															
B7. Risk Management <i>Reduce climate risks to buildings through improved information, education, and action, including: requiring hazard disclosures for property transactions, increasing awareness of adaptation options, and encouraging actions to manage flood risks.</i>															
Encourage real estate professionals, developers, and prospective property buyers to disclose and/or be made aware of local coastal hazards pertaining to property during the property transaction process. Municipal staff can be encouraged to share available local climate hazard information with property owners and/or prospective buyers when they come into city hall to discuss a property. Tenants should also be made aware of coastal hazards when renting property.	Risk reduction measures can prevent upfront costs for low income residents.					●							\$	Short	Number of property owners in hazard areas contacted; number of prospective buyers contacted.
B8. Limit Reconstruction & Encourage Relocation <i>Increase municipal energy efficiency through energy audits, renewable energy installation, and energy efficiency measures for all city owned properties and buildings.</i>															
● Placing regulatory limits on rebuilding structures damaged by natural hazards can mitigate future risk, damage, and expenses. Limits can follow a tiered system that allows for limited rebuilding (e.g., permitted only a certain number of times), completely prohibit rebuilding, or allow reconstruction with conditions, such as advanced resilient design standards. (Example: limit replacement or reconstruction of a structure that is 'substantially damaged' by storm impacts to one time for any single lot of record).	Restrictions on re-building must account for equity considerations. Will the cost of rebuilding with resilience measures pose a burden on disadvantaged community members? Will support be provided to ensure that community members can relocate or rebuild with resilience despite the associated costs?	●						●		●			\$	Long	Number of permits issued for reconstruction in hazard areas; Number of permits issued for relocation

★ = Priority action – Identified through public engagement

● = Associated goal/action in Comprehensive Plan

● = Potential regional action

Timeframe: Short = 1-2 years, Medium = 3-4 years, Long = 5+ years

Cost: \$ = Low, \$\$ = Moderate, \$\$\$ = High

Action Description	Equity Considerations	Co-Benefits										Cost	Time Frame	Metrics
		Cost Savings	Support Local Economy	Municipal Revenue	Water Conservation	Education & Awareness	Mobility Improvement	Smart Growth	Water & Air Quality	Greenspace & Recreation	Job Creation	Community (re)development		

Building Resilience (continued)

B9. Resilient Design Standards *Encourage or require new and redeveloped buildings to include sustainable and resilient design measures, especially in flood-prone areas.*

●	Encourage, incentivize, or require new and redeveloped buildings to incorporate sustainable and resilient design measures for buildings. Examples of measures include elevating structures above projected flood levels that account for future sea level rise; underground or covered parking; minimizing impervious surfaces; amending maximum building height standards to accommodate elevation of structures (i.e. freeboard) above projected flood levels; requiring consideration of sea level rise projections and impacts in development applications and review of those applications; and adopting resilient design guidelines for coastal and marine businesses.	Do the design standards represent a cost burden on vulnerable or disadvantaged community members? What supports could be put in place to ensure that disadvantaged community members are not harmed by this action?	●					●				●	\$	Short	—
---	--	---	---	--	--	--	--	---	--	--	--	---	----	-------	---

B10. Critical Facility Resilience *Increase the resilience of critical facilities such as our wastewater treatment facility through risk reduction or relocation.*

●	Ensuring critical facilities are operational and accessible at all times is vital for protecting the health, safety, and wellbeing of the community. This strategy is likely appropriate for the Biddeford Wastewater Treatment Facility and Biddeford Pool Fire Station. While the fire station is not expected to be directly impacted by flooding from sea level rise, access to and from the station is expected to be negatively impacted by road flooding from 1.6 ft of sea level rise combined with storm surge. Investigating flood protection measures and/or relocation of the fire station could enhance the flood resilience of the facility and its operations.	—				●						●	\$\$\$	Long	Create Plan by end of 2024.
---	---	---	--	--	--	---	--	--	--	--	--	---	--------	------	-----------------------------

★ = Priority action – Identified through public engagement

● = Associated goal/action in Comprehensive Plan

● = Potential regional action

Timeframe: Short = 1-2 years, Medium = 3-4 years, Long = 5+ years

Cost: \$ = Low, \$\$ = Moderate, \$\$\$ = High

Action Description	Equity Considerations	Co-Benefits										Cost	Time Frame	Metrics		
		Cost Savings	Support Local Economy	Municipal Revenue	Water Conservation	Education & Awareness	Mobility Improvement	Smart Growth	Water & Air Quality	Greenspace & Recreation	Job Creation				Community (re)development	
Energy Resilience																
B11. Maintain Power at Critical Facilities <i>Develop and implement a plan for maintaining power at critical facilities during power outages.</i>																
	Municipalities can develop and implement a power resilience plan by 1) partnering with the local utility, 2) identifying critical municipal and community facilities (i.e. hospitals and healthcare facilities, police, fire stations, community centers, water and wastewater facilities, and airports), 3) assessing power loads, 4) identifying and implementing energy efficiency measures, and 5) identifying and implementing backup power solutions (such as solar + storage, batteries, microgrids, etc).	Efforts to maintain power at municipal facilities should target those facilities that provide public services to vulnerable community members, such as police stations, healthcare facilities, emergency services and community center.	●				●					●		\$\$\$	Long	Assess needs for critical facilities by 2027.
B12. Improve Grid Resilience <i>Work with power companies and state agencies to advocate for efforts to improve the resilience of the electrical grid.</i>																
●	Extended power outages from extreme weather events pose a substantial risk to community members and businesses. The municipality or the larger region could work with CMP to identify frequency, duration, and location of power outages, their causes, and work together to find solutions for increasing grid resilience.	Power outages have disproportionate negative effects on vulnerable populations, especially people with disabilities, older people, and people with serious health conditions who rely on equipment powered by electricity, such as motorized wheelchairs, elevators, refrigerated medications, oxygen generators, and more.		●			●					●		\$-\$	Long	Identify frequency, duration, location, and causes of power outages in Southern Maine by 2026. Work with regional partners, including Central Maine Power.



