arrowsic climate action plan

TOWN OF ARROWSIC
Settled 1630

land acknowledgment

The Town of Arrowsic begins this plan with recognition of the stewardship of the Abenaki people, part of the Wabanaki Federation, who lived here before the arrival of European colonizers. These lands are the unceded territory of the Abenaki people. We pledge to build a better understanding of those who came before us and to continue to repair the relationship between our peoples and the land.

appreciation

Members of the Arrowsic Climate Resilience Committee

Jody Jones, Co-Chair

Aleisha Khan, Co-Chair

Jennifer Geiger

Tom Spear

Jack Carr

Jesse Nankin McMahon

Jenna Howard

Dan Cassidy

Mona Schlein

Karin Stadtler

Pam Wischkaemper

Members of the Arrowsic Select Board

Walter Briggs, First Selectperson

DeeDee Jorgensen

Jennifer Geiger

Members of the Arrowsic Conservation Commission

Phine Ewing, Chair

Jenna Howard

Clarke Cooper

Karen Robbins

Carla Wees

Jesse Nankin McMahon

Priscilla Tucker

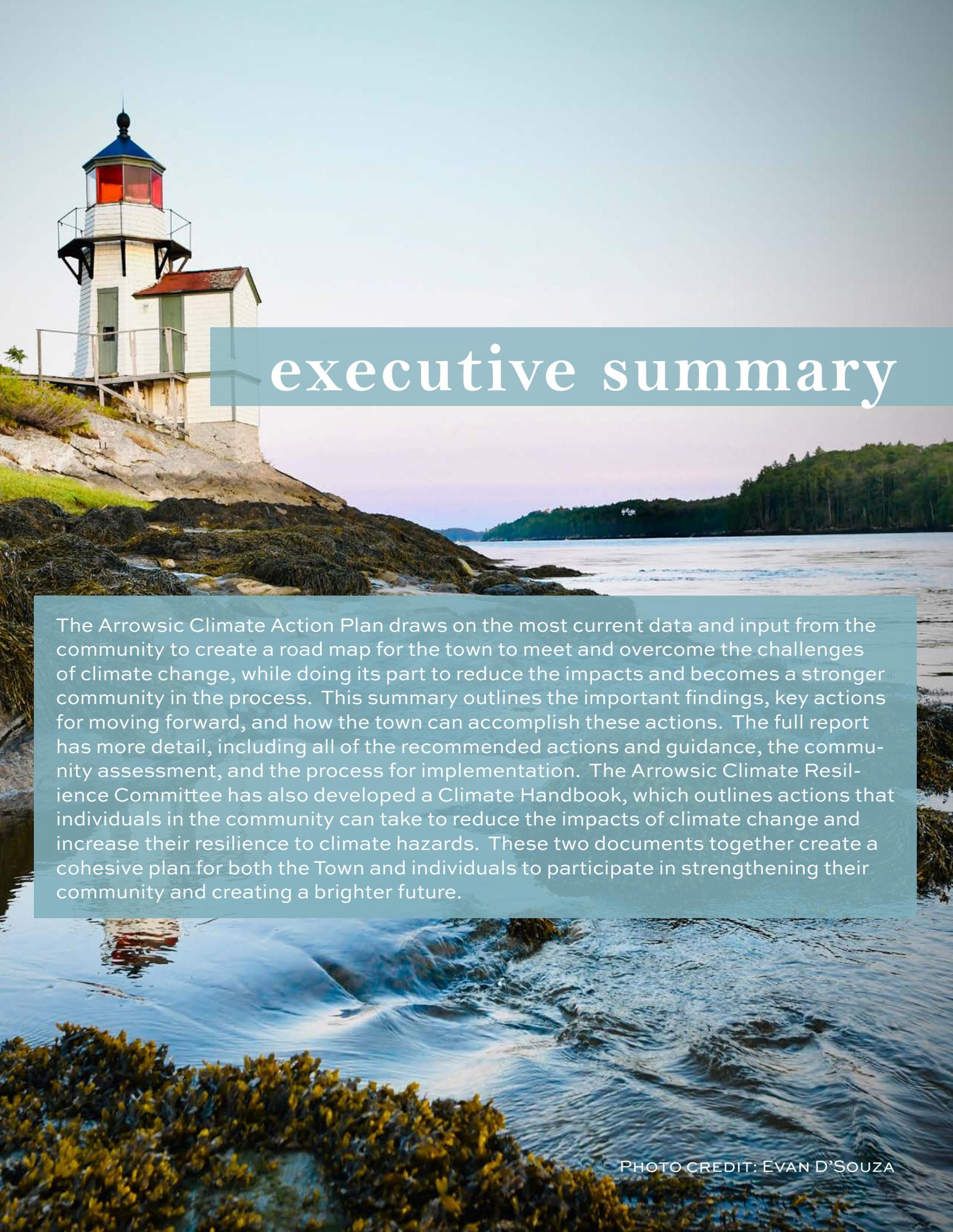## Other Committees that contributed to the ACAP:

Planning Board

Recycling & Solid Waste Committee

Road Commission

Shellfish Conservation Committee

Town Properties Committee

Arrowsic Fire Department

VIEWSHED
Landscape Architecture | GIS | Planning

Consultant Team

Judy Colby-George, Project Lead
Madeline Tripp

Contents

executive summary

The Arrowsic Climate Action Plan draws on the most current data and input from the community to create a road map for the town to meet and overcome the challenges of climate change, while doing its part to reduce the impacts and becomes a stronger community in the process. This summary outlines the important findings, key actions for moving forward, and how the town can accomplish these actions. The full report has more detail, including all of the recommended actions and guidance, the community assessment, and the process for implementation. The Arrowsic Climate Resilience Committee has also developed a Climate Handbook, which outlines actions that individuals in the community can take to reduce the impacts of climate change and increase their resilience to climate hazards. These two documents together create a cohesive plan for both the Town and individuals to participate in strengthening their community and creating a brighter future.

Why plan for Climate Change?

Arrowsic, as a small island community, is vulnerable to climate change impacts from rising sea levels to changing weather patterns. The community is already experiencing some impacts related to climate change, including more frequent droughts and periodic tidal and storm-related flooding. Arrowsic relies on the mainland for access to healthcare, food supplies, electricity, and other necessary resources. Any disruptions in access to the one road on and off the island impacts daily life for residents.

While there may be new challenges ahead, Arrowsic is an engaged community that has a long history of taking collective action to protect the environment and look out for each other. For example, in 2016, the community developed a stewardship guide to help community members care for Arrowsic's natural resources in their daily lives. We may be a small community, with finite capacity and resources, but this has also fostered a spirit of togetherness and interconnection that increases our capacity for care.

The community is building on this legacy of collaboration and care by working towards climate resilience. Reflecting the urgency of climate change, Arrowsic developed the following Climate Action and Outreach Plan to serve as a road map for the Town's adaptation and mitigation actions. It includes an assessment of the Town's assets and vulnerability, recommended actions, and a practical implementation guide. The Climate Handbook was developed as a companion document with guidance for individual action.

Photo credit: bart chapin

What is a Climate Action Plan?

The Arrowsic Climate Action Plan (ACAP) addresses what local government and civic organizations can do to mitigate and adapt to climate change. Mitigation focuses on what the town can do to minimize contributions to climate change. Protection and adaptation focus on the infrastructure, natural resources, economic impacts and the people of the community.

The ACAP was developed to provide a set of actions that will help guide the Town of Arrowsic and the community in decision-making as the community navigates the uncertainty of climate change. While this plan provides guidance on which committees will take up the work of implementation, the work of addressing climate change is in each of our hands. There will be individual actions that can be taken as well as new committee structures or changes to existing committee responsibilities that will need to be worked through if the plan is to achieve its goals.

Public Engagement

The Arrowsic Climate Resilience Committee invited input from the community, as well as specific committees and organizations, throughout the planning process. Several articles were published in the Arrowsic Arrow and email updates were sent via the Town's weekly email blast to raise awareness of the Climate Action Plan. Committees were looped in to provide information and feedback throughout the plan development. Once the initial community assessment was completed, a public meeting was held on September 26, 2023 from 6-8pm at the Fire Barn to prioritize actions recommended in the plan. Forty-five attendees provided feedback that was used to structure the final draft.
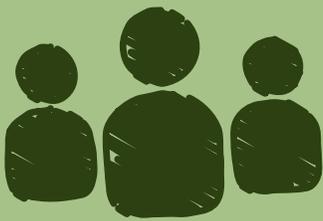
45 people attended the public meeting
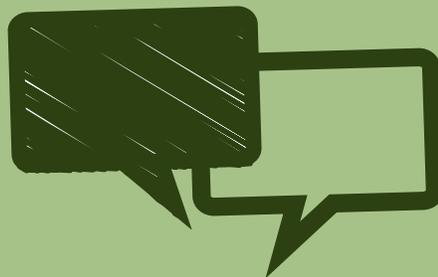
250+ comments provided by committees
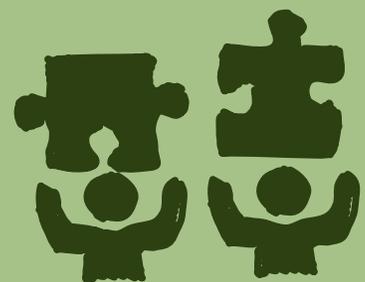
7 Town committees & organizations contributed

Through public outreach and conversations with town committees, the following issues and actions rose to the top as the most significant and urgent. For more detail on the actions, please refer to the Action Plan.

Infrastructure

Arrowsic relies on a sole access point to the mainland, Wilder Memorial Bridge, as does neighboring Georgetown. Access to the bridge has been blocked by flooding before, and this is expected to increase as sea levels rise and storm events increase. Ultimately, the road may become impassable, cutting off access to food, medical care, and other necessities. The town will need to pool its resources and work with Georgetown and the Maine DOT to ensure that both communities address this issue. It will be critical to participate in the development of road improvement plans far enough in advance to ensure that the needs of the communities are met, such as considerations for salt marsh impacts, community transportation needs, etc.

Groundwater

Arrowsic relies exclusively on private wells for drinking water, which access groundwater stored in fractures in the bedrock. In addition to threats from pollution, this valuable resource is threatened by several climate change impacts, including increased drought frequency and increased intensity of storms. Nearby towns also rely on bedrock wells, so it is important that Arrowsic collaborate with regional efforts to better understand saltwater intrusion and potential responses. Improving and updating the existing well data for Arrowsic will also be instrumental to understanding how to prepare for saltwater intrusion.
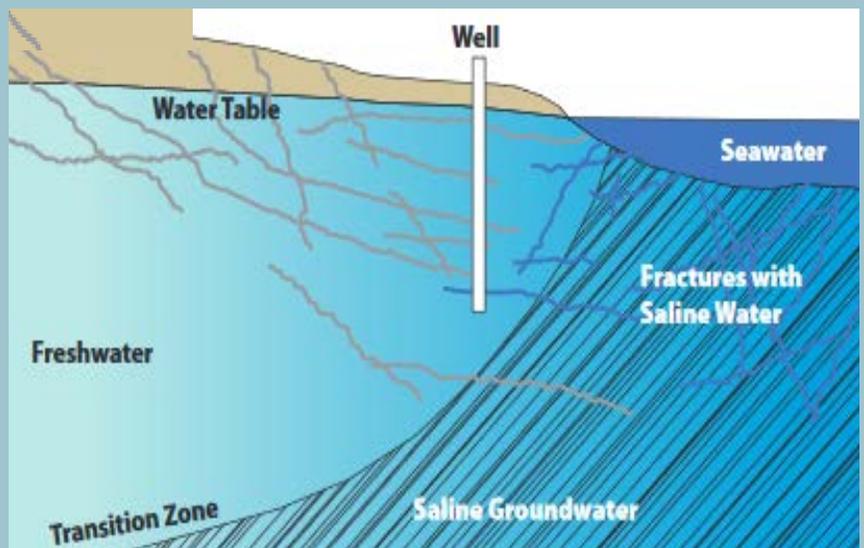
Emergency Services

The Arrowsic Fire Department (AFD) stops brush fires, supplies water to fight structure fires, coordinates emergency medical care, and keeps the community safe from downed wires. As the AFD adapts to meet greater climate-related emergency response needs, the department needs support to increase its capacity. This includes the recruitment of additional volunteers (with a variety of skills and training), improved communications, updated mapping, and signage to facilitate emergency response, and additional support to apply for funding for equipment and training.

Marsh Migration/ Coastal Erosion

Marshes are adjacent to several important stretches of road in Arrowsic, including along Route 127 near the Wilder Memorial Bridge. These ecosystems will face increased stress from rising sea levels and increased wave action, which will impede their ability to provide flood and erosion protections for roads. Conservation of lands adjoining to vulnerable marshes will allow these ecosystems to better adapt and migrate inland, which will mitigate the negative impact to the ecosystem services these areas provide.

Additional Considerations

Implementation of the actions identified in this plan will require leadership from many parts of the community. The first step will be for the town to review and vote on the plan and adopt as part of the community's official documents. Next, it will be important to create a standing committee to track progress towards goals, help coordinate between town committees, and to ensure the actions are implemented. This could be an extension of the existing ACRC or it could be a new committee all together.

The assessments in the plan are based on the best estimates of change that we have today and the input of the community. It will be important that whatever standing committee continue to review actions and engage with the community to fine tune and add to the actions presented in the plan. As Arrowsic gathers more data and more information becomes available to the community, there will be obvious steps that need to be taken to account for new inputs.

Arrowsic has begun the work of addressing change that is all encompassing and difficult to think about. Yet, the community has come together, participated, and excelled in creating a plan for moving forward. Over the next few years, achieving the actions set out in the plan will depend on the leadership in the community, building capacity for the work ahead and listening to one another as you move forward.

community assessment

1. Introduction

1.1 Why Arrowsic has a Climate Action Plan

Arrowsic, as a small island community, is vulnerable to climate change impacts from rising sea levels to changing weather patterns. The community is already experiencing some impacts related to climate change, including more frequent droughts and periodic tidal and storm-related flooding. Arrowsic relies on the mainland for access to healthcare, food supplies, electricity, and other necessary resources. Any disruptions in access to the one road on and off the island impacts daily life for residents.

While there may be new challenges ahead, Arrowsic is an engaged community that has a long history of taking collective action to protect the environment. For example, in 2016, the community developed a stewardship guide to help community members care for Arrowsic's natural resources in their daily lives.[1]

The community is building on this legacy of collaboration and care by working towards climate resilience. Reflecting the urgency of climate change, Arrowsic developed the following Climate Action and Outreach Plan to serve as a road map for the Town's adaptation and mitigation actions. It includes an assessment of the Town's assets and vulnerability, recommended actions, and a practical implementation guide. The Climate Handbook was developed as a companion document with guidance for individual action.

What's the Cost of Inaction?

This term refers to the estimated losses if a community does nothing to adapt to climate change or reduce emissions, usually measured in terms of damage from climate-related hazards.

To see a cost assessment for Maine: https://www.maine.gov/future/climate/reports. Click on "Assessing the Impacts…"

1.2 State & Regional Context

1.2.1 Maine Won't Wait

In 2020, the state released Maine Won't Wait, a comprehensive plan to reduce the state's carbon impact, avoid the costs of inaction (see inset), foster economic opportunity and prosperity, and advance equity through the climate response effort. This plan, based on an extensive scientific assessment of climate change in Maine, was also a call to action for communities across the state to create their own climate action plans. Strategy F, Build Healthy and Resilient Communities, includes measures to support towns like Arrowsic in "understanding, planning for, and acting to reduce their risk" related to climate change.[2]

1.2.2 Climate Resilience Partnership

To implement Strategy F of Maine Won't Wait, the Governor's Office of Policy Innovation and the Future (GOPIF) established the Community Resilience Partnership (CRP), a program that provides funding and support to help communities take steps towards climate resilience and emissions reductions. Arrowsic, as well as several communities around Arrowsic are enrolled in this program. [3]

There are several opportunities to collaborate with other communities in the CRP, particularly neighboring towns with similar concerns. Sharing lessons learned, research findings, and coordinating on regional issues could expand the capacity and resources for individual communities. Some examples of current projects that could be relevant to Arrowsic include Woolwich's project to improve emergency preparedness, Westport Island's groundwater monitoring/planning, and initiatives in Woolwich, Bath, and Southport to increase broadband access.[4]

1.2.3 Arrowsic's Climate Action Plan Process

Joining the Community Resilience Partnership

Arrowsic enrolled in the Community Resilience Partnership in 2022. As a part of this process, representatives from Arrowsic's Conservation Commission (ACC), Properties Committee, Fire Department, Planning Board, Selectboard, Recycling & Solid Waste Committee, and the Local Emergency Management Agency came together to complete the Community Resilience Partnership's Community Resilience Self-Assessment.[5] This assessment documented how resilience was already being addressed in Town activities and identified vulnerabilities.

In August of 2022, the Town held a community workshop at the Fire Barn to share the self-assessment and gather feedback from residents on the Town's resilience priorities. Following the workshop, the Selectboard adopted a resolution to participate in the CRP, designating the ACC to coordinate future resilience projects.[6]

Community members during a discussion at the Community Workshop in August 2022 (photo credit: Karin Sadtler)

Arrowsic Climate Resilience Committee

Developing the Community Action and Outreach Plan is the first climate resilience project undertaken by the Town since joining the CRP. The ACC formed an ad-hoc committee, the Arrowsic Climate Resilience Committee (ACRC), charged with coordinating the planning process. Arrowsic received funding through a CRP Community Action Grant in order to fund the development of the Climate Action and Outreach Plan. At the beginning of the planning process, the ACRC developed the following vision and mission to guide their decisions.

Community members gathered outside the Fire Barn during the Community Workshop (photo credit: Karin Sadtler)

Vision

We aspire to be a sustainable, resilient, and equitable community, acting to prepare its residents for the effects of the changing climate while reducing our greenhouse gas emissions.

Mission

We aim to identify actions and resources that support the island of Arrowsic and its residents in preparing for the changing climate and reducing the community's greenhouse gas emissions. We will work closely with the community to prioritize and implement effective strategies to help achieve these goals.