TRANSPORTATION AND INFRASTRUCTURE

- ★ = Priority action – Identified through public engagement
- = Associated goal/action in Comprehensive Plan
- = Potential regional action

Timeframe: Short = 1-2 years, Medium = 3-4 years, Long = 5+ years
Cost: \$ = Low, \$\$ = Moderate, \$\$\$ = High

Action Description	Equity Considerations	Co-Benefits										Cost	Time Frame	Metrics		
		Cost Savings	Support Local Economy	Municipal Revenue	Water Conservation	Education & Awareness	Mobility Improvement	Smart Growth	Water & Air Quality	Greenspace & Recreation	Job Creation				Community (re)development	
Reduce Vehicle Miles Traveled																
T1. Public Transit <i>Expand access to and use of public transit services.</i>																
★ ●	Biddeford is already working with BSOOB to expand use of public transit. Biddeford also developed a Transit Oriented Development Plan with Saco and GPCOG. Pgs 68-71 of the plan detail strategies to Increase use of transit, including: Develop welcoming bus stops, adopt innovative customer service technology, increase frequency and hours of operation, implement transit-supportive roadway improvements, involve the community, consider bus route redesign and microtransit options, transition to electric vehicles, support Downeaster improvement, and plan for rapid transit.	Although public transit does not serve a large portion of the population in these communities, public transit is an essential public service, especially for more vulnerable community members such as those without a vehicle and older residents.	●	●				●		●				\$\$-\$\$\$	Medium	BSOOB Ridership; Number of BSOOB routes; Number of BSOOB bus stops

★ = Priority action – Identified through public engagement

● = Associated goal/action in Comprehensive Plan

● = Potential regional action

Timeframe: Short = 1-2 years, Medium = 3-4 years, Long = 5+ years

Cost: \$ = Low, \$\$ = Moderate, \$\$\$ = High

Action Description	Equity Considerations	Co-Benefits										Cost	Time Frame	Metrics	
		Cost Savings	Support Local Economy	Municipal Revenue	Water Conservation	Education & Awareness	Mobility Improvement	Smart Growth	Water & Air Quality	Greenspace & Recreation	Job Creation				Community (re)development
Reduce Vehicle Miles Traveled (continued)															
T2. Increase Walkability <i>Improving the “walkability” of our city’s roadways through a safe, comfortable, and convenient network of pedestrian walkways.</i>															
★	Improving the “walkability” of our roadways and communities with safe, comfortable, and convenient walkways makes it possible to convert more short trips to walking, reducing VMT. The strategy can include: Maintain streets and sidewalks for efficiency and safety; Create Safe Routes ordinance to require or incentivize the creation of safe routes on private properties; Adopt a 'Complete Streets' policy, or similar.	Alternative transportation options are vital for households with one or no cars. Walking and bicycling to school is more common among children from low-income and minority households. For older adults, children, and people with disabilities, access to safe and comfortable walking infrastructure allows for greater independence and reduces reliance on cars. Investments in pedestrian infrastructure should consider who is most likely to benefit from that investment, and should direct resources to those portions of the community that would have the greatest equity outcomes.	●				●			●	●		\$\$\$	Long	Number of miles of "Complete Streets”
T3. Increase Bikeability <i>Improve the “bikeability” of our city’s roadways with safe, comfortable, and convenient networks of bikeways and bike-related infrastructure.</i>															
★	Improving the “bikeability” of our roadways and communities with safe, comfortable, and convenient bikeways makes it possible to convert more short trips to bicycling, reducing VMT. The strategy can include: Identify gaps in pedestrian and the bicycle networks and barriers to active modes of travel; Develop and implement a bicycle and pedestrian plan to improve connectivity in the community and beyond; collaborate with regional partners to connect on-and off-road bicycle facilities with existing and planned regional trail networks. It can also include strategies to increase access to bicycles, such as a bikeshare program.	Investments in bicycle infrastructure should consider who is most likely to benefit from that investment, and should direct resources to those portions of the community that would have the greatest equity outcome	●				●			●	●		\$\$\$	Long	Number of miles of "Complete Streets"

★ = Priority action – Identified through public engagement

● = Associated goal/action in Comprehensive Plan

● = Potential regional action

Timeframe: Short = 1-2 years, Medium = 3-4 years, Long = 5+ years

Cost: \$ = Low, \$\$ = Moderate, \$\$\$ = High

Action Description	Equity Considerations	Co-Benefits											Cost	Time Frame	Metrics	
		Cost Savings	Support Local Economy	Municipal Revenue	Water Conservation	Education & Awareness	Mobility Improvement	Smart Growth	Water & Air Quality	Greenspace & Recreation	Job Creation	Community (re)development				
Reduce Vehicle Miles Traveled (continued)																
T4. Transit-Oriented Development <i>Concentrate housing, business, and leisure activities within easy walking distance to public transit in new development.</i>																
★	Transit-oriented Development (TOD) is an approach to development that maximizes the amount of residential, business, and leisure space within an easy walk of public transit. The goal is to promote sustainable growth by increasing walkability and transit use while reducing reliance on private vehicles. Actions can include using Tax Increment Financing (TIF) districts to direct development to transit locations and requiring high levels of accessibility and connectivity for pedestrians, bicycles, and motor vehicles in all new development and significant redevelopment. The Biddeford Saco Transit Oriented Development Plan includes strategies to support transit oriented development including: Align Zoning To Support Higher Density Transit Oriented Development Principles, Leverage The Saco Transportation Center As A Community Anchor, and Advance Development And Investment Through Public-Private Partnerships.	The high demand for housing adjacent to transit can make TOD homes inaccessible to people with lower incomes, while the rapid appreciation sparked by new transit investments can lead to gentrification and displacement, countering equity goals. TOD can have an explicit commitment to achieve equity goals through dedicated strategies that ensure low-income residents and residents of color benefit from – and are not displaced by – the new development. With strategies in place to preserve and expand affordable housing, protect tenants from rising costs and displacement, connect residents to jobs and economic opportunities, stabilize and support small and local businesses, TOD can also increase equity outcomes.	●	●				●	●		●	●	●	\$\$\$	Long	—
T5. Reduce Single-Occupancy Vehicle Trips <i>Assess methods to reduce single-occupancy vehicle trips made by municipal staff.</i>																
●	Create programs and incentives to encourage municipal staff utilize all means of alternative transportation (i.e. active mobility, public transit, carpooling. Also, develop citywide Travel Demand Management (TMD) plans to focus the TDM-specific activities of the municipality. May include a description of current city activities, how these fit into state and regional plans and efforts, and a set of specific implementation objectives for the next several years.	—	●				●			●				\$	Short	Miles driven in municipal vehicles

- ★ = Priority action – Identified through public engagement
 ● = Associated goal/action in Comprehensive Plan
 ● = Potential regional action

Timeframe: Short = 1-2 years, Medium = 3-4 years, Long = 5+ years
 Cost: \$ = Low, \$\$ = Moderate, \$\$\$ = High

Action Description	Equity Considerations	Co-Benefits										Cost	Time Frame	Metrics
		Cost Savings	Support Local Economy	Municipal Revenue	Water Conservation	Education & Awareness	Mobility Improvement	Smart Growth	Water & Air Quality	Greenspace & Recreation	Job Creation	Community (re)development		

Reduce Vehicle Miles Traveled (continued)

T6. Direct Development Decrease the need for private vehicles by reducing sprawl through directing new development to areas where services are easily accessible and reducing minimum parking requirements.