2. Exploring Risk in the Community

2.1 Climate Risk

A broad definition of climate risk is the potential for climate change to have adverse consequences for a community, from the people who make it up to the ecosystems and infrastructure they rely on. Developing a sense of the climate risk that a community is facing is an important part of climate action planning. One approach to understanding climate risk involves exploring the potential climate hazards, community exposure, and vulnerability.

Another consideration is how risk may **change over time**, as hazards, exposure, and vulnerability interact.[8] For example, the effects of sea level rise (SLR) and erosion may reinforce each other, resulting in increased rates of erosion as time passes. The occurrence of a hazard may change the exposure and vulnerability of a community over time, as those who are able relocate or adapt. Evaluating climate risk should be an iterative process that takes this unpredictability into account.

These concepts are used in the following sections to explore Arrowsic's climate risk. Risk, along with community values and concerns, may serve as the basis for prioritizing the implementation of this plan.

Components of Risk

Hazards can be defined as phenomena that may have negative impacts, such as damage to infrastructure, ecosystems, property, livelihoods, or health.

Exposure encompasses all the people, livelihoods, resources, or assets that could be negatively impacted by hazards.

Vulnerability can be used to describe how susceptible a person, group, resource, or ecosystem is to harm, and the capacity to adapt to hazards.
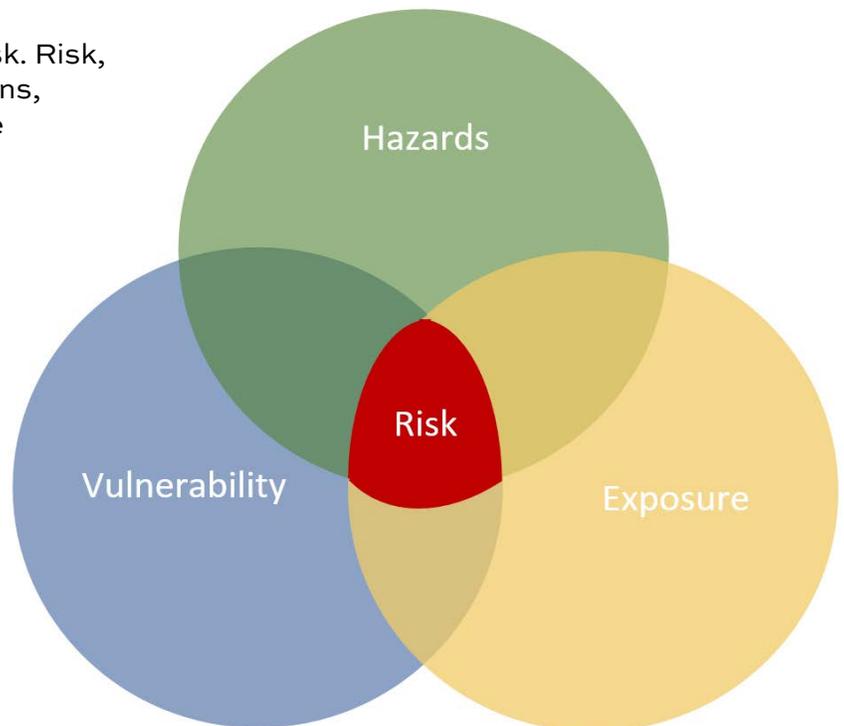

Figure 1: Above, a diagram of climate risk, which is the intersection of hazards, vulnerability, and exposure.

2.2 Hazards

Arrowsic is already experiencing the impacts of some climate hazards, and the intensity and frequency of these phenomena will increase as climate change progresses. Some of these hazards include flooding, more intense and frequent storms, greater variations in rainfall (drought and inundation cycles), high heat events, rising sea levels, wildfires, warmer temperature trends, and poor air quality. The exposure and vulnerability of Arrowsic's assets will play a role in how these hazards affect the community.

In the coming years, Arrowsic is predicted to experience a **shift in precipitation patterns**, toward more **torrential rainfall**, interspersed with periods of drought. One critical effect will likely be increased road flooding, which could cut off access to the mainland. Other effects could include water damage in buildings, impeded function of septic systems, and increased runoff, which can carry pollutants into nearby bodies of water and contaminate wells.

Most Critical Hazards in Arrowsic:

Road Flooding

Volatility in Precipitation Patterns

More Frequent & Severe Storms

Saltwater Intrusion

Pollution from runoff may be compounded by **higher ocean temperatures**, creating conditions that could increase algal blooms and harm freshwater and marine ecosystems.

Periods of drought, combined with high temperatures, could cause more evaporation from vernal pools, freshwater wetlands, and transpiration from other vegetative habitats. The drier soils and loss of vegetation caused by this cycle of inundation and drought would increase runoff, which may decrease the potential for groundwater infiltration and recharge.

Sea level rise (SLR), especially when combined with increased storm surge and flooding, poses a threat to the community as well. SLR may cause **saltwater intrusion** along the coast, pushing the salt front inland and increasing the salinity of groundwater in some areas.

Another effect of rising seas is increased **coastal erosion**, which could result in tidal marsh migration or loss, and the loss of the shoreline protection and other ecosystem services they provide. Depending on the rate of erosion, this could increase the risk of flood damage or inundation for buildings and septic systems on coastal properties. Erosion could also impact the functionality of infrastructure, destabilizing bridge pilings and utility poles.

Figure 2: Flooding along Route 127 (photo credit: Doug Kohring)

Figure 3: An example of erosion in Arrowsic (photo credit: Witham Jones)

More **frequent and severe storms** could contribute to infrastructure damage with high winds, erosion, lightning, or falling debris, which could affect the function of communication systems, broadband, electricity, and other services and pose a safety hazard for community members. Roads in low areas could be washed out, which may impede repair, evacuation, or access to emergency services.

There will likely be an increase in **high heat days** in Arrowsic, which could cause heat sickness in people and wildlife, while air conditioning could increase the strain on the electrical grid. The increase in storm events can trap people in their homes, making it difficult to access medical care, replenish medications, or power life-sustaining equipment in an emergency. Changes in temperature and environmental conditions may also increase existing pests like ticks, brown tail moths, and mosquitoes, and could lead to the introduction of new pests and diseases from warmer climates.

2.3 Community Exposure

To understand the potential effect of the climate hazards discussed above, this information needs to be grounded in the qualities, values, and needs of the community. The social network of the community and the values held by that community can shape and inform the level of risk an event or hazard may pose. Arrowsic has a strong social network and a long history of volunteerism and civic engagement. These social connections can make it easier for everyone to access information, share resources, and contribute their strengths to the whole. A functioning social network increases the community's resilience and helps to mitigate the risk that certain hazards may pose.

Along with social networks, community values play a role in understanding the impact of various hazards. A climate hazard that poses a risk to human life, like a flooded neighborhood, holds more weight than a washed-out dock. Assets could also include infrastructure like the Fire Barn or Bridge, or broader values like the health of local ecosystems. The level of exposure of these assets to climate hazards also influences the amount of risk. The risk posed by flooding is greater in residential areas that are in low-lying coastal areas of Arrowsic than houses along its steep coastal bluffs.

2.4 Vulnerability

Another factor to consider when discussing the risks associated with climate change is vulnerability. Vulnerability can be used to describe a climate hazard which poses a disproportionate threat to certain members of the community. It can also refer to certain geographic, physical, or socio-economic aspects of a community that increase the threat of hazards, such as Arrowsic's limited accessibility to the mainland. In the following section, vulnerability in Arrowsic is discussed in more depth, including a discussion of vulnerable portions of the population and factors that increase the vulnerability of the whole community. This assessment is organized into sections by hazard.

3. Vulnerability & Risk Assessment

3.1 Introduction

The demographic makeup and infrastructure in Arrowsic present unique challenges as the community prepares to manage the wide-ranging effects of climate change.

Of particular concern are (1) the aging population and high number of single-person households who may need extra support during storm events, heat waves, and flooding; and (2) single-road access (Route 127) to the mainland and a lack of on-island critical infrastructure, including medical care. When Route 127 is inaccessible, such as during flooding events, evacuations and access to supplies or emergency services are impeded.

The town will need a strategy for how it will accommodate its most vulnerable community members, as well as contingency plans for when Route 127 is impassable.

Social vulnerability describes the way that a population's demographic characteristics can predict how that population may be impacted disproportionately by different natural hazards. These portions of the population may need more support, resources, or considerations when planning for the impacts of climate change.

Arrowsic's population has a large proportion of older adults. Approximately 46% of Arrowsic's population is over the age of 60, and about 34% are over the age of 65. Older adults, especially those with limited mobility or pre-existing health concerns, may be disproportionately impacted by extreme temperatures, changes in air quality, and barriers to medical care access (such as during flooding or storm events). As Arrowsic plans to adapt to these changes, considering the needs of older adults will be a key part of ensuring the wellbeing and resilience of the community. As many as 22% of the population 65 or older also live alone, making it more difficult for them to access the care they need in the event of an emergency or evacuation.[9]
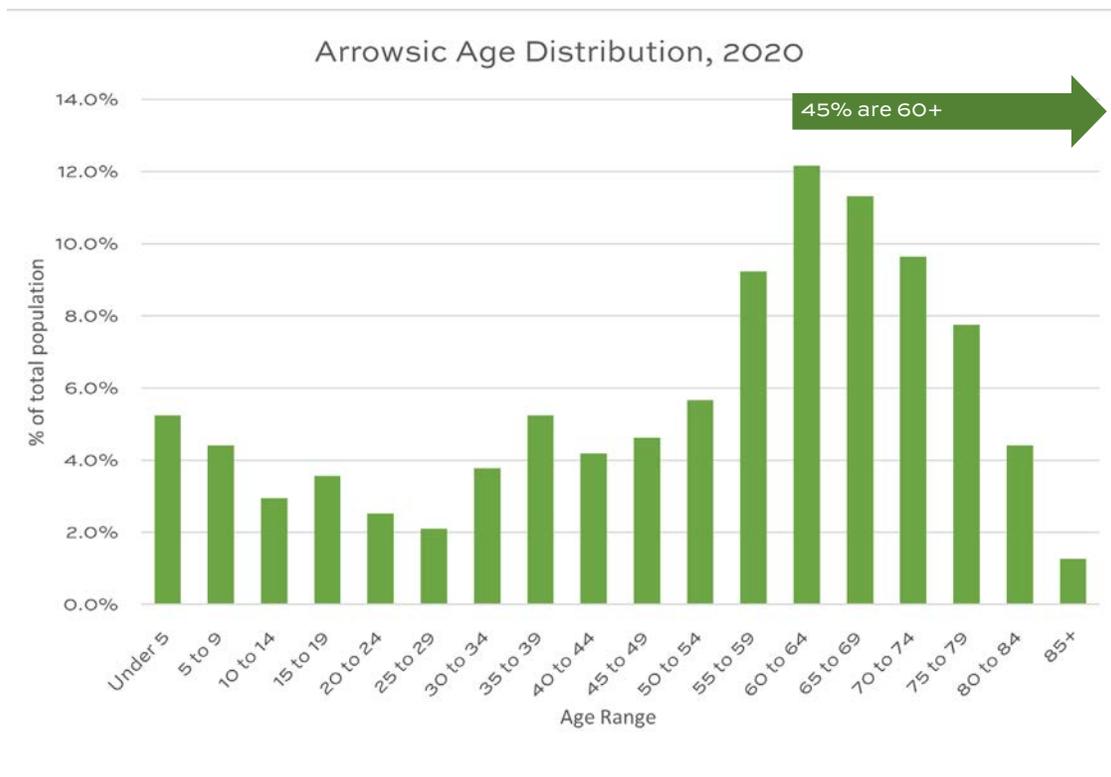
Figure 4: The age distribution of Arrowsic's population in 2020.

Disabilities can also impact how a person can access care and/or evacuate in the event of severe weather. The spectrum of ability is broad, impacting individuals in a variety of ways, from their hearing, mobility, eyesight, or independence. There is limited current data on the number of individuals in Arrowsic with disabilities and the types of disabilities they live with, but the American Community Survey (ACS) estimates that 10% of the Town's population lives with some type of disability. This reinforces the importance of considering a wide variety of abilities during the community's planning process, and making sure that resources, information, and help are accessible to all.[10]

Managing the care of children requires additional resources and considerations. Younger populations, especially those under 18, may be more vulnerable to the effects of extreme temperatures, air pollution, infectious disease, and trauma from natural disasters. They may rely more on their caretakers as climate change progresses, putting more strain on parents and caretakers, especially if there are disruptions in school or childcare schedules.

Households with children may need more support to navigate the impacts of climate change. Approximately 19% of households in Arrowsic have at least one child under 18 years old. Nearly 5% are single parent households.

The ACS estimated that 49 people were living below the poverty level in the last year, but the margin of error for this number is ±50. Though the number is relatively small, those with lower incomes may be at a higher risk of many chronic health conditions, such as diabetes or heart disease.[11] High heat and storm events that cut off access to medical care will disproportionately impact those with chronic disease. Even for those not living under the poverty level, a lower income may make it harder to access certain resources or information, such as adapting their housing to withstand flooding or storms. [10]

The American Community Survey estimates that no households in Arrowsic are without vehicles, and that little to no households are without internet or telephone service.[10]

Figure 5: Portions of the population in Arrowsic that may be disproportionately impacted by climate change.

3.2 Temperature Shifts & Heat Waves

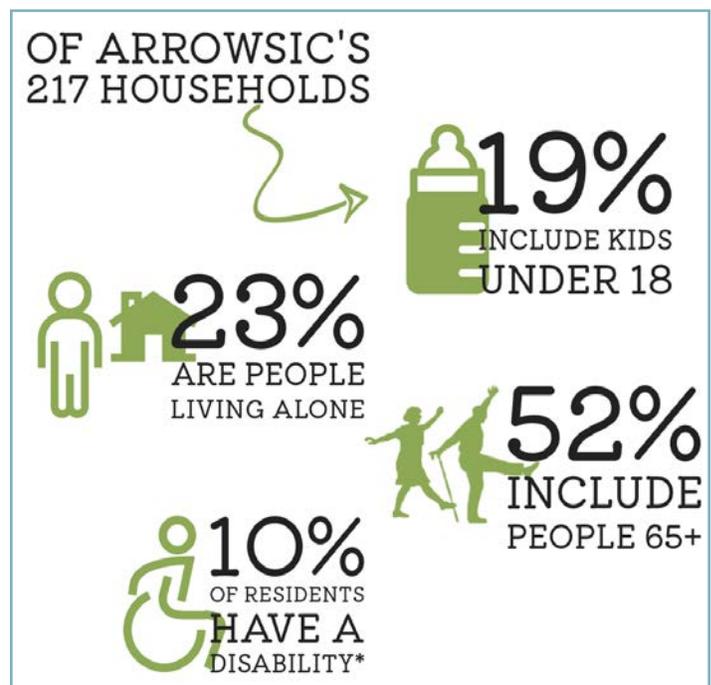On a county level, monthly temperature data/modeling is available as far back as 1895 from the U.S. Climate Divisional Database. For Sagadahoc County from 1895 to 2022, the average monthly temperature was 44.2 °F. However, the average monthly temperature from 2010 to 2020 is more than two degrees hotter, at 46.4 °F.[13] Even small changes in average temperatures can increase the odds of extreme weather events. All the warmest years in Sagadahoc County have occurred since 2006, and the coolest years occurred between 1904-1926. For the years since 2000, 75% of the monthly averages exceed the average for that same month between 1989-2022.

In addition to the trend towards warmer temperatures overall, climate change is predicted to increase the frequency of high heat days and heat waves. Heat can impact communities in different ways, depending on what temperature range is typical for an area.

High heat has the greatest impact on vulnerable populations, including older adults, children, low-income households, and those with chronic diseases, such as heart disease and diabetes. With the likelihood of more frequent heat waves as climate change progresses, hospitalizations are expected to increase for heat-related illnesses.[14] In 2019, only 58% of households in Sagadahoc County reported having air conditioning, which can compound the impacts of extreme heat.[15]

The First Street Foundation is a nonprofit that produces peer-reviewed climate risk projections for the U.S. on their free website, Risk Factor, in partnership with several government agencies and universities.[16] On their Risk Factor site, they have calculated what a "hot day" means for different counties around the country. This is calculated using Coupled Model Intercomparison Project data, based on the 7 hottest days in that county. [17]

In Sagadahoc County, a "hot day" was defined as 88°F or above. There have been 82 days reaching 88°F since 2011, with 40% of these occurring since 2020. This averages out to about seven hot days a year. The First Street Foundation predicts that this will increase to 17 days a year over the next thirty years.[18]

Temperature	Number of days
88°F or over	82
90°F or over	31
95°F or over	2

Figure 6: Number of High Heat Days Since 2011

Multiple days of high heat can increase the risk posed to a community. A heat wave occurs when there are three or more days of high heat in a row. When using the "hot day" temperature mentioned above, there have been 12 instances of heat waves recorded at the Bath weather station since 2011. The First Street Foundation calculated that the likelihood of a heat wave using the 88 °F threshold was 18% thirty years ago, 53% in 2023, and 83% thirty years from now.[18]

The Maine Center for Disease Control and Prevention's (CDC) Extreme Heat Plan lays out criteria for heat advisories, excessive heat warnings, and heat emergencies. These lower thresholds (compared to the National Weather Service standards) may be better aligned with Arrowsic's climate and the heat tolerance of community members.[19]

Alert Level	National Weather Service	Maine CDC
Heat Advisory	Heat index of 100-104 F for 2+ hours	Heat index of 95+ F for 2+ days
Excessive Heat Warning	Heat index of 105+ F for 2+ hours	Heat index of 100+ F for 2+ days
Heat Emergency	-	Heat index of 105+ F for 2+ days

Figure 7: Maine CDC's Extreme Heat Plan advisories, compared to those set by the National Weather Service.

3.2.1 Potential Effects

Spread of Disease

Milder winters and longer warm seasons contribute to the spread of vector-borne diseases carried by deer ticks, such as Lyme disease, anaplasmosis, babesiosis, and Powassan encephalitis virus, particularly in the Midcoast region. For example, in Sagadahoc County the rate of Lyme disease increased from 5.7 cases per 100,000 in 2001 to 231.5 cases per 100,000 in 2019.[20] Already, patient treatment for vector-borne diseases has cost Maine over $10 million annually, not including lost workdays and other individual costs of these diseases.[21]

Figure 8: A browntail moth caterpillar, showing the tell-tale red dots that can help identify it (Maine Department of Agriculture, Conservation, & Forestry).

Air Quality

Warmer temperatures also have impacts for air quality, creating conditions that can increase the potential for ground-level ozone (smog), pollen production, wildfires, and the spread of brown-tail moth caterpillars (which can cause skin and lung irritation).[15, 21] Large fires elsewhere, such as the Canadian wildfires in 2023, can also have an impact on local air quality.

This is particularly concerning for vulnerable populations, such as older adults and those with conditions that impact breathing, such as asthma. Maine has one of the highest rates of asthma in the country, with 12.5% of adults reporting a current diagnosis in 2021.[22] Air quality and environmental factors like pollen and brown-tail moth outbreaks can increase the frequency of asthma attacks.[15]

There is limited data on air quality in Arrowsic. The nearest Department of Environmental Protection air monitoring station to Arrowsic is at Popham Beach, which only started recording data in 2022.[23] Air quality can have a significant impact on quality of life, especially for residents with health concerns. As temperatures increase, Arrowsic will need to prepare for more variability in air quality.

Habitat Changes

The Gulf of Maine is warming at a rate ninety-nine percent faster than the rest of the world's oceans, causing shifts in the range of many important species, such as lobster, and increased ranges for some invasive species, such as European green crabs.[24] Warmer winters are associated with higher numbers of green crabs.[25] Green crabs can decimate shellfish populations and damage the root systems of salt marsh grasses. In Arrowsic, this could threaten shellfish harvesting and the ecosystem services provided by salt marshes.[26]

Temperature shifts will also likely impact forest habitats. Maine is located at the intersection of the northernmost and southernmost ranges of several species, which will increase the impacts of seasonal changes on ecosystems. Species may shift out of Arrowsic, following cooler temperatures, while other species may increase their range northward into Arrowsic.

As some diseases and species of parasites expand their range or reproduce faster, they are expected to have an increased impact on wildlife. Tree and plant diseases and pests may also spread, including insects like the Hemlock Woolly Adelgid or diseases like Oak Wilt Disease. The loss of trees will result in a decrease in carbon storage these forests provide, further driving climate change.[27]

Figure 9: Wetland researchers in the Holt Research Forest in Arrowsic (photo credit: Witham Jones)

3.3 Sea Level Rise

The rate of sea level rise (SLR) is increasing—about half of the total SLR that was observed in Maine over the last century occurred since 1990— and this will likely have impacts on the landscape of coastal and island communities.[24] Maine is predicted to experience 3-5 feet in SLR by 2100 in an intermediate scenario, though higher scenarios are plausible. In Maine Won't Wait, communities were advised to plan to manage 1.5 feet of rise by 2050 and 4 feet by 2100. Rising sea levels will likely magnify the impacts of storm surge from increasingly frequent and severe weather events.[28] One foot of SLR is predicted to make nuisance flooding more than ten times more frequent.[29]

3.3.1 Infrastructure Damage

As an island, one of Arrowsic's biggest vulnerabilities is its limited connection to the mainland. Route 127 represents the island's only access point by car, providing access to medical care, groceries and supplies, and an evacuation route. Based on an analysis of the town's roads, under the 1.6 ft and 3.9 ft SLR scenarios, only small sections of Arrowsic's roads are expected to be inundated at high tide under normal circumstances. However, these sections of road cut off access for many properties to the mainland or the rest of the island. In the map on the next page, the areas in dark pink show sections that may be impacted in the 1.6 ft scenario, and the light pink sections are those that may be impacted under a 3.9 ft scenario.

Road Class	1.6 ft Sea Level Rise	3.9 ft Sea Level Rise
Secondary	0.23 mi	0.57 mi
Local	0.37 mi	0.54 mi
Private	0.06 mi	0.23 mi

Figure 10: A view across the Kennebec River (photo credit: Chapman).
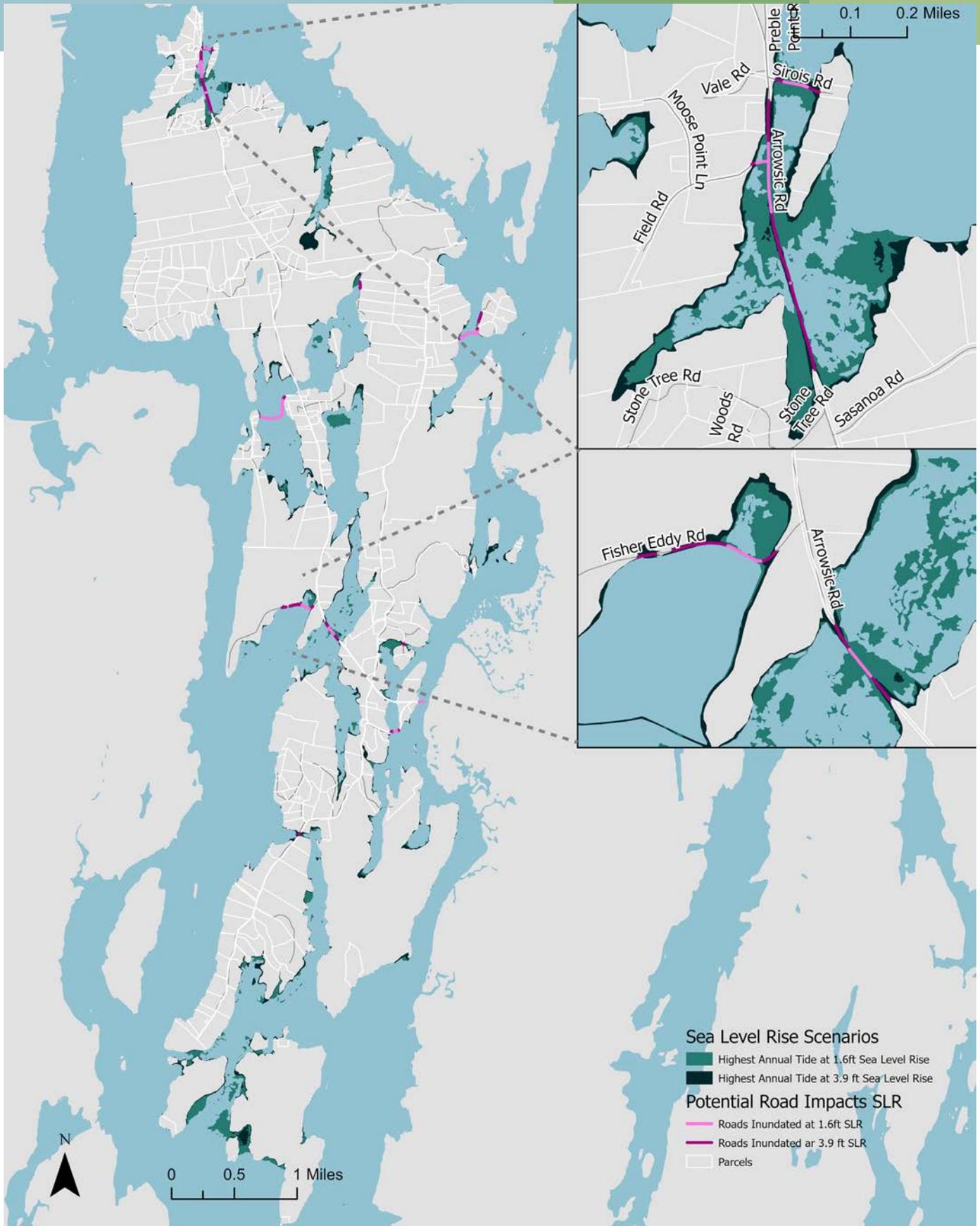
Figure 11: Roads in Arrowsic that could be inundated under a 1.6 ft (light pink) or a 3.9 ft (dark pink) sea level rise scenario.

An estimated 41 buildings may be cut off from access to the mainland under a 1.6-foot SLR scenario, and 84 buildings may be cut off under a 3.9-foot scenario. This does not take into consideration several long private roads and driveways that are not mapped in the state's Enhanced 911 data, so it may underestimate the total number of buildings impacted.

Access to certain areas of the island may also be impacted where there are tidal culverts that are improperly sized and unable to handle tidal flow. According to Maine's Tidal Restriction Atlas, there are seven road crossings and two other culverts that are restrictive, with one more with an unknown status. There are also three future tidal crossings in Arrowsic listed on the Atlas.

These restrictive crossings are areas where the tides are not able to flow to their natural extent, either from a too-small culvert or a culvert that is too high. In many cases, this restricted flow can change the marsh ecosystem and/or cause marsh erosion, which makes them less resilient to SLR. These culverts also wear out more quickly because there is more flow than they were designed for. With the additional volume of water from SLR, restrictive crossings are more likely to fail or over top, causing increased maintenance costs and potentially limiting evacuation routes.
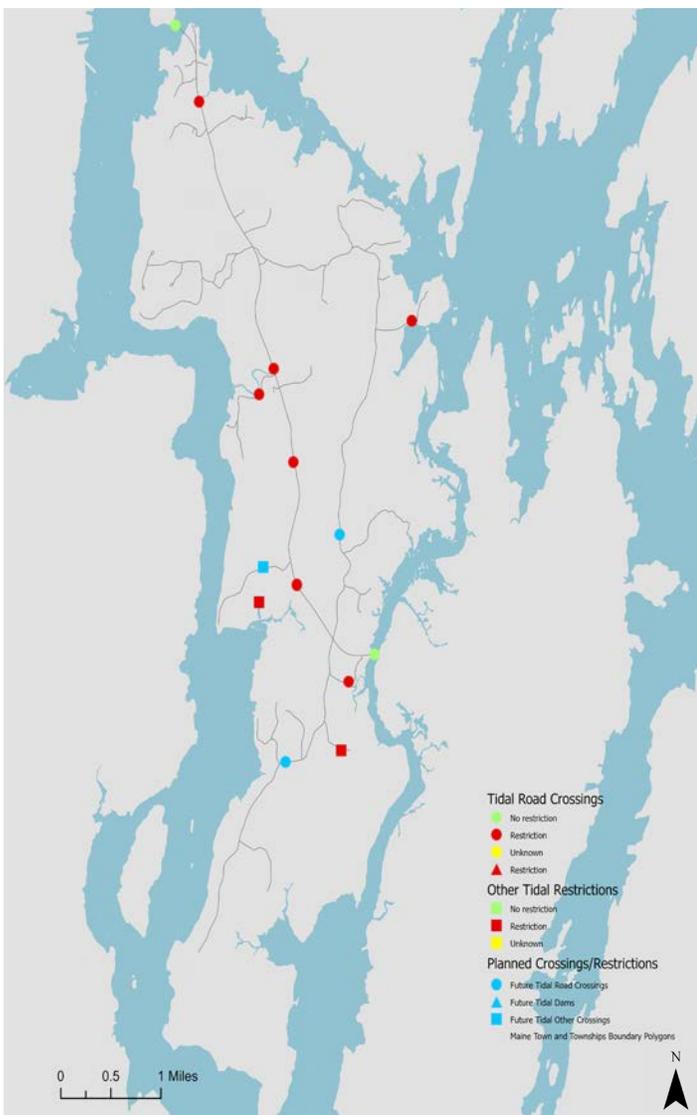
What is inundation?

According to the National Oceanic & Atmospheric Association (NOAA) defines coastal inundation as

"the covering of normally dry land with water. This refers to the long term result of sea-level rise, as well as the shorter and more variable impacts of high-tide and storm surge flooding."

In Maine, SLR scenarios are calculated as the amount of SLR in addition to current Highest Annual Tide levels.

More information:

- NOAA Coastal Inundation Story Map: https://storymaps.arcgis.com/sto-ries/5086cdc8c33b49919648f4142b-0f6e1d
- Maine Sea Level Rise Information: https://www.maine.gov/dacf/mgs/haz-ards/slr_ss/index.shtml

Figure 12: Tidal crossings in Arrowsic. (source: Maine Tidal Restriction Atlas)

Arrowsic relies on private bedrock wells for drinking water. Rising sea levels could cause saltwater intrusion and contamination of drinking water supplies.[30] This process is especially difficult to predict in bedrock wells, which access water located in fractures in the rock and vary in depth.

Our knowledge of Arrowsic's wells is limited. A high school project from 1988 lists information for about 90 wells. The Maine Geological Survey provides partial data on 105 wells. Detailed information about changes in yield, static level and salinity could be useful in better understanding and predicting future risks to individual wells. In general, deeper wells closer to shore and at lower elevations are more likely to experience salt water intrusion as sea levels rise.

The Town also relies on septic systems to treat wastewater, the function of which may be impeded by inundation from SLR or heavy rain events. Based on a survey of septic systems recorded in the Maine State Septic Permit Search Database, there are currently only four septic systems at risk of inundation in a 3.9-foot SLR scenario. This does not consider rising groundwater levels, which could effect infiltration and effectiveness of septic fields. Especially in areas with older, less effective systems, this could present an issue for water quality. [31]

Sea Level Rise Scenarios

Highest Annual Tide at 1.6ft Sea
Highest Annual Tide at 3.9 ft Sea
Parcels

MaineWellDatabase
Well Depth (ft)
○ ≤200
● ≤400
● ≤1250

0   0.5   1 Miles

Figure 13: Wells in Arrowsic that are recorded in the Maine Well Database, mapped by well depth.

3.3.2 Property & Building Damage

Arrowsic has a total of 384 parcels in town, covering a total land area of 4,229.7 acres. When overlaying the Maine Geological Survey's model of 1.6 feet of SLR, approximately 265 of these parcels will have at least some (if minimal) impact or inundation. This amounts to about 229 acres of inundation, or about 6% of the town's land area. In a 3.9 feet SLR scenario, about 256 parcels would have some level of inundation, affecting about 361 total acres.

This includes some marshland and conserved lands, which may result in decreased flood protection as these areas are less able to perform their ecological services. However, none of the island's buildings (that there is data available for) are predicted to be inundated.

Most of the impacted properties are privately owned, based on the data we have. Properties that are privately owned and have buildings on them were classified as "presumed residential." These make up about 122 acres inundated at 1.6 feet of SLR and 143 acres impacted by 3.9 feet of SLR.

Several of the impacted properties, accounting for 56 acres impacted at 1.6 feet of SLR and 70 acres impacted at 3.9 feet of SLR, have no listed owner in the Town's tax data, but most of these areas are islands or tidal marsh.

Any parcel without a building and not listed as a conservation area was classified as vacant. These areas make up about 88 acres of the impacted land in a 1.6-foot scenario and 114 acres in a 3.9-foot scenario. Conservation land also makes up a large chunk of the predicted area to be impacted, including 38 acres in a 1.6 foot- scenario and 62 acres in a 3.9 foot-scenario.

Only about 4.5-5 acres of Town-owned property are expected to be inundated under 1.6-3.9 feet of SLR, and all these properties are presumed vacant or conservation areas. No properties with a municipal use or known cemetery are predicted to be impacted, since they are mostly in the upland areas of the island.