Development patterns directly influence where and how much community members, employees, and visitors must drive. Directing development to areas of service and increasing density directly reduces sprawl. It can be combined with efforts to increase walkability and bikeability to reduce driving overall. Strategies to direct development include incentives to promote infill development, allow for mixed use development where appropriate, and supporting brownfield redevelopment.	Infill development may skew towards investment in parcels that provide a greater return on investment, which can exacerbate patterns of underinvestment in other areas. In other cases, infill development in historically underinvested areas can lead to the displacement of residents with lower incomes, especially if concentrated development results in an increased demand for residential and commercial spaces. To encourage equitable benefits for current residents and businesses, communities can implement affordable housing programs and policies, workforce development opportunities, and partnerships with local groups to ensure that infill developments benefit residents and local partners. Brownfield redevelopment in particular provides an opportunity to address environmental injustices, increase community assets, and improve conditions that impact the quality of life in historically underserved areas.		●				●	●				●	\$\$	Medium	Density bonus approvals
---	---	--	---	--	--	--	---	---	--	--	--	---	------	--------	-------------------------

★ = Priority action – Identified through public engagement

● = Associated goal/action in Comprehensive Plan

● = Potential regional action

Timeframe: Short = 1-2 years, Medium = 3-4 years, Long = 5+ years

Cost: \$ = Low, \$\$ = Moderate, \$\$\$ = High

Action Description	Equity Considerations	Co-Benefits											Cost	Time Frame	Metrics
		Cost Savings	Support Local Economy	Municipal Revenue	Water Conservation	Education & Awareness	Mobility Improvement	Smart Growth	Water & Air Quality	Greenspace & Recreation	Job Creation	Community (re)development			
Resilient Infrastructure															
T7. Protect Critical Infrastructure <i>Improving the “walkability” of our city's roadways through a safe, comfortable, and convenient network of pedestrian walkways.</i>															
Ensuring these critical assets are operational and accessible in the face of climate hazards is vital for emergency response and for protecting the health, safety, and wellbeing of community members. Take steps to protect critical assets (water, sewer, etc.) and other structures that will be impacted by sea level rise, storm surge, flooding and extreme weather events associated with climate change. Coordinate with the local water and sewer districts to incorporate climate change resilience and sustainability principles in management and decision-making and ensure they are planning for future conditions such as extreme precipitation events and coastal flooding that can overwhelm stormwater systems, exacerbate flooding, and cause significant damage. Ensure that drinking water sources are adequately protected to improve drought resilience. Both water and sewer directly impact public health. Planning for and adapting to future climate change conditions can help to minimize the indirect public health impacts of climate change. Some of Biddeford's stormwater and sewer infrastructure, including the wastewater treatment facility, and water infrastructure are located in areas at risk of flooding from storms and sea level rise. Infrastructure-specific assessments and adaptation planning should occur to provide the City with a better understanding of risks, vulnerabilities, and protection measures. The City should partner with Maine Water to assess vulnerabilities.	Upgrades to infrastructure should consider how upgrades will impact utility rate payers, as responsibility and the burden of trying to repair and rehabilitate aging infrastructure has traditional fallen on the backs of local ratepayers, For this reason, community involvement is critical in the decision making process. Biddeford's WWTP is located near the downtown in an area with elevated social vulnerability, meaning that public health impacts due to infrastructure failures would be born by more disadvantaged community members.	●										●	\$\$\$	Long	Initiate identification of vulnerable critical infrastructure by 2026.

★ = Priority action – Identified through public engagement

● = Associated goal/action in Comprehensive Plan

● = Potential regional action

Timeframe: Short = 1-2 years, Medium = 3-4 years, Long = 5+ years

Cost: \$ = Low, \$\$ = Moderate, \$\$\$ = High

Action Description	Equity Considerations	Co-Benefits											Cost	Time Frame	Metrics	
		Cost Savings	Support Local Economy	Municipal Revenue	Water Conservation	Education & Awareness	Mobility Improvement	Smart Growth	Water & Air Quality	Greenspace & Recreation	Job Creation	Community (re)development				
Resilient Infrastructure (continued)																
T8. Vulnerability Assessment Assess the vulnerability of transportation infrastructure to the impacts of heat, groundwater rise, and saltwater intrusion caused by sea level rise.																
	Extreme heat, groundwater rise caused by sea level rise, and saltwater intrusion can impact and degrade critical infrastructure above and below ground, shortening its lifespan and increasing maintenance costs. Assess impacts of heat, groundwater rise, and saltwater intrusion caused by sea level rise on local transportation infrastructure to better understand how climate change might impact important infrastructure assets and plan for appropriate upgrades.	—												\$\$	Medium	The Sustainability Commission, in partnership with Public Works will complete an assessment of transportation infrastructure by 2026.
T9. Build Infrastructure Resilience Modify roads, culverts, and bridges to increase their resilience to flooding, sea level rise, and other climate hazards, including raising, relocating, and/or upsizing.																
	With a better understanding of what key travel routes are at risk of flooding, municipalities can plan to prioritize detours and alternative routes that both redirect traffic to safety and prioritize access to key economic centers. Roads at risk of coastal flooding include Mile Stretch Road, Hills Beach Road, Yates Street, Bridge Road, Maddox Pond Road, Fortunes Rocks Road, Granite Point Road, Timber Point Road, and Beach House Lane	—												\$\$\$	Long	The sustainability Commission, in partnership with Public Works and engineering will develop a plan to identify vulnerable roads, bridges, and culverts by 2026.

- ★ = Priority action – Identified through public engagement
 ● = Associated goal/action in Comprehensive Plan
 ● = Potential regional action

Timeframe: Short = 1-2 years, Medium = 3-4 years, Long = 5+ years
 Cost: \$ = Low, \$\$ = Moderate, \$\$\$ = High