A quick method for estimating the value of property lost is by taking the assessed land value, dividing it by the assessed acreage, and then multiplying this value per acre rate by the acreage predicted to be inundated on that property. This is imperfect, because it assumes that all areas of a property would be valued at the same rate (even if, for example, the inundated area is unbuildable). However, it is a starting point for understanding the value that may be lost due to climate change. Based on this method, about $2.5 million worth of property may be impacted by SLR in a 1.6-foot scenario, and about $3.3 million worth of land may be impacted in the 3.9-foot scenario.
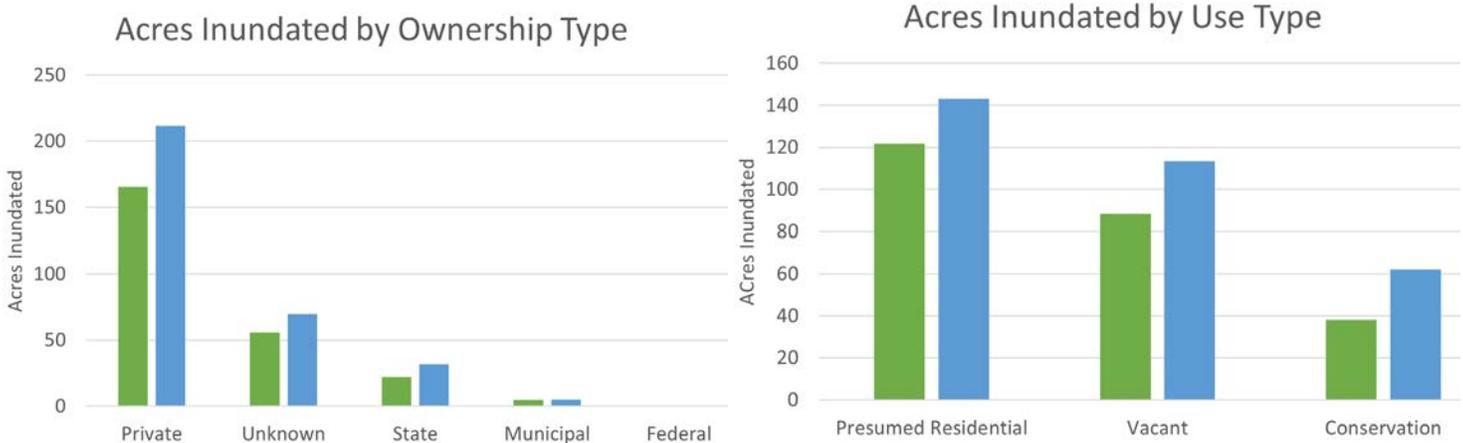
Figure 14: Charts showing the acres impacted by 1.6 feet (green) and 3.9 feet (blue) of sea level rise, broken down by ownership (left) and use (right).
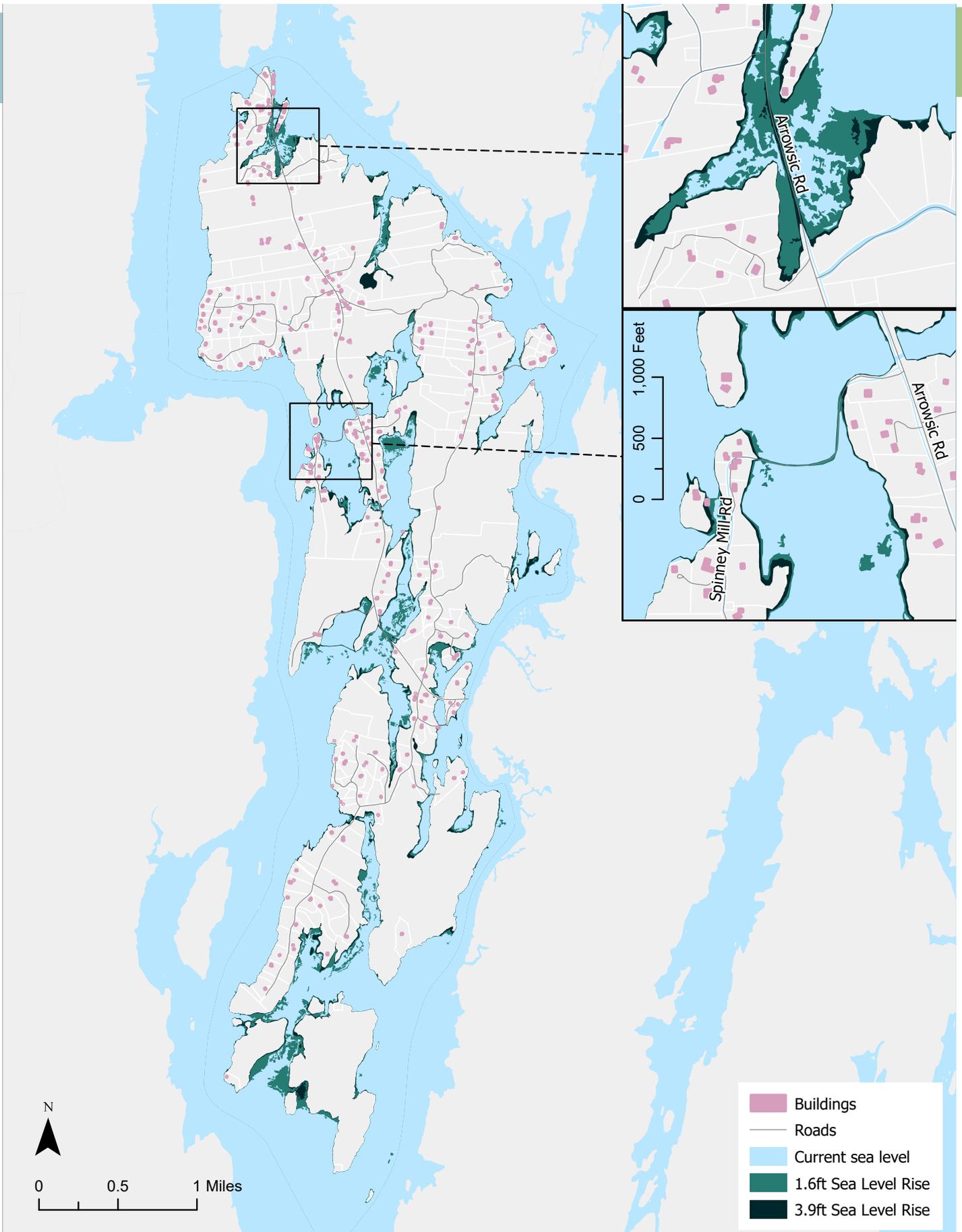
Figure 15: Levels of potential inundation in Arrowsic based on a 1.6 ft and 3.9 ft sea level rise scenario. Parcel lines shown in white.

Legend:
- Buildings
- Roads
- Current sea level
- 1.6ft Sea Level Rise
- 3.9ft Sea Level Rise

N

0   0.5   1 Miles

1,000 Feet
500
0

Arrowsic Rd

Spinney Mill Rd

Figure 16: Coastal bluffs in Arrowsic, mapped by the Maine Geological Survey. Green areas indicate stable bluffs, yellow are unstable. Arrowsic does not have any bluffs classified as "highly unstable."
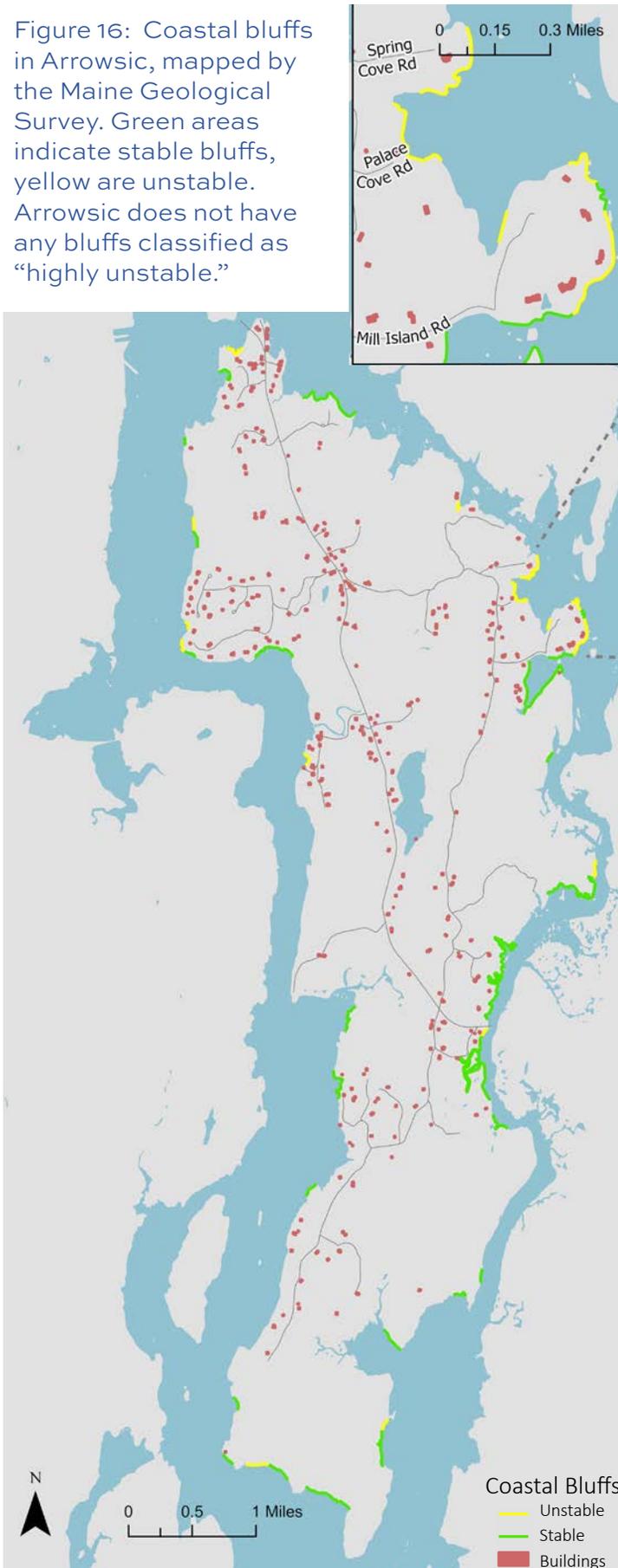
Of greater concern are the number of properties and buildings that are likely to be cut off from access to the rest of the island or to the surrounding mainland. Based on a visual analysis, under 1.6 feet of SLR, 41 buildings and 40 parcels will be cut off by road inundation. Under a 3.9-foot scenario, 84 buildings and 86 parcels will be cut off from accessing the mainland. This threatens the ability of people to access services, medical care, and basic food and supplies. This does not consider additional flooding due to storm surge.

Arrowsic has almost 5 miles of bluffs, three miles of which are classified as "unstable" by the Maine Geological Survey. Figure 15 shows a map of these bluffs, with those classified as "stable" shown as green and the unstable bluffs highlighted in yellow. [32] These unstable bluffs could represent areas where SLR increases the risk of rapid erosion. This is especially important in areas where buildings or infrastructure are near the bluffs and could be impacted.

In areas with salt marshes adjacent to coastal bluffs, whether those bluffs are stable or not, there is a risk that the bluff could prevent the salt marsh from migrating inland as sea levels rise. Especially in areas with unstable bluffs, erosion could deposit sediment on the marshes. The effect of sedimentation is unclear, because while it could smother the marsh vegetation, it could also help elevate the marsh.[33]

What's a coastal bluff?

According to the Maine Geological Survey (MGS), "a bluff is defined as a steep shoreline slope formed [of loose sediment] that has [3+ feet] of vertical elevation just above the high tide line."

Visit the MGS's webpage for more info: https://www.maine.gov/dacf/mgs/pubs/mapuse/series/descrip-bluff.htm

Coastal Bluffs
Unstable
Stable
Buildings
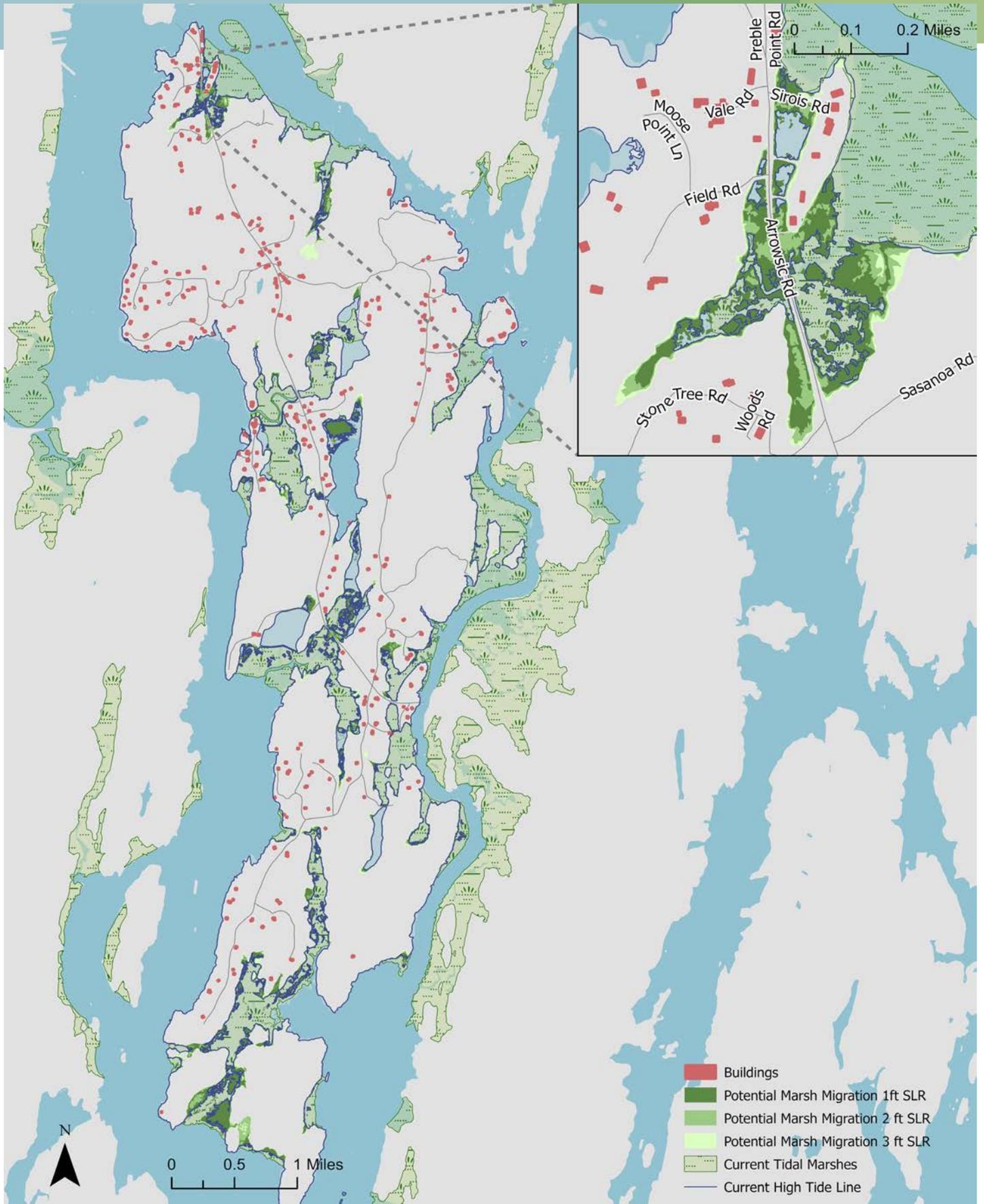
Figure 17: Predicted tidal marsh migration under 1, 2, and 3 ft sea level rise scenarios. This model disregards areas with development (source: Maine Geological Survey)

3.3.3 Salt Marsh Migration

In tidal rivers and coves like those surrounding Arrowsic, SLR and storm surge are predicted to increase erosion in salt marshes. These valuable ecosystems serve as nurseries for many ecologically and economically important marine species in Maine, and these disruptions may impact their life cycles. The valuable habitat and ecosystem services of marshes may be impacted by increased inundation, which will negatively affect the ability of Arrowsic and its ecosystems to adapt to rising seas. Where marshes are unable to migrate inland, they may be converted to open water. The impacts of the eroded sediment on mudflat ecosystems are not well known. [33]

3.3.4 Economic Disruption

For those engaged in remote work or businesses that are reliant on electricity and electronic communications outages caused by extreme storm events and flooding will have a negative impact on the ability of people and businesses to conduct business as usual. In addition, 1.6 feet of SLR by 2050 could cause up to $17.5 billion in building damage and the loss of 22,000 jobs in Maine. This does not take into account the losses for businesses associated with disruptions from storms, flooding, and extreme weather.[34] Due to the small number of businesses in Arrowsic, the greatest economic disruption will be reduced ability to work from home.

3.3.5 Limited Healthcare Access

Especially in island communities like Arrowsic with limited connections to the mainland, rising sea levels and storm surge will impede access to emergency services during weather events or even during extreme high tides.

3.4 Precipitation Changes

In the last several years, Sagadahoc County has experienced periods of moderate to extreme summer drought every year except for 2019 and 2023 (2019 had a period of "abnormally dry" weather).[35] It is becoming more common for areas of Maine to experience snow drought, which can impact seasonal stream flows, vernal pools, and groundwater recharge.[36]

At the same time, Arrowsic has experienced more abnormally wet days and heavy precipitation events. According to data from NASA's Earth Exchange Global Daily Projections, Arrowsic is currently experiencing 1-5% more extreme precipitation events than the average over 1980-2010. The Town is predicted to experience 5-10% more extreme precipitation events compared to this same baseline in the next 15 years. [37]

Swings between dry and wet periods may impact wildlife and vegetation, erosion, flash flooding, and water supplies. Preparing for this increasing pattern of extremes will require awareness of the risks posed by both extremes and flexibility to manage both.

3.4.1 Public Health

Increased incidences of flooding and extreme precipitation will likely have impacts for water quality in Arrowsic, especially due to reliance on well water and septic systems. Swings between periods of inundation and drought may impair the ability of groundwater to recharge from rainfall, resulting in diminished drinking water resources. Flooding and rising water tables can increase septic failure, releasing pollution into surrounding water bodies and increasing the spread of diseases such as giardiasis.[38, 39]

3.4.2 Environment

Increased drought and changes in seasonal runoff could impact freshwater communities like vernal pools, which rely on snow melt as an ephemeral water source for spawning amphibians.[40]
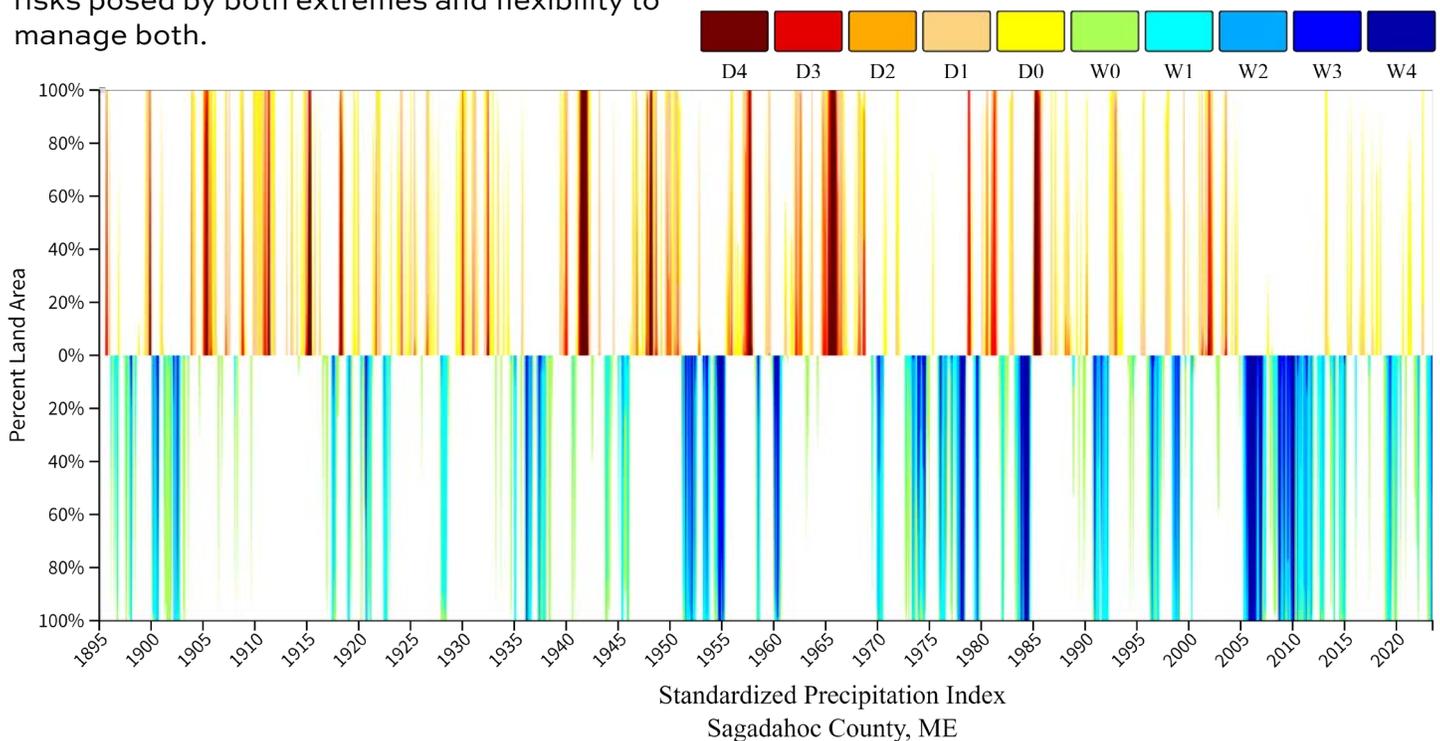
Figure 18: The Standardized Precipitation Index (SPI) for Sagadahoc County, showing wet (cool hues)and dry (warm hues) conditions since 1895. SPI captures how observed precipitation (rain, hail, snow) deviates from the climatological average over a given time period.

Resources

1. Arrowsic Stewardship Guide

2. What's the Plan | Maine Climate Plan

3. Community Resilience Partnership | Office of Policy Innovation & Future (maine.gov)

4. Climate Action Around Maine | Office of Policy Innovation & Future

5. Town of Arrowsic Community Resilience Self-Evaluation

6. Arrowsic Community Workshop Summary

7. Viner D, Ekstrom M, Hulbert M, Warner NK, Wreford A, Zommers Z. Understanding the dynamic nature of risk in climate change assessments—A new starting point for discussion. Atmos Sci Lett. 2020;21:e958. https://doi.org/10.1002/asl.958

8. Tonmoy, F.N., Rissik, D. & Palutikof, J.P. A three-tier risk assessment process for climate change adaptation at a local scale. Climatic Change 153, 539–557 (2019). https://doi.org/10.1007/s10584-019-02367-z

9. Decennial Census 2020

10. DP05: ACS DEMOGRAPHIC AND ... - Census Bureau Table

11. https://health.gov/healthypeople/priority-areas/social-determinants-health/literature-summaries/poverty

12. https://www.nature.com/articles/s41893-020-0512-y

13. NOAA Monthly U.S. Climate Divisional Database (NClimDiv)

14. Climate Change Harms the Health of Maine People | NRCM

15. Maine Environmental Public Health Tracking (EPHT) Network - Public Data Portal - IBM Cognos Viewer

16. Methodology - First Street Foundation

17. CMIP - Coupled Model Intercomparison Project (wcrp-cmip.org)

18. Sagadahoc County, Maine Heat Factor® | Risk Factor

19. mainecdcallhazheat.doc (live.com)

20. Tickborne Diseases | Maine Tracking Network (mainepublichealth.gov)

21. UMaine research connects rising temperatures with browntail moth resurgence - UMaine News - University of Maine

22. Most Recent Asthma State Data | CDC

23. Historical Data, Air Quality Forecast, Maine Department of Environmental Protection

24. MaineClimateScienceUpdate2021.pdf

25. European Green Crab (Fact Sheet) (maine.edu)

26. Measuring Impacts of Invasive European Green Crabs on Maine Salt Marshes: A Novel Approach (epa.gov)

27. The State of Maine and Climate Change (umaine.edu)(forest research article)

28. GOPIF_SLR_Factsheet_2021_05_06.pdf (maine.gov)

29. Maine Climate Office (umaine.edu)

30. CAGS_04_Drinking Water.pdf (maine.gov)

31. "Avoiding Septic Shock: How Climate Change Can Cause Septic System Fail" by Elena Mihaly (maine.edu)

32. Maine Geological Survey: Coastal Bluffs Maps

33. marshes-on-the-move.pdf (noaa.gov)

34. ERG_MCC_AssessingImpactsClimateChangeMaine_Summary.pdf

35. Arrowsic, Town Of Arrowsic, Maine Conditions | Drought.gov

36. Maine | Drought.gov

37. https://doi.org/10.7917/OFSG3345

38. "Avoiding Septic Shock: How Climate Change Can Cause Septic System Fail" by Elena Mihaly (maine.edu)

39. Climate Change Harms the Health of Maine People | NRCM

40. BiodiversityFlyer.pdf (umaine.edu)

action plan

How to Use the Action Plan

This section of the plan lays out a course of action to address climate change in Arrowsic. Actions are organized by the community resource/value to be protected & strengthened. *These are not listed according to priority.*

These topics include the following:

- Surface Water Resources
- Groundwater Resources
- Transportation & Infrastructure
- Housing & Built Environments
- Energy & Waste Efficiency
- Environmental Resources
- Emergency Response
- Public Health
- Governance
- Community Resilience

Each section includes:

Discussion: an introduction to the topic and why it is relevant to Arrowsic's resilience

Existing Policies & Projects: summary of existing policies & projects addressing this topic

Community Actions: actions that would be most effective if undertaken on a community-level, such as through a Town Ordinance or committee activity

For the top three recommendations, extra guidance is provided, including:

> **Why** this action is helpful & how it builds resilience
>
> **How** this activity might be accomplished
>
> **Resources & Examples** from other Maine communities or organizations

Additional Options: other potential actions that might be pursued, given the resources and capacity

Individual Actions: things that anyone can do to increase their resilience and contribute to the Town's goals. These actions are prioritized in the Implementation Plan in the next section.

1.1 Discussion

Arrowsic is particularly vulnerable to sea level rise and flooding because it relies on a sole access point to the mainland, Wilder Memorial Bridge at the north end of the island. Georgetown also relies on this bridge and the Islands Road Bridge over Back River for access to the mainland. Higher sea levels and more frequent flood events may increase erosion and apply stress on the bridge. The stretch of Route 127 located on the Arrowsic side of the bridge passes through a low-lying area that is predicted to be inundated at 3 feet of sea level rise or storm surge.

As sea levels rise, Arrowsic should plan for flooding to become increasingly common in this area during storm or flood events, as well as sunny-day flooding. In the longer term, this road may become impassable if no action is taken. In addition, four segments of Town Ways are also vulnerable to regular flooding and at times are impassible. These include portions of Spinney Mill Road, Sirois Road, Bald Head Road, and Indian Rest Road.

1.2 Existing Policies & Projects

- **Town Way Criteria** The Town currently requires new subdivisions to meet general standards for roads that will be adopted as Town Ways.
- **Additional Subdivision Access** The Town has an optional provision for the Planning board to require two access points to a subdivision.

1.3 Community Actions

1.3.1 Adopt the Maine Coastal Program's CoastWise Approach and Maine Audubon's Stream Smart Crossing Guidelines as standard practice for culvert and bridge improvements. Identify vulnerable crossings and apply for DEP improvement funds.

Why

Maine Audubon's Stream Smart program provides best practices for designing culverts that minimize disruptions to the flow of streams and the wildlife that relies on them. The equivalent program for tidal marsh crossings, CoastWise, includes recommendations to allow proper tidal flow in salt marshes. Not only are these approaches nature-friendly, but they also increase the resilience of the roads by allowing better water flow, which decreases the chance of washing out in storms.

How

These guidelines include sizing culverts to span the entire stream, line up with the natural elevation of the stream, and have natural bottoms where possible to encourage habitat continuation.

Route 127 is maintained by the Maine Department of Transportation, and any changes to this road will need to be in coordination with the state.

Resources & Examples

- The Maine Audubon Stream Smart web page: https://maineaudubon.org/projects/stream-smart/resource-library/
- CoastWise: https://maineaudubon.org/projects/stream-smart/resource-library/

1.3.2 Educate private road owners about sea level rise impacts and Stream Smart culverts and other best practices for resilient road design.

Why

Sharing these resources with landowners is especially important in Arrowsic, since so many roads are privately owned and there are many driveways that cross large areas. Following these practices will lessen the burden on emergency services due to washed out roads and driveways and will also lower costly long term maintenance for landowners.

How

Share these resources with Homeowner's Associations, at the Town Hall, and the Town website. Publicize when Maine Audubon holds a workshop. The Town could also require new private roads to follow the standards set by these programs.

Resources & Examples

- The Maine Audubon Stream Smart webpage and the Maine Department of Marine Resources webpage each provide design guidelines, resources for Stream Smart technical assistance, and sample presentations on the value of these practices:
    - https://maineaudubon.org/projects/stream-smart/resource-library/
    - https://www.maine.gov/dmr/programs/maine-coastal-program/coastal-community-support/the-coastwise-approach
- Maine Audubon also holds Stream Smart Workshops throughout the state: https://maineaudubon.org/projects/stream-smart/stream-smart-workshops/

1.3.3 Incorporate resilience to sea level rise into the Capital Improvement Plan, including installing culverts able to handle 3.9 ft of sea level rise by 2100, implementing stormwater management and/or raising road surfaces as a part of normal road improvements.

Why

The Governor's Office of Policy Innovation and the Future recommends that municipalities commit to manage 1.6 feet of sea level rise by 2050 and 3.9 feet by 2100 (https://www.maine.gov/future/sites/maine.gov.future/files/2021-05/GOPIF_SLR_Factsheet_2021_05_06.pdf).

While these improvements can be expensive, they could be more economical in the long run than not addressing sea level rise. As the Town replaces or maintains road infrastructure, using inappropriately sized culverts may be cheaper up front, but they could fail and need to be replaced much sooner than culverts designed to withstand sea level rise.

How

As the Town plans for regular capital improvements, incorporate data on restrictive tidal crossings and sections of roads that have been flagged as vulnerable to sea level rise. If an area in need of repair or culvert replacement overlaps with an area vulnerable to sea level rise, explore options to address both the immediate repair needs and the long-term sea level rise resilience of this infrastructure.

Preparing the engineering plans for these improvements ahead of time can also make it easier to apply for grant funding.

Resources & Examples

- The Town of Harpswell has incorporated a list of roads vulnerable to sea level rise into their capital improvements, including the current Basin Cove Road Project: https://www.harpswell.maine.gov/vertical/Sites/%7B3F690C92-5208-4D62-BAFB-2559293F6CAE%7D/uploads/FINAL_Coastal_Communites_Basin_Point_Rd_Project_12.31.18.pdf

- KELT project with Woolwich: https://www.kennebecestuary.org/2019-annual-report-restoration

1.3.4 Additional Options

- Create standards for new subdivision roads that are candidates for Town adoption, which would require incorporating sea level rise in the design process (including culvert design).

- Encourage marsh restoration, both on Town lands (area near bridge) and on private properties.

- Coordinate with Georgetown and Maine Department of Transportation on road improvement projects.

- Create an emergency response plan for flood scenarios and incorporate sea level rise and the Federal Emergency Management Act's Flood Insurance Rate Maps (FIRM) into emergency planning.

2.1 Discussion

Sea level rise has the potential to submerge roads and other land access to electrical infrastructure, greatly increasing the difficulty of repairs. Sea level rise also destabilizes and/or washes away soil and other substrates that provide structural support to power lines increasing their risk of falling or washing out.

As climate change persists, flooding and intense storms will only become more frequent and severe. With the increase of these events will come an increased risk of damage to electrical infrastructure in many forms. These could include power line damage due to high winds, falling debris, and erosion; conductor damage or failure due to slapping and galloping of power lines; the submerging of electrical infrastructure and building connections during flooding events.

Central Maine Power supplies power to Arrowsic, so there is limited action that can be done on a local level to adapt without the cooperation of the utility company. However, there are options to diversify local power supply through alternative energy sources like solar, as well as ways to prepare for outages.

Arrowsic is in the process of accessing broadband via existing telephone poles. This infrastructure would face many of the same issues that electric faces in terms of outages caused by climate change.

2.2 Community Actions

2.2.1 Consider diversifying energy sources through community solar initiatives, especially projects that enable "islanding" during an outage.

Why

Microgrids can decrease the impact of storm damage to power lines and decrease the reliance of a community on outside power sources.

How

Creating micro grids or "islanding" refers to the development of an electrical network that can operate self-sufficiently, as needed. This involves developing local sources of power, such as a community solar project, and creating redundancies so that the microgrid can operate when connected to the larger electrical grid and self-sufficiently when it is isolated by a downed power line. Microgrids can supply emergency power to a few key locations, such as an emergency shelter, or an entire neighborhood, depending on a community's values, needs, and energy consumption. A few towns in Maine have pursued funding and technical assistance through the U.S. Dept. of Energy's Energy Transitions Initiative Partnership Project.

Resources & Examples

- The Maine Office of the Public Advocate has info on community solar: https://www.maine.gov/meopa/electricity/community_solar.
- Islanding and micro grids explanation: https://www.energy.gov/femp/articles/islanding-microgrid
- Ongoing microgrid and hydropower project by the Department of Energy and the Town of Eastport: https://www.energy.gov/eere/energy-transitions-initiative-partnership-project-eastport-maine

2.2.2 Petition Central Maine Power to reinforce lines in Arrowsic.

Why

Reinforcement measures increase the stability of power lines, and could decrease the probability of downed lines, slapping/galloping lines, and conductor failure.

How

This could include installing guy wires on poles, replacing wooden poles with metal, installing dampers, etc. Electrical lines are under the jurisdiction of CMP, but residents and municipalities can advocate for change through the Maine Public Utilities Commission (MPUC).

Resources

- General guidance from Audubon on how individuals can help improve the electrical grid: https://www.audubon.org/magazine/fall-2019/how-you-can-help-fix-electric-grid
- General guidance from Audubon on how to voice concerns with a Utilities Commission: https://www.audubon.org/magazine/fall-2019/get-know-your-public-utility-commission-and
- Keep track of cases being heard by MPUC and submit public comments here: https://www.maine.gov/mpuc/home
- There are federal grants, like Grid Resilience Utility and Industry Provider (GRIP) grants, that provide funding for power companies to increase the resilience of the grid in vulnerable areas: https://www.energy.gov/gdo/grid-resilience-utility-and-industry-grants.

2.3 Individual Actions

- Diversify energy resources at home (solar and battery storage): https://www.energy.gov/gdo/grid-resilience-utility-and-industry-grants
- Practice safe generator use: https://www.maine.gov/mema/maine-prepares/home-preparedness/generator-safety

3.1 Discussion

Arrowsic relies exclusively on private wells for drinking water, which access groundwater stored in fractures in the bedrock. In addition to threats from pollution, this valuable resource is threatened by several climate change impacts, including increased drought frequency and increased intensity of storms.

Instances of drought are projected to increase, in addition to a general increase of average temperatures. This could cause more evaporation from vernal pools, freshwater wetlands, and other vegetative habitats that support the ability of freshwater to infiltrate and recharge groundwater. Drier soils and periods of torrential rainfall may cause rainwater to turn into runoff rather than being absorbed into the soil to replenish groundwater.

Saltwater intrusion is another threat to Arrowsic's groundwater resources. It occurs when the salt front (the line where fresh and saltwater meet) shifts vertically or moves inland, which can increase the salinity of the groundwater. Groundwater salinity levels can be impacted by a variety of factors, including periods of drought, sea level rise, variations in the volume of water demand/use, rates of groundwater recharge, and the geological features of the groundwater source of a well. High salinity levels in groundwater can make the resource unsuitable for use as drinking water.

3.2 Existing Policies & Projects

- **Subdivision Hydrologic Study** In the Subdivision Ordinance Section 8.3.2.2.U, Arrowsic requires subdivisions to conduct a hydrologic study to determine the impact of a new development on groundwater resources. Subdivisions are required to show that under drought conditions (less than 60% average precipitation), the new development will not impact groundwater resources beyond the subdivision.

- **New Construction Requirements** In the Zoning Ordinance Section 3.24, the Town requires all new construction and development to minimize stormwater runoff caused by the development. Where possible, existing natural runoff control features, such as berms, swales, terraces, and wooded areas, shall be retained to reduce run-off and encourage infiltration of stormwater.

3.3 Community Actions

3.3.1 Collaborate with regional efforts to understand impacts of saltwater intrusion.

Why

In several of the towns surrounding Arrowsic, there are similar bedrock groundwater resources. Studies of saltwater intrusion in these towns could increase the understanding of the process in Arrowsic. Collaborating on studies and projects to address saltwater intrusion could also increase the capacity and resources available.

How

Start by strengthening the working relationship between committees in adjacent towns, like Georgetown. Communicate about needs and share information from studies or projects in Arrowsic. When a common need is identified, explore the possibility of a joint project or study.

Resources & Examples

- Eight towns on the Bluehill Peninsula have formed a partnership, Peninsula Tomorrow, to work on climate resilience and emissions (https://www.hcpcme.org/environment/pen-insulatomorrow/index.htm). Within this group, Bluehill and Brooksville have partnered to receive a Community Action Grant to conduct a joint Climate Vulnerability Analysis.

3.3.2 Support research on current and future capacity of wells in Arrowsic.

Why

A study conducted by Oak Ridge Laboratories in July 2023 found that if aquifer recharge rates continue to decline, groundwater availability will not be able to meet demand. This study also began the process of modeling sea level rise impacts on the depth of the saltwater lens, which could provide insight into saltwater intrusion risk in Arrowsic.

How

There are several data gaps that are barriers to a thorough study of groundwater in Arrowsic:

- Incomplete count and characterization of wells
- Number of people per lot is unknown
- Changes in annual well yield unknown
- Annual well salinity data not available

The Town could fill in these data needs by continuing to promote the online well survey started this summer and supporting data collection projects to document well yield and salinity. This could be accomplished by pursuing funding through a Community Action Grant, to pay for well water testing kits or a formal groundwater study.

Resources

- Westport Island's Groundwater Study: https://westportisland.us/images/site/body-images/Summary_report_on_Current_status_of_Westport_Island_Groundwater_Study.pdf

3.3.3 Educate and encourage residents to adopt water conservation measures.

3.3.4 Encourage homeowners to implement water recycling systems.

Why

It's difficult to understand how wells may be impacted by changes to drought and precipitation patterns, but there is anecdotal evidence that water supply may vary more in coming years in bedrock wells. The natural flow of fresh groundwater towards the sea keeps saltwater from migrating into inland water supplies. Drawing too much freshwater out of wells can allow the saltwater barrier to migrate inland and contaminate supplies. Water conservation measures could help decrease demand on wells and lower the risk of saltwater intrusion.

How

Developing handout or a Town web page with simple tips to reduce water use could encourage people to incorporate small measures into their lives. These materials could also include information on how to take advantage of Efficiency Maine rebates on efficient appliances. Materials could be distributed at Town events, in the Arrowsic Arrow, or in tax bill inserts.