Action Description	Equity Considerations	Co-Benefits										Cost	Time Frame	Metrics		
		Cost Savings	Support Local Economy	Municipal Revenue	Water Conservation	Education & Awareness	Mobility Improvement	Smart Growth	Water & Air Quality	Greenspace & Recreation	Job Creation				Community (re)development	
Support Electric Vehicles																
T10. Encourage Transition to Electric Vehicles Streamline permitting, install public EV chargers, require EV chargers in new development, and transition city fleets to EV.																
★ ●	Municipalities that manage their own electrical permitting and inspections are responsible for ensuring the safe installation of EV charging stations (EVCS). According to EVCS providers, expensive, complex, protracted, and/or non-uniform permitting and inspection procedures are a significant barrier to charger installations. Delays and confusion can result in residents and businesses giving up on EVCS installations. In Maine, the state has not yet issued any guidance on how municipalities should be permitting and inspecting EV charging stations. To encourage and expedite EVCS installations, permitting and inspection processes should be designed to: 1. Clarify the requirements for EV charging stations; 2. Simplify the permitting and inspection process; 3. Ensure permitting fees do not place a significant cost burden onto the EVCS owner; 4. Provide training to Code Enforcement staff on EV charging station installations.	Unequal access to EV charging infrastructure can be a limiting factor to community adoption. Low- and moderate-income drivers have less access to charging-enabled off street parking. Municipalities can design permitting processes to reduce barriers to EV charging station installation, including installation costs. Currently EVs can be cost prohibitive for lower income folks so in the current market EV charging infrastructure tends to support higher income populations.	●						●					\$\$\$	Short	Number of EVCS located in Biddeford; Number of EVs registered in Biddeford Targets: Increase total Vehicle Miles traveled by Electric Vehicles 30% by 2030. Increase total Vehicle Miles Traveled by Electric Vehicles replacing diesel vehicles 15% by 2030.



LAND USE AND NATURAL ENVIRONMENT

★ = Priority action – Identified through public engagement

● = Associated goal/action in Comprehensive Plan

● = Potential regional action

Timeframe: Short = 1-2 years, Medium = 3-4 years, Long = 5+ years

Cost: \$ = Low, \$\$ = Moderate, \$\$\$ = High

Action Description	Equity Considerations	Co-Benefits										Cost	Time Frame	Metrics
		Cost Savings	Support Local Economy	Municipal Revenue	Water Conservation	Education & Awareness	Mobility Improvement	Smart Growth	Water & Air Quality	Greenspace & Recreation	Job Creation	Community (re)development		

Protection of Natural Resources

LN1. Sustainable Landscaping Create and enforce climate resilient and sustainable landscaping approaches, eliminating the use of fertilizers, herbicides, and pesticides, especially in city parks and green spaces.

★	Create and enforce climate resilience and sustainable landscaping approaches. Draft zoning standards that require or incentivize new development and redevelopment to increase the amount of landscaping, open space, and tree canopy in neighborhoods that currently have less of these site design features. Manage municipal landscaped areas using natural products and low-impact practices. Promote native, climate resilient, and sustainable landscaping initiatives community wide by connecting residents to plants and information	Historically disadvantaged and vulnerable neighborhoods often have less tree canopy to cool properties and offset heat island effects, which make many of these neighborhoods significantly warmer than others and creates health challenges for older adults and persons experiencing disabilities.	●			●	●		●	●	●	●	\$	Medium	Number of trees planted and monitored; city expenditures on pesticides, insecticides, and herbicides; number of property owners contacted with educational materials
---	---	--	---	--	--	---	---	--	---	---	---	---	----	--------	--

- ★ = Priority action – Identified through public engagement
 ● = Associated goal/action in Comprehensive Plan
 ● = Potential regional action

Timeframe: Short = 1-2 years, Medium = 3-4 years, Long = 5+ years
 Cost: \$ = Low, \$\$ = Moderate, \$\$\$ = High

Action Description	Equity Considerations	Co-Benefits										Cost	Time Frame	Metrics
		Cost Savings	Support Local Economy	Municipal Revenue	Water Conservation	Education & Awareness	Mobility Improvement	Smart Growth	Water & Air Quality	Greenspace & Recreation	Job Creation	Community (re)development		

Protection of Natural Resources (continued)

LN2. Protect Vulnerable Areas Conserve areas of the city that are vulnerable to climate hazards, as well as those that help to minimize climate risks through carbon storage and flood reduction.

●	Strengthen ecosystem resilience by preserving climate-threatened natural areas such as wetlands, riparian areas, and headwater streams, as well as those areas that provide carbon sequestration, through zoning or other regulations. Conserve, revegetate, and reconnect floodplains and buffers in riparian areas. Possible measures: Enact and enforce policies (such as a wetland impact assessment requirement) that preserve and restore functioning wetlands. Partner with local and regional land trusts for strategic land conservation and management of those lands. Participate in a watershed protection program and coordinate with watershed communities on stormwater management and watershed protection measures. Apply land use regulations, like shoreland zoning standards, to wetlands that are smaller than state threshold of 10 acres.	The benefits of conservation may come at a cost to communities. Conserved areas should be identified, protected, and governed equitably				●	●			●	●			—	—	Acres in conservation areas; Acres of preserved wetlands; Acres of re-vegetated areas. Work with regional partners to identify conservation and climate resilience priorities by 2026.
---	--	---	--	--	--	---	---	--	--	---	---	--	--	---	---	--

★ = Priority action – Identified through public engagement

● = Associated goal/action in Comprehensive Plan

● = Potential regional action

Timeframe: Short = 1-2 years, Medium = 3-4 years, Long = 5+ years

Cost: \$ = Low, \$\$ = Moderate, \$\$\$ = High

Action Description	Equity Considerations	Co-Benefits										Cost	Time Frame	Metrics
		Cost Savings	Support Local Economy	Municipal Revenue	Water Conservation	Education & Awareness	Mobility Improvement	Smart Growth	Water & Air Quality	Greenspace & Recreation	Job Creation	Community (re)development		

Protection of Natural Resources (continued)

LN3. Nature Based Solutions *Promote and enable "nature-based solutions", such as the restoration of sand dunes or wetlands, to protect shorelines and coastal property from flooding and erosion.*

●	Nature-based solutions (NBS) are sustainable planning, design, environmental management, and engineering practices that weave natural features or processes into the built environment to promote adaptation and resilience. These solutions use natural features and processes to combat the effects of climate change, improve water quality, and protect coastal property from flooding and erosion. They offer an alternative to traditional 'hard' or 'gray' infrastructure approaches and provide monetary and non-monetary benefits to people and the environment. Ensure local land use regulations enable the use of NBS and promote the use of NBS on public and private property. Conduct education to property owners about NBS for shoreline stabilization and climate resilience measures they can implement on their own properties. Examples of NBS include vegetation and/or geotextiles, dune restoration, wetland restoration, thin layer deposition, wetland enhancement, living shorelines, beach nourishment, and soft armoring.	Nature based solutions projects should incorporate equity throughout: 1. Ensure that design governance and implementation processes are inclusive and transparent. 2. Tackle root causes of marginalization, inequality and injustice at all stages. 3. Limit the creation of economic and non-economic losses, and avoid the unjust redistribution of risks and costs. 4. Prioritize interventions for the most at-risk places and communities.	●	●	●	●	●		●	●	●		\$\$	Long	Non-native species removed; acres of wetlands preserved; Sea berm installation in coastal areas.
---	--	--	---	---	---	---	---	--	---	---	---	--	------	------	--