Resources & Examples

- Maine's Emergency Management Agency has a webpage with techniques to conserve water at home: https://www.maine.gov/mema/hazards/natural-hazards/drought/sensible-water-use
- Arrowsic Stewardship Guide: https://arrowsic.org/uploads/Stewardship_Arrowsic.pdf

Why

Diversifying water sources can help create more resilience to water supply issues, while also decreasing water demand on wells.

How

Provide information on these water recycling options to residents, either on the Town website, spotlights in the Arrowsic Arrow, or handouts in the Town Hall. This could include systems that collect and purify water for household reuse, or the tried-and-true method of collecting water in rain barrels for irrigation and other outdoor uses.

Resources & Examples

- Source has a solar-powered water purifying system, called a Hydropanel. This may be cost prohibitive, but options may increase as the technology advances: https://www.source.co/hydropanel-r3/
- Monhegan Plantation: Alternative water supply study: feasibility study https://www.maine.gov/dacf/municipalplanning/casestudies/docs/70%20-%20Monhegan%20Island%20Alt%20Domestic%20Water%20Supply%20study.pdf

3.3.5 Additional Options

- Require new development to incorporate Low Impact Development standards to increase infiltration of runoff.

- Update the existing 1989 Wellhead study. Capture location, depth, recharge rate, mineral levels (at least potassium), well history (has it been redrilled, hydro-fractured, deepened, etc.).

3.4 Individual Actions

- Practice water conservation practices and install water efficient appliances and fixtures.

- Transition to low water use lawns and plant rain gardens and native vegetation to slow runoff and allow for infiltration.

- Install rainwater collection structures for outdoor water use.

4. Surface Water Resources

4.1 Discussion

Surface water resources, such as streams, wetlands, and vernal pools, will also face threats associated with climate change. These include drought, increased temperatures, and runoff from flooding and heavy rainfall, which carry pollutants and sediment into nearby bodies of water. Sewall Pond already has a history of high phosphorus levels and pollution from runoff.

Pollutants can disrupt the function of aquatic ecosystems. A common example is nutrient pollution from fertilizer causing algal blooms that block light and reduce oxygen in surface water. This would result in a loss of the vital ecosystem services that they provide, such as freshwater infiltration, cooling, and flood protection. Communities can make these ecosystems more resilient to environmental changes by reducing harm from pollution, sedimentation, and development.

4.2 Existing Policies & Projects

- **Shoreland Zone** Arrowsic has adopted a shoreland overlay district in line with Maine's Mandatory Shoreland Zoning Act, which restricts development within the shoreland zone (Arrowsic Zoning Ordinance, Section 2.3.1: Shoreland Zoning Overlay Districts). This zone includes any area within 250 feet of a great pond or river, and the upland edge of coastal and freshwater wetlands, as well as areas within 75 feet of perennial streams.
- **Foliar Herbicide Ban** The Town voted in 1984 to ban foliar herbicide application along Town roads, Route 127, and under power lines.

4.3 Community Actions

4.3.1 Prioritize conservation and management of significant freshwater habitat.

Why

Arrowsic's freshwater ponds, streams, and wetlands are important wildlife habitat. They also provide ecosystem services to the community, such as aiding groundwater recharge and supporting vegetation that filters runoff and decreases erosion.

How

Arrowsic's freshwater resources include Sewall Pond, Newtown Creek, Lost Pond, and several wetlands and vernal pools. The Town has already identified these areas in the Special Protection Zone. There are 129 parcels adjacent to freshwater resources, and of these, 21 parcels are at least partially conserved. Eighty of these parcels are residential.

Where possible, surrounding lots could be identified for conservation through purchase or conservation easements, potentially with the support of a land trust, such as Kennebec Estuary Land Trust.

Expanding the Town's successful water quality monitoring and improvement program at Sewall Pond to additional waterbodies could help identify additional areas of focus for the Town.

Resources & Examples

- Beginning with Habitat, a program under the Maine Dept. of Inland Fisheries & Wildlife, has data and conservation strategies to inform Arrowsic's approach to prioritizing, conserving, and managing freshwater habitat: https://www.maine.gov/ifw/fish-wildlife/wildlife/beginning-with-habitat/municipalities/conservation-strategies.html

4.3.2 Educate community members on best practices for limiting runoff, including maintaining healthy native plant buffers.

Why

Private landowners, in a mostly residential town like Arrowsic, have the greatest impact on water quality and runoff control. If landowners limit runoff and erosion, it benefits not only freshwater habitat, but also protects their property from erosion and increases groundwater infiltration to their well.

How

There are many options to address runoff, including rain gardens, rain barrels, dripline trenches, and more. When incorporating vegetative measures, using native plants and maintaining the health of these buffers is important to their function. Landowners could be informed of these options by distributing the handouts created by the Maine Department of Environmental Protection at a Town Meeting or any other Town event. There could also be a series included in the Arrowsic Arrow, spotlighting different techniques.

Resources & Examples

- The Maine Department of Environmental Protection has a series of handouts about reducing runoff, including guidance on how to plant vegetative buffers and what plants to use, shoreline stabilization techniques, and other best management practices: https://www.maine.gov/dep/land/watershed/materials.html
- Arrowsic Stewardship Guide: https://arrowsic.org/uploads/Stewardship_Arrowsic.pdf

4.3.3 Restrict pesticide use on town owned property and roadways.

Why

Pesticides are more likely to run off into surface water as precipitation becomes more intense and frequent. Increased pollution from runoff could contaminate groundwater supplies and will put stress on freshwater resources already under strain from other climate hazards. This could also harm aquatic ecosystems and reduce the flood protection, water filtration, groundwater recharge, and other ecosystem services they provide.

How

This could be done by adopting a pesticide ordinance to restrict the application of pesticides on Town properties, in an overlay zone, or the Town overall. Pesticide Ordinances can vary in restrictiveness. Some ban certain application methods (such as aerial) or types of pesticides (such as neonicotinoids) that cause the most harm. Others restrict the use of all pesticides, encouraging organic alternatives, or require a permit for pesticide use. All municipalities must notify the Board of Pesticides Control, which is attached to the Maine Department of Agriculture, Conservation, and Forestry (Maine DACF), at least 30 days prior to voting on an ordinance restricting pesticide use.

Resources & Examples

- The State maintains a list of all municipal ordinances on pesticide, as well as resources on best management practices: https://www.maine.gov/dacf/php/pesticides/public/municipal_ordinances.shtml.
- Law relating to Municipal Pesticide Ordinances: MRS Title 38, Chapter 3, §§ 435-449
- Harpswell banned the outdoor use of insect growth regulators, as well as the aerial application of any pesticide that harms aquatic invertebrates.
- Brunswick created a groundwater protection zone and banned the storage or use of any pesticide, except for agricultural or indoor use.
- Amherst, Maine requires a permit for the application of pesticides in the Shoreland Zone.

4.4 Individual Actions

- Read the Arrowsic Stewardship Guide and incorporate best practices into your daily life: https://arrowsic.org/uploads/Stewardship_Arrowsic.pdf
- Avoid disturbing vegetative buffers around freshwater habitats.
- Identify sensitive freshwater ecosystems on your property and monitor for changes.
- Participate in local community science initiatives:
  - Sewall Pond Water quality monitoring with the Arrowsic Conservation Commission
  - Kennebec Estuary water sampling with Kennebec Estuary Land Trust
- Use natural pest management practices and avoid pesticides.

5.1 Discussion

Erosion is a natural process anywhere with water and high winds; Arrowsic has an abundance of both already. This process is accelerating due to climate change via increased intensity of storms and storm surge, rising sea levels, and the loss of protective coastal vegetation. Salt marsh migration is predicted to occur as coastal wetlands are inundated with rising sea levels and the leading edge of wetlands are eroded and converted into sediment. In areas where topography or development prevents wetlands from shifting inland, this may result in the loss of marshland and the habitat and ecosystem services it provides. When combined with the impacts of storms and sea level rise, this could have implications for coastal erosion rates, flood vulnerability of adjacent properties, species loss, ecosystem resilience.

5.2 Community Actions

5.2.1 Consider adding a Climate Change Observatory Network site or a similar community science site to document change over time at priority wetlands.

Why

The Climate Change Observatory Network is a community science project run by the Southern Maine Conservation Collaborative (SMCC) to document environmental change in Maine, including sea level rise, vegetation change, restoration projects, etc. This can be an important source of information documenting the effectiveness of a restoration project, management practices, or localized impacts of climate change. It's also an easy way for residents to be engaged in community science and to fostering a sense of stewardship.

How

Signs at specific sites instruct users on how to take a photo and upload it to the project website. These photos create a timelapse of change at the site. This could be added to conservation land or to Town-owned lands. Reach out to SMCC to get started.

Resources & Examples

- Southern Maine Conservation Collaborative's Climate Change Observatory webpage: https://southernmaineconservation.org/cco-network/

5.2.2 Identify and conserve open land adjacent to priority wetlands.

Why

It is important to conserve lands adjacent to tidal wetlands, especially those predicted to migrate inland due to sea level rise. If a marsh is adjacent to developed land, the development will be at risk of erosion and flooding, as the marsh may not be able to naturally move inland. The flood protection and habitat this resource provides will be lost.

How

The Town could work with a land trust, such as Kennebec Estuary Land Trust, and landowners to either purchase or establish an easement on undeveloped lands adjacent to important tidal marshes. The Town could also partner with a land trust or technical resource provider like the Midcoast Council of Governments to conduct a restoration study.

Resources & Examples

- The Community Intertidal Data Portal's Sea Level Rise and the Nearshore Environment Story Map: https://community-intertid-al-data-portal-gpcog.hub.arcgis.com/apps/be4a2a7e272749428fa8bdcd083d3789

- Woolwich and KELT partnered on a study of tidal marsh restoration along Route 1: https://www.wiscassetnewspaper.com/article/kelt-will-facilitate-study-returning-woolwich-mead-ow-salt-marsh/110482

5.3 Individual Actions

- Participate in community science efforts to document change.
- Preserve undeveloped land adjacent to wetlands by creating a conservation easement.
- Participate in community efforts to restore or stabilize eroding wetlands.

6.1 Discussion

Rising sea levels will cause low lying areas to flood and lead to the transformation of dry land into clusters of islands, shrinking existing landmasses. This can cause habitat ranges to shift, pushing plant and animal species up in elevation and further inland. The reduction of dry land and creation of barriers in the form of water will reduce the carrying capacity of many species of plants and animals in the Arrowsic area. Smaller populations are more prone to local extinction by events such as natural disasters and disease.

Rising oceans will also change the groundwater and soil composition in coastal areas. These chemical changes affect the ability of certain plant and tree species to grow in these areas as well as the animals that rely on them. Sea level rise is likely to submerge much of what is now saltwater marsh, which serves as a huge breeding and feeding ground for many species of birds, fish, and insects. Changing temperature and rainfall patterns will likely impact the entire ecosystem, well beyond the boundaries of Arrowsic.

6.2 Existing Policies & Projects

- **Cool Little Culvert** The Arrowsic Conservation Commission and Kennebec Estuary Land Trust partnered to install a wildlife culvert to replace the existing Sewall Pond Culvert, as a part of a project to restore the Alewife population in Sewall Pond.

6.3 Community Actions

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6.3.1 Conduct a natural resource inventory. Maintain data in a GIS format so it can be monitored, updated, and visualized over time.

Why

While there are state-level resources on habitat and wildlife readily available, there is also a need for local level habitat and wildlife data to inform management and conservation decisions on a local scale. Tracking this information could provide valuable insight into Arrowsic's natural resources, which could be incorporated into future plans, policies, zoning, and conservation decisions.

How

Conducting a natural resources inventory usually involves conducting surveys and assessments of habitat types and conditions, wildlife ranges, invasive species locations, etc. These surveys should be tailored to the Town's interests and needs. Spatial data should be collected as a part of this process for incorporation into maps and the Town's GIS.

The Town could solicit assistance from the Midcoast Council of Government for mapping assistance or could apply for grant funding to hire a consultant to develop a Town GIS. Arrowsic would also need to maintain the GIS.

Resources & Examples

- The Maine Land Trust Network has resources for finding natural resource data, using GIS, and finding technical support that is relevant for municipalities: https://www.mltn.org/resources/gis/
- An example of a natural resource inventory application for Gardiner, NY: https://tognri.maps.arcgis.com/apps/MapSeries/index.html?ap-

6.3.2 Encourage participation in existing citizen science projects to monitor species changes.

Why

Documenting local knowledge and observations is an easy way to educate and engage community members, while also gaining valuable insight into the local habitat and wildlife. This information could make for better management decisions.

How

Arrowsic's Shellfish Commission already conducts yearly green crab trapping events, and the Arrowsic Conservation Commission conducts monitoring, and Alewife counts at Sewall Pond. The Town could encourage resident or committee participant in community science projects like the bird monitor program with Kennbec Estuary Land Trust, and continue to encourage participation in Arrowsic Conservation Commission's iNaturalist activity.

Resources & Examples

- Arrowsic Nature Sightings: https://www.inaturalist.org/projects/arrowsic-nature-sightings
- Green Crab Trapping: arrowsic.org/shellfish/greencrabproject.html

- KELT Bird Monitoring: https://www.kennebecestuary.org/bird-monitoring

6.3.3 Adopt Stream Smart culvert requirements in new road projects and subdivisions.

See recommendation 1.3.1 *4. in the Transportation: Roads & Bridges* section on page 36 .

6.3.4 Additional Options

- Prioritize conservation of the most vulnerable habitat types in Arrowsic, such as riparian areas and land adjacent to salt marshes.
- Understand implications and work to reduce populations of particularly damaging species, green crabs, woolly adelgid, etc.
- Do more detailed soils studies to understand the impacts of climate change on the soil characteristics and plants they can support.

6.4 Individual Actions

- Maintain yards to protect native flora and fauna.
- Find and remove invasive plants from your property using recommended practices (see https://www.maine.gov/dacf/mnap/features/invasive_plants/invsheets.htm).

7. Emergency Response

7.1 Discussion

The volunteers of the Arrowsic Fire Department (AFD) are essential for our town's resilience. The AFD stops brush fires, supplies water to fight structure fires, provides aid and support as we wait for an ambulance, and keeps us safe from downed wires. In addition, the department is part of a regional mutual aid network, a system that has well-served our emergency response needs. Mutual aid partners will assist neighboring communities unless they must respond to calls in their own municipalities. Emergency medical services are provided under contract by ambulances and EMTs from the Bath Fire Department. Over the past twenty years, emergency calls have fluctuated between 24 and 54 yearly calls without a clear trend.

The AFD is adapting to meet greater climate-related emergency response needs. This is particularly true as it relates to severe weather events which increase the risk of:

- Road flooding due to tidal storm surge, extreme high tides, and stormwater runoff
- Brush fires due to extended periods of drought
- Blocked roads from downed trees, utility poles and/or electrical wires
- Vehicle accidents
- Damage from high winds, gusts and freezing rain or ice buildup

The need for traffic control during road flooding and power outages has increased the challenges to the AFD as storm-induced road blockages can last for hours or days while utility companies cope with outages state-wide. Arrowsic is often one of the last communities to get power back. Multi-day events require more volunteers to cycle in and out of an emergency scene.

The AFD would benefit from expanded capacity to continue to keep the Town safe, including additional volunteers (with a variety of skills and training), improved communications, updated mapping and signage to facilitate emergency response, and additional support to apply for funding for equipment and training. Strengthening the AFD would help build community resilience and leave Arrowsic better prepared for the next emergency.

7.2 Community Actions

7.2.1 Update the town road map for use by the AFD.

Why

Common road map apps (Google, Bing) do not consistently update their data to reflect changes. At times when cellular phone service is unreliable, a printed map can provide the geographic information needed to respond efficiently to the location of an emergency. The map currently used by AFD needs continual updating to include newly built and renamed roads.

How

Options range from amending the existing document to creating a new map from E-911 Roads data available in the Maine Geographic Information System (GIS) library. An advantage to using GIS is the ability to map other natural and infrastructure features, such as topography and water supply resources.

It could also be a useful tool for other committee projects moving forward. Once a draft is created it is important to "ground truth" the information before finalizing the map.

Resources & Examples

- Maine's guidance on updating E-911 Roads: https://www.maine.gov/megis/projects/e911.shtml

7.2.2 Implement a standardized house addressing program.

Why

Emergency services must be able to find an address easily and quickly in the event of an emergency. Residents may display addresses in different locations, with different fonts and styles that are difficult to read quickly or may not display an address at all. Towns can require residents to display their address in a standardized way that minimizes confusion and helps emergency services quickly identify a household.

How

The Town could create and adopt an addressing ordinance to standardize the signage and location for addresses. See the model ordinance below.

Resources & Examples

- Maine's Emergency Services Communication Bureau guidance on addressing: https://www.maine.gov/maine911/community-addressing/addressing
- Berwick, ME Fire Dept sells standardized reflective signs to residents: https://www.berwickmaine.org/departments/fire_and_rescue/reflective_address_signs.php

7.2.3 Create a Community Emergency Response Team (CERT).

Why

CERT is a program administered by the Federal Emergency Management Agency (FEMA) to train volunteers to provide critical support to first responders during an emergency and increase the capacity of the local emergency management agency. There are over 2,700 local CERT programs nationwide and more than 600,000 people have trained since CERT became a national program. Local CERT programs are tailored to the unique needs and capacity of the community.

This program provides a streamlined approach to engaging and training community members so that they can contribute to the safety of their families, neighbors, and community.

How

CERT programs can be created on a local, regional, or county level. Sagadahoc County Emergency Management Agency (SCEMA) does not currently have a CERT in place. Arrowsic could create a CERT program as a Town, or collaborate with adjacent municipalities, or SCEMA.

Resources & Examples

- CERT in Action: https://www.fema.gov/emergency-managers/individuals-communities/preparedness-activities-webinars/community-emergency-response-team
- CERT Training: https://community.fema.gov/PreparednessCommunity/s/cert-trainings?language=en_US
- Maine's guidance on CERT program: https://www.maine.gov/mema/maine-prepares/community-preparedness/emergency-response-teams/cert
- How to register a CERT: https://community.fema.gov/PreparednessCommunity/s/about-registering-a-cert?language=en_US

7.2.4 Consider Town Hall as a community emergency shelter.

Why

Severe weather events exacerbated by tidal flow causing road flooding or washout could isolate most of our island community and Georgetown residents from the mainland. A wildfire could destroy individual homes. Community members may need to shelter with neighbors or in a municipal building for the duration of the event.

How

The Arrowsic Town Hall could provide emergency shelter for residents during extended, severe, adverse events. The Fire Station is less suitable as its main purpose is the safe storage of the fire trucks and the department's equipment. During the cold season the fire trucks must be stored in a heated building to prevent the water from freezing.

The Town Hall is heated via propane furnace forced air, has a small bathroom with toilet and one sink, and an additional outdoor faucet, each with cold water only. During power outages an on-demand propane-fueled generator provides electricity at the Fire Station and Little Barn. The Town Hall has an external hookup only for a portable generator. It is unknown whether the quality of the well water meets the guidelines for potable water during a public emergency.

In conversations with community members, define the community's needs for an emergency shelter, appropriate equipment, and supplies. Plan with residents to provide blankets, cots, mattresses, food and water in case of an extended emergency situation.

7.2.5 Designate an emergency alert official to join the Integrated Public Alert and Warning System (IPAWS).

Why

The Department of Homeland Security maintains the Emergency Alert System or EAS (broadcasts to radios, cable, and other media) and the Wireless Alert System or WAS (broadcasts to cell phones) to notify communities in the event of a disaster or emergency. IPAWS integrates these two alert systems. These systems can also be used locally for emergency messages specific to a community. This could be an efficient way to reach residents and anyone in the area quickly and without having to maintain a Town database of contacts.

How

The EAS sends messages over media, like public radio, while the WAS sends alerts via text message within a certain radius. To sign up, these systems require a community to designate a liaison.

Resources & Examples

- General information for WAS and EAS alert systems: https://www.ready.gov/alerts
- How to become an Alerting Authority for IPAWS: https://www.fema.gov/emergency-managers/practitioners/integrated-public-alert-warning-system/public-safety-officials/alerting-authorities

7.2.6 Map private drives to make emergency response more efficient.

See recommendation 12.3.3 in the *Housing & Built Environment* on page 67.

7.2.7 Additional Options

- Create a voluntary messaging system: Awareness of unfolding events can be helpful in reducing the impact to residents. During road blockages or emergencies, the AFD may need to inform residents to allow for appropriate response or to prevent progression of a dangerous situation. The town could develop a communication plan to explain the purpose and ask residents to sign up for emergency notifications from the AFD using cell phone services.
- Conduct a confidential survey of vulnerable households (e.g., older adults, people with life-sustaining medical equipment or impaired mobility) to inform emergency response.

7.3 Individual Actions

- Join or support the Arrowsic Fire Department.
- Reduce wildfire risk and protect your home from wildfire: (Wild-Urban Interface) https://www.usfa.fema.gov/wui/what-is-the-wui.html (Burn permit) https://apps1.web.maine.gov/
- Be prepared for extended power outtages.

8.1 Discussion

While there are many technical things that can be done to ensure that communities can move forward as we face climate change, the most important thing is how well community members communicate with one another and how connected people are to one another. Community is what helps people access the information they need, share resources/support, and pool their collective expertise to solve issues. Arrowsic already excels in this area due to the nature of the committee and volunteer-run Town government. Strengthening the existing ties with one another, ensuring that everyone has a chance to contribute to the community's journey toward resilience and has the support they need, will prepare Arrowsic for the climate of the future. This plan is an opportunity to create common goals and strategies to address climate change with input from the entire community. It's also a chance to take stock of under-resourced or over-burdened committees and issues related to climate change.

8.2 Community Recommendations

8.2.1 Maintain and strengthen channels of communication between committees. Consider implementing regular meetings or email updates between committee chairs.

Why

Arrowsic relies on the functioning of and communication between its committees to operate. Goals of these different committees overlap or intersect, and the ability to address shared concerns is bolstered by cooperation. Each committee has knowledge, skill, and capacity to contribute.

How

This could be as simple as setting up regular email updates between the chairs of each committee, summarizing their committee's significant updates or actions. Publishing committee meeting agendas a week prior in town's weekly meetings notices could also serve this purpose. Another option is to hold a quarterly meeting between committee chairs.

8.2.2 Incorporate chances for public input and workshops into community planning and projects at every possible step.

Why

Public engagement can help create community buy-in for a project, and it is important in gathering local knowledge to make a plan/project more effective, applicable, and successful.

How

Public engagement should start early in the process and happen frequently. There should be a variety of ways to participate, such as online and in-person. Meeting needs to accommodate a variety of schedules (check the school calendar, think about work schedules, holidays, and tides for shellfish harvesters). Events do not need to be formal! Hold small discussions and dot-voting activities.

Resources & Examples

- This guide includes an introduction to public engagement, considerations, and ideas: https://publicagenda.org/wp-content/uploads/PublicAgenda_StrengtheningAndSustainingPublicEngagement_2018.pdf
- Maine Development Foundation hosted a workshop on public engagement, with resources available here: https://www.mdf.org/event/maine-downtown-institute-engaging-communities-in-difficult-conversations/

8.2.3 Develop a system to encourage neighbors to check in on neighbors during emergencies, and to provide aid to people who need it. This could include a phone tree or a "buddy program" to pair individuals in need with a check-in partner/neighbor.

Why

During emergencies, communication redundancy is important. This can increase the chances of people receiving important information or accessing help if needed. Phone trees help neighbors check in on each other, even when other communication methods are down.

How

Identify individuals to include on the phone tree, especially those who are isolated or more vulnerable. Identify key people to serve as the trunk of the tree, and coordinate with the AFD to make sure that these individuals are notified during emergencies. Keep numbers updated.

Resources & Examples

- The Red Cross has a guide and template: https://www.redcross.org.au/act/action-catalogue/preparedness/start-an-emergency-phone-tree/

8.2.4 Additional Options

- Re-invigorate the Food Co-op.
- Have an annual upcycle/recycle party.

9. Public Health

9.1 Discussion

There are a variety of ways that climate change will impact public health. There will likely be more heat waves, which can create serious health issues, especially for those without air-conditioning, among older adults and very young children, and for those with chronic diseases. The increase in storm events can trap people in their homes, making it difficult to access medical care, replenish medications, or power life-sustaining equipment in an emergency. Finally, changes in temperature and environmental conditions will likely increase populations of existing pests like ticks, brown tail moths, and mosquitoes, and could lead to the introduction of new pests and diseases from warmer climates.

9.2 Community Actions

9.2.1 Create a system for residents to report information about the spread of pests and disease in the community.

Why

While the progression and movement of pests and disease is tracked on a state level by the Maine Center for Disease Control, understanding what is occurring on a local level can inform how the town and residents of Arrowsic prepare and respond. For example, the spread of brown tail moth caterpillars can vary from one town to another due to environmental conditions. Having local ways to track the spread could help residents take precautions, as well as help emergency services prepare to provide care (if this is necessary).

How

Choose one pest or disease to track, such as brown tail moth, as a starting point. Some communities have created a hotline or a survey to collect reports/sightings for community science projects. Free applications, like Google Forms, are a low-barrier way to start.

Resources & Examples

- Oregon State University's Extension Service has a Forest Pest Detector Program and hotline: https://extension.oregonstate.edu/ofpd/forest-pest-resources.

9.2.2 Coordinate with the AFD to ensure that vulnerable people are contacted during heat waves, power outages, or other emergencies.

Why

Vulnerable people, such as older adults, those who rely on electrical life-supporting equipment, and those with disabilities, may need more assistance during an emergency event. Understanding where these households are could help emergency services assist people sooner and check in on them more regularly.

How

The Town could create a survey of vulnerable households to create a database for emergency services to check in on during certain emergencies. This survey could ask for information to inform different scenarios, including whether the person relies on electricity for essential equipment, whether the person has an air conditioner, and whether the person has mobility issues.

9.2.3 Understand various options for reducing populations of disease-carrying pests. Create programs to control the populations of these pests while balancing water quality standards.

Why

Pests can impact the health of residents, but many pest control methods involve pesticides that may negatively affect aquatic ecosystems. Water quality and public health can be addressed by using best management practices or natural pest control methods.

How

The Town could require best management practices on Town lands, and provide educational materials to residents on how to balance water quality and pest control on their property.

Resources & Examples

- State Guidance on best practices: https://www.maine.gov/dacf/php/pesticides/applicators/best_management_practices.shtml

9.3 Individual Actions

- Use low impact methods for pest control.
- Wear protective clothing when working outside.
- Check for ticks on people and pets.
- Check in on your neighbors during an emergency (heat wave, power outage, etc.). Create a neighborhood phone tree.

10. Energy Efficiency

10.1 Discussion

Due to the huge role conventional energy production plays in producing greenhouse gases and contributing to climate change, it is vital that buildings are built and renovated to be energy efficient. It is equally important that the community is mindful of its energy consumption and aware of the ways they can limit it. This includes: improving insulation and windows to minimize heat loss in the winter and unwanted warming during the summer; installing renewable energy generation such as solar panels; and education on the benefits of energy conservation measures. Using water efficiently can also reduce energy used by well pumps.

10.2 Existing Policies & Projects

- **Capital Needs Assessment** The Properties Committee completed a Capital Needs Assessment for Town buildings in 2019, which included a brief assessment of energy efficiency for each building.
- **Annual Inspections** of the Town Hall, Fire Barn, and Little Fire Barn are conducted by the Properties Committee.
- **Town Solar Array** Installation of a PV Solar array is planned on the Fire Barn Roof.

10.3 Community Actions

10.3.1 Keep track of energy use in Town buildings to understand use and be able to compare impacts of future improvements.

Why

Arrowsic has two newer buildings, the Fire Barn and Little Fire Barn, that were built to more recent energy efficiency standards. Town Hall is over 170 years old and has single-pane windows with poor efficiency and an uninsulated attic floor. A simplified way to track energy use and emissions for the Town is keeping annual records of the amount of heating fuel and electricity used by each Town-owned building. This data would provide a general baseline for consumption and be a way to document the effect of improvements on overall energy efficiency.

How

The Town already keeps track of bills for heating fuel and electricity consumption. As these bills are received (monthly), enter the gallons of fuel used or kilowatt hours (kWh) used, by building. There are templates available, such as the one from the Environmental Protection Agency, that can be adapted to use for continuous tracking rather than a single greenhouse gas emissions inventory.

Resources & Examples

- Local Greenhouse Gas Inventory Tool │ US EPA: https://www.epa.gov/statelocalenergy/local-greenhouse-gas-inventory-tool

10.3.2 Consider adopting the IECC 2021 "Stretch" building and energy efficiency code.

Why

The Maine Uniform Building and Energy Code (MUBEC) is the base building code in Maine and sets efficiency standards for the entire state. However, municipalities under 4,000 people are not required to enforce this base code. Simply enforcing the standard MUBEC code could save as much as $200/year in energy savings per each building constructed to code.

There is also a "stretch code" option to allow municipalities to adopt more stringent efficiency requirements which is based off the 2021 International Energy Conservation Code (IECC). Municipalities that opt into this stretch code are required to enforce it.

Resources & Examples

- Natural Resources Council of Maine's Building and Energy Codes web page: https://www.nrcm.org/programs/climate/energy-efficiency/maines-building-energy-codes-2/
- Efficiency Maine Resources on the baseline code (MUBEC): https://www.efficiencymaine.com/building-energy-codes/

Energy Efficiency

10.3.3 Provide information to residents about the savings available through Efficiency Maine credits for energy audits, insulation, and efficient appliance upgrades.

Why

Efficiency Maine already keeps a table of resources for at-home efficiency upgrades and audits, as well as a list of certified providers, but many people do not know about these resources. Spreading the word about these opportunities and how to take advantage of them may help increase participation in these programs.

How

The Town could add a web page on the municipal website with information on the opportunities available through Efficiency Maine and publicize this information at the Town Hall and in the Town emails. It may also be helpful to send this information out with the tax bills to each household.

Resources & Examples

- Efficiency Maine home resources table: https://www.efficiencymaine.com/at-home/

10.3.4 Additional Options

- Conduct energy audits of Town buildings with an Efficiency Maine approved contractor. Prioritize efficiency improvements to lower energy consumption and operating costs.
- Create guidance for weatherization of existing houses and structures and aid for weatherization for vulnerable households.
- Install EV charging locations at town hall/fire barn.
- Developing bike lanes/paths to encourage non-auto travel.

10.4 Individual Actions

- Switch to LED lighting.
- Practice energy conservation. Unplug appliances and turn off lights when not in use.
- Switch outdoor lighting to motion-sensor (direct downward if possible).
- Buy local foods when possible to reduce transportation-related fossil emissions
- Schedule an energy audit with an approved contractor listed on Efficiency Maine's website and receive a tax credit to cover part of the cost.
- Weatherize your home and increase energy and water efficiency by updating appliances as your old ones wear out. Install a heat pump, insulate your home, and get efficient appliances using Efficiency Maine incentives.

11. Waste Efficiency

11.1 Discussion

Waste reduction is an area that could have one of the greatest impacts on Arrowsic's carbon footprint. As of 2021, solid waste accounted for 9% of the Town's total carbon footprint, or 224 metric tons of carbon.

In line with the national trend, Arrowsic has seen an increase in the total tons of solid waste produced. Arrowsic's Solid Waste & Recycling Committee has also noted that not all households participate in the recycling program.

Arrowsic has strong recycling and composting programs, with a recycling to trash ratio of 35% in 2022. The Town has also seen consistent composting rates, with about 23 tons of waste diverted from the landfill each year. However, there is a need for education on recycling and composting best practices for residents to ensure that materials are not needlessly sent to the landfill.

Increased education could also generate more participation in the composting program. Composting is a net carbon sink, since compost helps soil store more carbon that is emitted through the composting process.

11.2 Existing Policies & Projects

- **Arrowsic's Recycling and Composting** Programs diverted approximately 35% of waste from the landfill in 2022.
- **Swap Barn** Arrowsic's Recycling and Solid Waste Committee holds a biweekly event for residents to donate or trade unwanted items.

Figure 19: The Swap Barn serves as the venue for twice monthly swapping events.

Waste Efficiency

11.3 Community Actions

11.3.1 Create a resident education & outreach program.

Why

Residents may not be aware of the impacts of waste diversion and the proper way to participate in the Town's Recycling & Composting programs. An education program may lower the barrier to participation for residents.

How

Develop outreach materials, such as fliers to leave at residences that do not recycle. Develop a brochure on the impact of waste diversion to leave at the Town Hall. Create community events, such as a town-wide recycling or composting challenge or a waste reduction fair to engage the entire community on meeting a waste reduction goals.

Resources & Examples

- South Portland has examples of waste reduction events and community challenges, as well as educational materials on recycling and composting. They also had a successful intern program to conduct recycling audits.
- The Maine Resource Recovery Association provides member towns with community outreach assistance, educational events, and wholesale priced composting and recycling bins: https://mrra.net/

11.3.2 Create a Town Waste Efficiency Ordinance.

Why

Requiring households to participate in the recycling program will save costs for the Town and, by extension, the entire community for waste disposal. The Town currently pays $20 per ton of recycling and $94 per ton of trash. This could also help keep households accountable for recycling properly.

How

This would require resident support and a dedicated volunteer program to conduct audits of recycling and waste. A system of warnings could involve several notifications and educational materials provided to non-compliant households, followed by a small fee after a certain number of strikes.

Resources & Examples

- An example ordinance from York that requires residents to participate in the Town's recycling program: https://www.yorkmaine.org/DocumentCenter/View/733/Solid-Waste-Collection-Recycling-and-Disposal-Ordinance-PDF

11.3.3 Invest in the Town's Composting Program.

Why

Encouraging increased participation in the Town's composting program is a way to divert waste, helping the Town save on costs for garbage while reducing the carbon emissions. Some ways to increase participation could include purchasing town composting bins with educational signage, hosting composting workshops, and conducting an outreach campaign.

How

Based on survey results in 2023, the Recycling and Solid Waste Committee identified composting bins and education as a potential barrier to participation in the program. There are Solid Waste Diversion grants available through Maine's Department of Environmental Protection that can be used to improve organics management. With grant funding, an intern could be hired to organize a workshop series or develop brochures and educational signage.

Resources & Examples

- Solid Waste Diversion Grant Program:https://www.maine.gov/dep/sustainability/compost/grant.html
- Social Marketing Toolkit provided by the Environmental Protection Agency, with resources, examples, and templates for increasing compost participation: https://www.epa.gov/sustainable-management-food/forms/composting-food-scraps-your-community-social-marketing-toolkit

11.4 Individual Actions

- Participate in the recycling and composting programs in Arrowsic. Research what can be recycled and composted in town and best practices for participation.
- Limit your waste. Buy less, participate in the Swap Barn, purchase items with less single-use packaging, and buy in bulk when possible.

12.1 Discussion

While no town-owned buildings are predicted to be inundated by either the 1.6-foot or 3.9-foot sea level rise scenarios recommended as planning benchmarks by the State of Maine, some houses could be impacted by storm surge or erosion under these scenarios. Loss of marshland and vegetative barriers around shorefront property can exacerbate this vulnerability. An equal threat is the inundation of private roads and driveways, which could hinder evacuation or access by emergency services. In many cases, these roads are not mapped, which makes the risk more difficult to understand and plan for.

12.2 Existing Policies & Projects

- **New Development Erosion Controls**
  The Town's Zoning Ordinance requires new building sites to meet erosion control requirements throughout the building process. New buildings are required to conform to natural contours as closely as possible. New driveways must be constructed to withstand a 100-year storm.
- **Shoreland Setbacks** The Town's Shoreland zoning requires setbacks from the high water line, ranging from 300-400 feet.

12.3 Community Actions

12.3.1 Adopt Low Impact Design standards for stormwater management, for both public and private infrastructure.

See the LID information in the Groundwater Resources Section.

12.3.2 Continue to participate in the National Flood Insurance Program (NFIP).

Why

Even though none of the buildings in Arrowsic are predicted to be submerged in high tide under the 1.9 foot and 3.9 foot sea level rise scenarios, it could still be possible for houses to flood during storm or high-precipitation events, especially if they are located in the flood zone.