LN4. Restoration of Natural Habitats *Promote the restoration or enhancement of natural habitats for biodiversity and wildlife protection.*

	Healthy ecosystems and the biological diversity they support are a source of food, water, medicine, shelter and other material goods. They also provide ecosystem services – the cleaning of air and water – which sustain life and increase resiliency in the face of mounting pressures.	The benefits of habitat restoration may come at a cost to communities. Restoration projects should be identified, managed, and governed equitably				●	●		●	●			\$\$	Long	Number of non-native species removed; Number of native trees planted; Number of wildlife corridors created. Work with regional partners to identify and prioritize most important areas to restore for habitat protection.
--	--	---	--	--	--	---	---	--	---	---	--	--	------	------	--

★ = Priority action – Identified through public engagement

● = Associated goal/action in Comprehensive Plan

● = Potential regional action

Timeframe: Short = 1-2 years, Medium = 3-4 years, Long = 5+ years

Cost: \$ = Low, \$\$ = Moderate, \$\$\$ = High

Action Description	Equity Considerations	Co-Benefits											Cost	Time Frame	Metrics
		Cost Savings	Support Local Economy	Municipal Revenue	Water Conservation	Education & Awareness	Mobility Improvement	Smart Growth	Water & Air Quality	Greenspace & Recreation	Job Creation	Community (re)development			

Sustainable and Resilient Development

LN5. Sustainable Food Systems *Promote and expand local and resilient food systems through sustainable practices such as actions that improve soil health and that store carbon.*

★	Food production systems and eating habits are major contributors to climate change, and it is impossible to meet our climate targets unless a shift occurs. Eating more plant-based foods will reduce our carbon footprint in no uncertain terms. Because greenhouse gas emissions occur at every step of food production, growing food locally will reduce emissions attributed to storing and transporting food for local consumption. Regenerative agriculture restores soil health and promotes carbon sequestration, increasing ecosystem resilience and creating localized carbon sinks. Regenerative farming practices can also be used to by fruit and vegetable farmers.	—	●			●		●					\$\$	Long	Number of community gardens per resident Acres of productive farmland and forest land
---	---	---	---	--	--	---	--	---	--	--	--	--	------	------	--

LN6. Mixed-Use Zoning *Implement zoning to allow a blend of residential and commercial uses in some areas of the city, in order to reduce sprawl and make neighborhoods more walkable.*

★	Land use regulations, such as zoning ordinances and building codes that determine the location and type of development permitted in an area, impact the natural environment and resilience of a community. Policies that promote higher-density, mixed-use developments with access to public infrastructure, along with energy-efficiency improvements to older structures being redeveloped, can reduce greenhouse gas emissions. Enable and incentivize climate resilient and compact, mixed-use development in appropriate areas to reduce environmental impacts, increase housing affordability, and enhance community resilience to climate change	Growth and investment in the downtown area have led to gentrification in Biddeford and a housing affordability crisis. The city needs to consider how investments can be paired with affordability to ensure equitable access to livable, walkable areas.		●	●			●	●			●	\$	Medium	Number of new or upgraded sidewalks created; Miles of bike lanes created; Average distance of new housing to critical services (food shopping, schools etc.).
---	--	---	--	---	---	--	--	---	---	--	--	---	----	--------	---

- ★ = Priority action – Identified through public engagement
 ● = Associated goal/action in Comprehensive Plan
 ● = Potential regional action

Timeframe: Short = 1-2 years, Medium = 3-4 years, Long = 5+ years
 Cost: \$ = Low, \$\$ = Moderate, \$\$\$ = High

Action Description	Equity Considerations	Co-Benefits										Cost	Time Frame	Metrics
		Cost Savings	Support Local Economy	Municipal Revenue	Water Conservation	Education & Awareness	Mobility Improvement	Smart Growth	Water & Air Quality	Greenspace & Recreation	Job Creation	Community (re)development		

Sustainable and Resilient Development (continued)

LN7. Direct Development Direct development away from areas of the city that are exposed to climate-related risks, including sea level rise, erosion, and inland flooding.

Where and how communities accommodate growth, development, and redevelopment profoundly affects vulnerability of people and property, as well as the quality and health of water, beaches, and coastal wetlands. Investigate use of regulatory and policy mechanisms to discourage development in areas exposed to climate hazards and toward more suitable and less vulnerable locations. Actions could include both regulatory (zoning and land use regulations) and non-regulatory measures. Examples include prohibition of new development in hazard areas; erosion-based setbacks; development setbacks from hazard areas; transfer of development rights (TDR); rolling easements; incentivizing and encouraging development in areas that have low exposure to hazards and are appropriate for density. Consider adopting zoning overlay district(s) to help protect buildings and people from climate hazards. The overlay(s) should include development standards and regulations that aim to increase the resilience of development to climate hazards and promote sustainable development approaches.	Evaluate potential policies and regulations for their impact on socially vulnerable and traditionally marginalized populations			●				●		●		●	\$\$\$	Long	Number of square miles newly designated Limited Growth Areas; Area of Overlay districts that protect hazard areas from development.
---	--	--	--	---	--	--	--	---	--	---	--	---	--------	------	---

★ = Priority action – Identified through public engagement

● = Associated goal/action in Comprehensive Plan

● = Potential regional action

Timeframe: Short = 1-2 years, Medium = 3-4 years, Long = 5+ years

Cost: \$ = Low, \$\$ = Moderate, \$\$\$ = High

Action Description	Equity Considerations	Co-Benefits										Cost	Time Frame	Metrics
		Cost Savings	Support Local Economy	Municipal Revenue	Water Conservation	Education & Awareness	Mobility Improvement	Smart Growth	Water & Air Quality	Greenspace & Recreation	Job Creation	Community (re)development		

Sustainable and Resilient Development (continued)

LN8. Land Use Ordinance Review *Conduct a review of the city's land use ordinances and policies to identify changes needed to include climate resilience and sustainability measures and standards*

●	Municipal land use planning and regulations are indispensable tools for enhancing local climate resilience and sustainability. Maine's home rule status offers valuable opportunities for municipalities to adopt creative, innovative, and flexible land use solutions that address coastal hazards, promote energy efficiency, reduce GHG e	Any substantial review of land use ordinances should also incorporate equity. Equity in zoning means that those who write, administer, or enforce zoning regulations take clear steps to avoid or "undo" unfair outcomes and mitigate the unequal ability to participate in or influence all parts of the zoning process.			●	●	●	●	●	●	●	●	\$	Short	Milestone: Completed land use ordinance review
---	---	---	--	--	---	---	---	---	---	---	---	---	----	-------	---

LN9. Encourage Development in Appropriate Areas *Encourage development in appropriate areas that are already developed, have public services (e.g., water and sewer), and are less vulnerable to natural hazards*

	Consider incentives for infill development in appropriate areas, such as areas close to goods and services, including downtown and village centers outside of flood hazard areas. These can be paired with requirements for energy efficiency, and sustainable and resilient design.	Infill development in historically underinvested areas can lead to the displacement of residents with lower incomes, especially if concentrated development results in an increased demand for residential and commercial spaces	●					●		●		●	\$	Short	Number of density bonus approvals; Number of new housing units created in the three Main Street Revitalization District zones (MSRD-1, MSRD-2, MSRD-3).
--	--	--	---	--	--	--	--	---	--	---	--	---	----	-------	--



HEALTH, SAFETY, AND WELL BEING

★ = Priority action – Identified through public engagement

● = Associated goal/action in Comprehensive Plan

● = Potential regional action

Timeframe: Short = 1-2 years, Medium = 3-4 years, Long = 5+ years

Cost: \$ = Low, \$\$ = Moderate, \$\$\$ = High

Action Description	Equity Considerations	Co-Benefits										Cost	Time Frame	Metrics
		Cost Savings	Support Local Economy	Municipal Revenue	Water Conservation	Education & Awareness	Mobility Improvement	Smart Growth	Water & Air Quality	Greenspace & Recreation	Job Creation	Community (re)development		

Community Resilience/Disaster Preparedness

H1. Resilience Hubs Establish a designated site to serve as a "resilience hub" that can provide critical services to residents during climate-related emergencies or disruptions.

In the event of a disruption, the Hub will provide community members with critical services, including access to electricity, food and water, shelter, health and medical supplies, information, and logistical coordination with partner groups that provide post-disruption support. The Resilience Hub will reduce the burden on local emergency response teams, improve access to public health initiatives, foster greater community cohesion, and increase the effectiveness of community-centered institutions and programs.	Resilience Hubs can help to shift power to communities and enable them to plan, react, and recover without reliance on local government. In addition to being designed and managed by the community, hubs are meant to be in well-trusted, well-utilized community facilities that serve the needs of the community more broadly than temporary emergency shelters do. Hubs can also enhance social cohesion because they can be designed to serve as community gathering places and "community centers"					●						●	\$\$\$	Medium	Number of designated resilience hubs in operations; number of users.
---	--	--	--	--	--	---	--	--	--	--	--	---	--------	--------	--

★ = Priority action – Identified through public engagement

● = Associated goal/action in Comprehensive Plan

● = Potential regional action

Timeframe: Short = 1-2 years, Medium = 3-4 years, Long = 5+ years

Cost: \$ = Low, \$\$ = Moderate, \$\$\$ = High

Action Description	Equity Considerations	Co-Benefits											Cost	Time Frame	Metrics	
		Cost Savings	Support Local Economy	Municipal Revenue	Water Conservation	Education & Awareness	Mobility Improvement	Smart Growth	Water & Air Quality	Greenspace & Recreation	Job Creation	Community (re)development				
Disaster Preparedness																
H2. Improve Disaster Planning <i>Improve disaster planning and response to be better prepared for climate change risks, including early warning systems and community evacuation plans.</i>																
●	For every \$1 invested in hazard mitigation, communities save \$6 in avoided future disaster costs. Disaster preparedness is key to a quick, safe, effective recovery after an event. Enhance resilience by taking steps now to prepare for hazards and emergency events. Actions include: developing a storm debris management plan; developing an extreme temperatures emergency plan with strategies that increase use of cooling centers by residents; assessing and monitoring wildfire risk, creating a Coordinated Climate and Health Response Team to address climate health and disaster risks in the community; and establishing a network for pre- and post-storm coordination.	Public health systems should be designed to ensure that they are reaching the most vulnerable community members. This may involve community members without access to internet, cellphones, television, etc.					●							\$\$	Long	Number of preparedness plans in place; Number of resilience hubs
H3. Climate Hazard Training <i>Provide emergency responders and medical providers with training about the types of illnesses that might occur as a result of climate hazards</i>																
●	Work with local fire and rescue departments to provide training about climate related illnesses, including heat exhaustion, cardiovascular and pulmonary stressors, and vector-borne diseases. When first responders can recognize and treat these illness, people will be more likely to receive appropriate care. It also allows these departments to plan more strategically for climate related events such as heatwaves, droughts, or pest infestations.	Increasing climate hazards will have a disproportionate impact on already vulnerable community members.					●							\$	Short	Milestone: Create training materials, hold trainings at least once annually with Fire/Rescue and PD by 2026. Metric: Number of emergency responders trained for climate-related illnesses.

★ = Priority action – Identified through public engagement

● = Associated goal/action in Comprehensive Plan

● = Potential regional action

Timeframe: Short = 1-2 years, Medium = 3-4 years, Long = 5+ years

Cost: \$ = Low, \$\$ = Moderate, \$\$\$ = High

Action Description	Equity Considerations	Co-Benefits										Cost	Time Frame	Metrics
		Cost Savings	Support Local Economy	Municipal Revenue	Water Conservation	Education & Awareness	Mobility Improvement	Smart Growth	Water & Air Quality	Greenspace & Recreation	Job Creation	Community (re)development		

Disaster Preparedness (continued)

H4. Public Health Outreach *Conduct outreach about public health advisories for climate-related health impacts and weather events.*

●	Publicize and amplify public health advisories for climate related health and weather events such as air quality advisories, extreme heat or cold events, extreme storms, power outages, waterborne disease outbreaks, harmful algal blooms, and vector borne disease trends. Use the town's existing lines of communication (website, social media, neighborhood forums, direct contact of at-risk residents, etc.)	Public health systems should be designed to ensure that they are reaching the most vulnerable community members. This may involve community members without access to internet, cellphones, television, etc.					●							\$	Medium	Milestone: Create outreach materials and begin doing quarterly outreach by 2026, with hazard-specific outreach/warnings as appropriate. Metric: Number of climate advisories distributed, whether through social media or direct contact.
---	--	--	--	--	--	--	---	--	--	--	--	--	--	----	--------	---

Health and Safety

H5. Affordable Housing *Encourage and support the creation of resilient, energy-efficient, and low-carbon affordable housing.*

★	The recommendations of the Mayor's Affordable Housing Task Force includes: 1. Create or preserve ninety (90) units of affordable rental units per year for five years, with half of the units targeted to serve the 40% to 80% median income community and a desired goal of having at least half the units being created by new construction; 2. Rehabilitate at least sixty-five (65) rental units per year for the next three years so that the units are healthy homes and lead free.	Creation of affordable housing can protect tenants from rising costs and displacement and increase equity outcomes.		●	●			●			●	●	\$\$\$	Long	Number of affordable housing units created.
---	---	---	--	---	---	--	--	---	--	--	---	---	--------	------	---

★ = Priority action – Identified through public engagement

● = Associated goal/action in Comprehensive Plan

● = Potential regional action

Timeframe: Short = 1-2 years, Medium = 3-4 years, Long = 5+ years

Cost: \$ = Low, \$\$ = Moderate, \$\$\$ = High

Action Description	Equity Considerations	Co-Benefits											Cost	Time Frame	Metrics
		Cost Savings	Support Local Economy	Municipal Revenue	Water Conservation	Education & Awareness	Mobility Improvement	Smart Growth	Water & Air Quality	Greenspace & Recreation	Job Creation	Community (re)development			
Health and Safety (continued)															
H6. Ensure Safe Drinking Water Supply Ensure the safety and quality of drinking water supplies, including through assessment and management of climate change impacts to septic systems and wells.															
★ ●	Partner with Maine Water to establish and implement a program to protect drinking water sources and ensure safe and reliable drinking water supply. Prioritize vulnerable neighborhoods and replace lead service lines for drinking water consumption. Monitor and protect water quality in private wells and create resilient water utilities through conservation, demand management, technology, and operations efficiency				●				●			●	\$-\$-\$	Medium	Number of private wells tested
H7. Shade Structure Ordinance Develop an ordinance to require shade structures (covered bus stops, gazebos, etc.) on city-owned properties.															
★	Require shade structures on all properties local governments own. Shade structures can include gazebos, trees, covered outdoor facilities, and transit stops. Full shade canopies have the greatest reduction potential for surface and perceived temperatures. Shade structures provide relief for residents, pets, and wildlife during extreme heat events. Transit stops should be prioritized; shade structures serve the added benefit of protecting people from inclement weather									●			\$	Short	Number of shade structures; Percent of transit stops with adequate shade structures

★ = Priority action – Identified through public engagement

● = Associated goal/action in Comprehensive Plan

● = Potential regional action

Timeframe: Short = 1-2 years, Medium = 3-4 years, Long = 5+ years

Cost: \$ = Low, \$\$ = Moderate, \$\$\$ = High

Action Description	Equity Considerations	Co-Benefits											Cost	Time Frame	Metrics	
		Cost Savings	Support Local Economy	Municipal Revenue	Water Conservation	Education & Awareness	Mobility Improvement	Smart Growth	Water & Air Quality	Greenspace & Recreation	Job Creation	Community (re)development				
Health and Safety (continued)																
H8. Tree Ordinance <i>Develop an ordinance to increase tree canopy both on city-owned and private property.</i>																
★	Adopt tree ordinance that requires planting of native trees and other climate-resilient and native vegetation in locations where they make a direct, positive impact on the community or act as a buffer to filter air and water, limit storm runoff, and stabilize soil.										●			\$	Short	Number of trees planted and monitored
H9. Monitor Vector-Borne Diseases and Invasive Species <i>Explore options for monitoring and managing pests, like ticks and mosquitoes, that are associated with increases in diseases (e.g. Lyme disease) using natural and ecologically sound methods.</i>																
●	Explore options for monitoring and managing pests, like ticks and mosquitoes, that are associated with increases in diseases (e.g. Lyme disease) using natural and ecologically sound methods. Conduct outreach and education to property owners and provide user-friendly guidance about invasive and native species.					●								\$\$	Medium	Number of property owners contacted with educational materials; Vector Borne disease rate reduction.



LEADERSHIP AND SUPPORT

★ = Priority action – Identified through public engagement

● = Associated goal/action in Comprehensive Plan

● = Potential regional action

Timeframe: Short = 1-2 years, Medium = 3-4 years, Long = 5+ years

Cost: \$ = Low, \$\$ = Moderate, \$\$\$ = High

Action Description	Equity Considerations	Co-Benefits										Cost	Time Frame	Metrics		
		Cost Savings	Support Local Economy	Municipal Revenue	Water Conservation	Education & Awareness	Mobility Improvement	Smart Growth	Water & Air Quality	Greenspace & Recreation	Job Creation				Community (re)development	
Community Outreach																
LS1. Create Climate Commission Create a municipal Climate Commission made of up city residents to assist with the implementation of the Climate Action Plan.																
★	Created by city ordinance, this commission would collaborate with municipal, public, and private sectors to collectively guide and track climate action. This commission will actively engage community members in local climate sustainability and resilience issues.	A climate commission can weave equity considerations into all future climate actions to ensure that all people, regardless of age, race, income, etc., will benefit equally from progress made toward resiliency.	●	●			●							\$	Short	Hire Intern or AmeriCorps Volunteer to assist with CAP implementation. Milestone: Created and operational by beginning of 2024.

★ = Priority action – Identified through public engagement

● = Associated goal/action in Comprehensive Plan

● = Potential regional action

Timeframe: Short = 1-2 years, Medium = 3-4 years, Long = 5+ years

Cost: \$ = Low, \$\$ = Moderate, \$\$\$ = High

Action Description	Equity Considerations	Co-Benefits										Cost	Time Frame	Metrics
		Cost Savings	Support Local Economy	Municipal Revenue	Water Conservation	Education & Awareness	Mobility Improvement	Smart Growth	Water & Air Quality	Greenspace & Recreation	Job Creation	Community (re)development		

Community Outreach (continued)

LS2. School Curricula *Support local schools to include climate change and sustainability in school curricula.*

★	Climate change and sustainability are sometimes incorporated into science courses, however these issues intersect with all subject areas. Work with the school district and teachers to develop new classes or adapt existing classes to bring climate, sustainability, and resilience to the classroom. Ensuring that the next generation has an understanding of these issues will promote sustained engagement and give them the skills they need to navigate the challenges in their futures.	—				●							\$	Short	Milestone: Establish relationships with appropriate school staff by end of 2025. Create relevant curricula by the end of 2026. ' Metric: Number of teachers who incorporate climate and sustainability issues into lesson plans.
---	---	---	--	--	--	---	--	--	--	--	--	--	----	-------	---

LS3. Climate Change Training *Provide climate change training for municipal boards, commissions, and committees.*

	Community members play a key role in creating a culture of sustainability and resilience by taking action in their own homes and businesses and by providing support and input into municipal initiatives. Biddeford can enable individual and community action by actively engaging City commissions, boards, and committees on local climate, sustainability, and resilience issues through education events, the city website, and other communication outreach.	—				●							\$	Short	Milestones: Present in person to the council and all boards and commissions at least once by the end of 2025; Create ongoing training materials available in an online resource by the end of 2026. Metrics: Number of commission, board and committee members engaged in climate training. Number of educational events conducted annually.
--	---	---	--	--	--	---	--	--	--	--	--	--	----	-------	---

- ★ = Priority action – Identified through public engagement
 ● = Associated goal/action in Comprehensive Plan
 ● = Potential regional action

Timeframe: Short = 1-2 years, Medium = 3-4 years, Long = 5+ years
 Cost: \$ = Low, \$\$ = Moderate, \$\$\$ = High

Action Description	Equity Considerations	Co-Benefits											Cost	Time Frame	Metrics
		Cost Savings	Support Local Economy	Municipal Revenue	Water Conservation	Education & Awareness	Mobility Improvement	Smart Growth	Water & Air Quality	Greenspace & Recreation	Job Creation	Community (re)development			
Municipal Operations and Funding															
LS4. Create Position of Sustainability Coordinator Create a municipal Office of Sustainability and position of Sustainability Coordinator, whose mandate will be to implement the Climate Action Plan.															
★	The Sustainability Coordinator will oversee the development of climate adaptation and mitigation solutions and creates policy to put solutions into action. This position collaborates with residents and businesses, and local, regional, state, and federal partners. This commission will actively engage community members in local climate sustainability and resilience issues.	A Sustainability Coordinator can weave equity considerations into all future climate actions to ensure that all people, regardless of age, race, income, etc., will benefit equally from progress made toward resiliency.	●	●		●	●	●	●	●		●	\$\$	Short	Milestone: Created by the end of 2024.
LS5. Establish Local Climate Funding Establish local funding mechanisms to support implementation of the Climate Action Plan.															
	Establish a municipal fund and make annual appropriations to the fund and invest the assets to grow the fund over the long-term. This approach provides a significant funding source to supplement more conventional methods, such as bonding and grants. Incorporate elements of accountability into funding programs so that funds are being used to maximize community benefits. Consider establishing a Tax Increment Finance (TIF) District to support local climate resilience projects. A TIF is an economic development tool for capturing the projected increase in tax revenue that is created by a development within a defined area and reinvests those funds into public improvements and development projects for that benefit the zone and increase resilience to coastal hazards. Enact impact fees on new and redevelopment projects to help financially support climate change adaptation and mitigation action within the community.	Evaluate potential policies and regulations for their impact on socially vulnerable and traditionally marginalized populations. Explicitly consider how use of funds (what, where, who, etc.) could perpetuate disparities and/or provide an imbalance of benefits to less vulnerable people/populations. Ensure there is transparency and community input in the decision making process to allow for accountability		●		●			●	●		●	\$-\$	Medium	Annual appropriations to new Climate Action Fund.

- ★ = Priority action – Identified through public engagement
 ● = Associated goal/action in Comprehensive Plan
 ● = Potential regional action

Timeframe: Short = 1-2 years, Medium = 3-4 years, Long = 5+ years
 Cost: \$ = Low, \$\$ = Moderate, \$\$\$ = High

Action Description	Equity Considerations	Co-Benefits											Cost	Time Frame	Metrics	
		Cost Savings	Support Local Economy	Municipal Revenue	Water Conservation	Education & Awareness	Mobility Improvement	Smart Growth	Water & Air Quality	Greenspace & Recreation	Job Creation	Community (re)development				
Municipal Operations and Funding (continued)																
LS6. Include Climate in Municipal Investments <i>Incorporate climate resilience and carbon emissions measures into planned investments for city-owned infrastructure and equipment</i>																
★	Accounting for environmental conditions of tomorrow in today's decision-making is not only necessary for ensuring safe and vibrant communities now and into the future, it is also a wise investment of limited municipal funds. However, capacity limitations, strapped municipal budgets, and insufficient information about cumulative costs of storm response and repair have hindered progress on municipal planning and action aimed at addressing growing natural hazards.	Evaluate potential policies and regulations for their impact on socially vulnerable and traditionally marginalized populations. Explicitly consider how use of funds (what, where, who, etc.) could perpetuate disparities and/or provide an imbalance of benefits to less vulnerable people/populations. Ensure there is transparency and community input in the decision making process to allow for accountability	●						●				●	\$	Medium – Long	Amount of funding obtained from federal, state, or private funding opportunities

★ = Priority action – Identified through public engagement

● = Associated goal/action in Comprehensive Plan

● = Potential regional action

Timeframe: Short = 1-2 years, Medium = 3-4 years, Long = 5+ years

Cost: \$ = Low, \$\$ = Moderate, \$\$\$ = High

Action Description	Equity Considerations	Co-Benefits										Cost	Time Frame	Metrics
		Cost Savings	Support Local Economy	Municipal Revenue	Water Conservation	Education & Awareness	Mobility Improvement	Smart Growth	Water & Air Quality	Greenspace & Recreation	Job Creation	Community (re)development		

Municipal Operations and Funding (continued)

LS7. Include Climate Considerations in Decision Making *Incorporate future climatic conditions in land use planning and municipal policies.*

Municipal and regional planning and policy documents form the foundation for local decision-making, regulation, and ordinances. Most land use policies and regulations in place today were designed for environmental conditions of the past, and need to be updated to account for increasing risk and changing conditions to protect development, people, and municipal expenditures. Similarly, municipal policies often do not account for climate change. These policies govern the day to day operations of the municipality, so considering the intersection with climate change aligns short term and long term decision making with resilience and sustainability goals. Incorporating climate resilience and sustainability in all short- and long-term municipal decision-making and policy documents and plans, including the Comprehensive Plan, can help a community ensure that decisions, regulations, and policies are supporting local climate change goals and priorities. Coordinating with the County Emergency Management Agency can ensure inclusion of local climate hazards and areas of concern/vulnerability in the County Hazard Mitigation Plan, elevating the significance of those hazards and areas on a regional scale and offering opportunities for hazard mitigation funding.	Evaluate potential policies and regulations for their impact on socially vulnerable and traditionally marginalized populations. Explicitly consider how use of funds (what, where, who, etc.) could perpetuate disparities and/or provide an imbalance of benefits to less vulnerable people/populations. Ensure there is transparency and community input in the decision making process to allow for accountability.	●	●	●	●	●	●	●	●	●	●	●	\$\$-	Medium	—
--	---	---	---	---	---	---	---	---	---	---	---	---	-------	--------	---

LS8. Build Municipal Capacity *Ensure municipal departments have the resources, guidance, and support to implement the Climate Action Plan*

Municipal departments carry out the day to day operations of the community. To ensure these day to day operations align with long-term climate goals, the departments must be provided with the staff, resources, and training they need to adjust their activities accordingly .	Trainings for staff should include the ways that historically disadvantaged and vulnerable populations are more vulnerable to climate change impacts and should be incorporated with equity training												\$\$-	Short - Medium	—
--	---	--	--	--	--	--	--	--	--	--	--	--	-------	----------------	---