Resources & Examples

The Federal Emergency Management Agency's NFIP has resources on how to navigate this process as a community, as well as how/whether to buy flood insurance as a homeowner: https://www.floodsmart.gov/why-buy-flood-insurance.

12.3.3 Map all private drives and incorporate this information into emergency services & planning.

Why

Arrowsic has many long private driveways that are unmapped, which could cause delays in emergency services accessing a residence, especially if the drive is blocked or washed out. Having an updated map of all the private driveways in Town could mean a quicker response during an emergency.

How

The Town could start by looking at site plans for residences and identifying drives longer than ¼ mile. The Town may be able to collaborate with Midcoast Council of Governments (MCOG), a local university, or hire a consultant.

Resources & Examples

- MCOG Technical Assistance for mapping: https://www.midcoastcog.com/town-resources

12.3.4 Develop shoreline erosion control standards for the Town. This could include native plantings or other natural stabilization measures.

Why

Arrowsic has several potentially unstable coastal bluffs, which could become more vulnerable to erosion as sea levels rise. This could result in property, infrastructure, and/or habitat loss. Shoreline stabilization techniques may help slow or mitigate erosion in these areas.

How

Arrowsic could identify a study area along an unstable coastal bluff and explore natural and traditional stabilization methods. Once a pilot site is identified, the Town could apply for funding to implement the best stabilization method to understand how well it works in the Town's specific conditions.

Resources & Examples

- Brunswick has a working group studying shoreline stabilization techniques to develop municipal standards. As a part of this project, Brunswick received funding to install two living shoreline sites: https://www.brunswickme.org/239/Shoreline-Erosion-Management

12.4 Recommended Individual Actions

- Use low-impact design standards when building a new structure.
- Implement natural stormwater control measures, like bioswales and native plantings.
- Maintain a healthy shoreline buffer of native vegetation.

13.1 Discussion

The Town should continue and expand its work with neighboring communities to implement policies, share experiences, and apply for grants. Collaborating regionally can increase capacity to apply for grant funding, implement new projects to achieve shared goals, and address needs during emergencies. Some issues, such as transportation and emergency response, are regional in nature and require a larger, coordinated effort. Regional knowledge sharing and coordination should be built into the Town's approach to climate action.

13.2 Recommendations

13.2.1 Coordinate with regional planning agencies and stay updated on ongoing projects, services, and collaborative programs.

Why

Small towns like Arrowsic benefit from pooling resources and information with similar communities in the region. The Midcoast Council of Governments (MCOG) can help connect Arrowsic to other communities, as well as offer resources and technical assistance.

How

Participate in regional meetings and join MCOG or SCEMA's email list. Attend workshops and meetings as possible. Use the resources and plans provided by SCEMA and MCOG, and make sure town plans are in line with these plans. Stay in touch with the staff at these organizations for relevant updates and information.

Resources & Examples

- Midcoast Council of Governments: https://www.midcoastcog.com/

13.2.2 Attend regional training opportunities and report back to the appropriate committees.

Why

Regional opportunities for training and workshops can expand the capacity of Arrowsic's community members and provide connections to other municipalities and service providers.

How

Assign a member of the ACRC to regularly check the event pages of these organizations, sign up for email lists and newsletters, and include these opportunities in Town announcements.

Resources & Examples

- MCOG Events Calendar: https://www.mid-coastcog.com/upcoming
- SCEMA Trainings Webpage: https://www.sagadahoccountyme.gov/departments_and_services/emergency_management_agency_and_board_of_health/training.php

13.2.3 Consider regional renewable energy opportunities including solar, wind, and tidal.

Why

While Arrowsic may not have appropriate spaces or funding to support certain types and scales of renewable energy projects, pooling resources with other surrounding communities may make these more feasible.

How

Create a collaborative, perhaps facilitated through a regional council of governments (MCOG), pools the resources, funds, and knowledge of several communities. This results in better bids from energy developers, less municipal staff time, and competitive contract terms.

Resources & Examples

- Community Solar information from the Maine Office of the Public Advocate: https://www.maine.gov/meopa/electricity/community_solar
- An example of how Southern Maine Planning and Development Commission created a collaborative partnership between 6 towns to request a joint proposal for community solar: https://smpdc.org/solar
- A study on regional energy projects: https://energsustainsoc.biomedcentral.com/articles/10.1186/s13705-021-00295-4

13.2.4 Consider inter-municipal cooperation.

Why

Certain issues and opportunities cross town boundaries, such as the infrastructure (road, electrical, broadband) that passes through Arrowsic to Georgetown. The capacity of each town to address these issues is increased when municipal actions are complementary.

How

Collaboration could be as simple as establishing quarterly meetings or creating a system for regular email updates between corresponding committees within each town (such as Climate Resilience Committees). It could also be formalized as a joint committee between towns, designated to address or discuss shared issues. A grant-funded inter-municipal climate coordinator position could also be established to guide cooperative projects.

Resources & Examples

- An example in Long Island, NY, of how communities can create inter-municipal committees to address shared concerns: https://www.huntingtonny.gov/content/13749/16439/16577/99657/42854/default.aspx

13.2.5 Additional Options

- Consider regional transportation models including EV buses, ride sharing, commuting options.

14.1 Discussion

Increasing resilience and reducing emissions are connected to many of the activities the Town is engaged in and should be embedded into the decision-making process from start to finish. This can be done by adding language related to climate change impacts into Town ordinances and policies, and incorporating climate change considerations into capital planning and comprehensive plans. Fostering communication and coordination between committees is important for lasting change.

14.2 Recommendations

14.2.1 Conduct a Town-wide greenhouse gas inventory.

Why

Greenhouse gas inventories can give a community a baseline idea of how the Town or the community as a whole emit carbon through daily operations or activities. Though Arrowsic's Town infrastructure is small, it can be helpful to identify areas where emissions could be reduced. This could inform management decisions about Town properties.

How

Emissions inventories can be scaled depending on the needs and desires of a community, from the few Town buildings Arrowsic owns and manages to the entire community's emissions. The thoroughness can vary depending on capacity as well, from calculations done using a worksheet, like the Environmental Protection Agency's Community Greenhouse Gas Inventory spreadsheet, to hiring a consultant to calculate an in-depth analysis. Even tracking the fuel consumption to heat Town buildings is a good place to start.

Resources & Examples

- EPA greenhouse gas inventory spreadsheet: https://www.epa.gov/statelocalenergy/local-greenhouse-gas-inventory-tool
- The Southern Maine Planning and Development Commission has developed a protocol for communities in Maine to conduct inventories, based on the organization's experience conducting inventories in Biddeford, Kennebunk, and Kennebunkport: https://smpdc.org/ghginventory

14.2.2 Adopt a purchasing standard for Town equipment, requiring new purchases to meet efficiency standards, such as Energy Star rated appliances.

Why

Incorporating the cost of an upgrade to increase efficiency into an existing need can help save money and resources in addition to reducing emissions.

How

Incorporate the cost of these replacements into the existing maintenance and improvement plan and budget created by the Properties Committee.

Resources & Examples

- Efficiency Maine provides resources on the options for more efficient appliances: https://www.efficiencymaine.com/
- Energy Star: https://www.energystar.gov/products

14.2.3 Evaluate budget and incorporate consideration of climate change impacts into the Town's financial values.

Why

Incorporating climate resilience priorities into the Town's budget, especially by adding climate change considerations to existing projects or programs, will make sure that action is taken to make the Town more resilient. Adding funds to make existing capital improvement projects more resilient can amplify the benefit of investing in the community.

How

Each committee that is responsible for contributing to creating budget proposals could reflect on where their priorities overlap with climate change considerations, using the data in this plan. This could include allocating more funding for emergency services, updating Town buildings, or conducting coastal restoration projects. Funding for specific projects may be able to be accessed through grants, but these may require some amount of match, which the Town could budget for in advance.

Resources & Examples

- The Casco Bay Estuary Partnership and New England Environmental Finance Center held a workshop in 2021 on how communities could budget for climate change, and the resources are available online: https://neefc.org/wp-content/uploads/2021/05/Resilience-Funding-Guidance-Series_Municipalities_052621.pdf

14.2.4 Additional Options

- Conduct an energy audit of Town buildings.
- Evaluate Town operations and develop operation policies for water & energy conservation.
- Incorporate predicted climate change impacts for Arrowsic into all applicable plans the community creates in the future.

The Action Plan identifies and explains a series of actions the town can take to mitigate and adapt to climate change. The Implementation Plan is a crucial document which outlines the steps, costs, and timelines for various actions.

The table below identifies the priorities developed with the Arrowsic Climate Resilience Committee and the public who attended the public meeting. This information was collated to create the "Priority" column in the database. Actions were listed as a high priority when they received more the 66% of the votes in a particular section. If they received 33% - 66% they were listed as a medium priority action and they received less than 33% pf votes they were listed as low priority.

The "Cost" column is an estimate of the range of funding a project might require, from minimal-cost project to ones which would require a large amount of money or grant funding.

The "Length of Time to Accomplish" column identifies projects which would take anywhere from a few weeks to more than two years for the town to complete. It also identifies projects which are ongoing, meaning that they either already exists and should be maintained or they will need to be continuously monitored in order to be of value to the community.

 The "Scale" column refers to the scale of work, whether it is organized and identified at the municipal level (Arrowsic), regional level (MidCoast Council of Governments), or state level (Climate Resilience Planning).

The "Competence" column is intended to identify which committee(s) have skills/knowledge about a certain topic and have the expertise to implement an action in their work.

The implementation plan serves as a bridge connecting the desire to implement climate mitigation and adaptation and the action needed to do so. The table is intended to provide a structured framework to guide the allocation of time, energy, resources, and expertise to have the greatest impact on Arrowsic's resilience. The implementation should serve as a compass to guide the community into a future that is more resilient and prepared for climate change.

	Priority	Estimated Cost	Length of Time to Accomplish	Scale	Competence	Funding Opportunities
Implementation Table						
Topics						
Actions/Strategies	High	$	Short (< 1 yr)	Municipal	Committee with expertise and other committees to involve	List applicable opportunities, dates
	Medium	$$	Medium (1- 2 yrs)	Regional		
	Low	$$$	Long (> 2 yrs)	State		
			Ongoing			
Transportation & Infrastructure: Roads & Bridges						
Incorporate resilience to sea level rise into the Capital Improvement Plan, including installing culverts able to handle 3.9 ft of sea level rise by 2100, implementing stormwater management and/or raising road surfaces as a part of normal road improvements.	High	$$$	Long	Municipal	ACRC, Roads Commission, Maine DOT	
Coordinate with Georgetown and Maine Department of Transportation on road improvement projects.	High	$$$	Long	Regional	ACRC, Roads Commission	
Adopt the Maine CoastalProgram's Coastwise Approach and Maine Audubon's Stream Smart Crossing Guidelines as standard practice for culvert and bridge improvements. Identify vulnerable crossings and apply for DEP improvement funds.	Medium	$	Short	Municipal	ACRC/Conservation Commission	
Encourage marsh restoration and resilience practices, both on Town lands (area near bridge) and on private properties.	Medium	$$-$$$	Ongoing	Municipal	Conservation Commission	
Create an emergency response plan for flood scenarios and incorporate sea level rise and the Federal Emergency Management Act's Flood Insurance Rate Maps (FIRM) into emergency planning.	Medium	$$ - $$$	Medium	Municipal/ Regional	AFD, Sagadahoc Emergency Management	
Educate private road owners about sea level rise impacts and Stream Smart culverts and other best practices for resilient road design.	Low	0	Short	Municipal	ACRC	
Create standards for new subdivisions roads that are candidates for Town adoption, which require incorporating sea level rise in the design process (including culvert design).	Low	$	Medium	Municipal	ACRC, Planning Board	
Transportation & Infrastructure: Broadband & Electric						
Consider diversifying energy sources through community solar initiatives, especially projects that enable "islanding" during an outage.	High	$$$	Long	Municipal	ACRC, Conservation, Selectboard	
Petition Central Maine Power to reinforce lines in Arrowsic.	Medium	$	Short	Municipal	ACRC, Selectboard, in collaboration with Georgetown	

Implementation Table						
	Priority	Estimated Cost	Length of Time to Accomplish	Scale	Competence	Funding Opportunities
Groundwater Resources & Water Supply						
Collaborate with regional efforts to understand impacts of saltwater intrusion.	High	$	Ongoing	Municipal/ Regional	ACRC/MCOG	
Update the existing 1989 Wellhead study. Capture location, depth, recharge rate, mineral levels (at least potassium), well history (has it been redrilled, hydro-fractured, deepened, etc.).	High	$-$$	Medium	Municipal	ACRC	
Conduct a hydrologic assessment of groundwater resources, including current wells and future capacity.	High	$$$	Long	Municipal	ACRC	
Educate and encourage residents to adopt water conservation measures.	Medium	0	Ongoing	Municipal	ACRC/Conservation	
Encourage homeowners to implement water recycling systems.	Low	0	Ongoing	Municipal	ACRC/Conservation	
Surface & Water Resources						
Prioritize conservation and management of significant freshwater habitat.	High	$ - $$$	Ongoing	Municipal	ACRC/Conservation	
Educate community members on best practices for limiting runoff, including maintaining healthy native plant buffers.	High	$	Ongoing	Municipal	ACRC/Conservation	
Require new development to incorporate Low Impact Development standards, limit the amount of impervious surfaces allowed.	Medium	$-$$	Medium	Municipal	Planning Board	
Restrict pesticide use on town owned property and roadways.	Low	$	Short	Municipal	Town Owned Lands/ Roads Committee/ ACRC	
Environmental Resources: Coastal Erosion & Salt Marsh Migration						
Identify and conserve open land adjacent to priority wetlands.	High	$$$	Long	Municipal/ Regional	Conservation	
Consider adding a Climate Change Observatory Network site or a similar community science site to document change over time at priority wetlands.	Medium	$	Short	Municipal	ACRC	
Environmental Resources: Habitat Protection & Species Change						
Adopt Stream Smart culvert requirements in new road projects and subdivisions.	High	$ - $$	Short	Municipal	ACRC/Planning Board/ Roads Committee	
Prioritize conservation of the most vulnerable habitat types in Arrowsic, such as riparian areas and land adjacent to salt marshes.	High	$$$	Long	Municipal	Conservation	

Implementation Table						
	Priority	**Estimated Cost**	**Length of Time to Accomplish**	**Scale**	**Competence**	**Funding Opportunities**
Environmental Resources: Habitat Protection & Species Change						
Understand implications and work to reduce populations of particularly damaging species, green crabs, woolly adelgid, etc.	Medium	$	Ongoing	Municipal	ACRC/Conservation/ Shellfish	
Conduct a natural resource inventory. Maintain data in a GIS format so it can be monitored, updated, and visualized over time.	Low	$$	Med	Municipal	Conservation	
Encourage participation in existing citizen science projects to monitor species changes.	Low	$	Short	Municipal	ACRC	
Emergency Response						
Conduct a confidential survey of vulnerable households (e.g., older adults, people with life-sustaining equipment that uses electricity, those with mobility difficulties, etc.) to inform emergency response.	High	$	Short	Municipal	AFD	
Identify priorities for investment and identify funding opportunities to support AFD.	High	$ - $$$	Ongoing	Municipal	AFD	
Develop a non-emergency communications plan to incorporate updates from the AFD into Town communications and generate community awareness of AFD's volunteer needs.	Medium	0	Short	Municipal	AFD	
Update the town road map for use by the AFD.	Low	$	Short	Municipal	Roads Committee/ AFD	
Create a Community Emergency Response Team (CERT).	Low	?	Medium	Municipal	AFD	
Implement a standardized house addressing program.	Low	0	Short	Municipal	AFD/ Sagadahoc Emergency Management	
Map private drives to make emergency response more efficient.	Low	$	Short	Municipal	AFD/ Planning Board/ Addressing	
Designate an emergency alert official to join the Integrated Public Alert and Warning System (IPAWS).	Low	0	Short	Municipal	Roads Committee/ AFD	
Designate funding in the Town Budget for providing standardized/approved address stickers/signs or create a program for residents to purchase signs from the town.	Low	$	Short	Municipal	AFD/Selectboard	
Create an Addressing Committee.	Low	0	Short	Municipal	Selectboard	

Implementation Table

	Priority	Estimated Cost	Length of Time to Accomplish	Scale	Competence	Funding Opportunities
Community Resilience						
Maintain and strengthen channels of communication between committees. Consider implementing regular meetings or email updates between committee chairs.	High	0	Short	Municipal	ACRC/All	
Develop a system to encourage neighbors to check in on neighbors during emergencies, and to provide aid to people who need it. This could include a phone tree or a "buddy program" to pair individuals in need with a check-in partner/neighbor.	High	$	Ongoing	Municipal	ACRC	
Incorporate chances for public input and workshops into community planning and projects at every possible step.	Medium	$ - $$	Ongoing	Municipal	Selectboard	
Re-invigorate the Food Co-op.	Low	?	Short	Municipal	?	
Have an annual upcycle/recycle party	Low	$	Short	Municipal	Recycling Committee	
Public Health						
Coordinate with the AFD to ensure that vulnerable people are contacted during heat waves, power outages, or other emergencies.	High	$	Ongoing	Municipal	?	
Understand various options for reducing populations of disease-carrying pests. Create programs to control the populations of these pests while balancing water quality standards.	High	$ - $$$	Ongoing	Municipal	ACRC/Conservation	
Create a system for residents to report information about the spread of pests and disease in the community.	Medium	$ - $$	Short	Municipal	Conservation	

Implementation Table						
	Priority	Estimated Cost	Length of Time to Accomplish	Scale	Competence	Funding Opportunities
Energy Efficiency						
Provide information to residents about the savings available through Efficiency Maine credits for energy audits, insulation, and efficient appliance upgrades.	High	0	Ongoing	Municipal	ACRC	
Developing bike lanes/paths to encourage non-auto travel.	High	$$	Long	Municipal	ACRC	
Create guidance for weatherization of existing houses and structures and aid for weatherization for vulnerable households	Medium	$$	Medium	Municipal	ACRC	
Keep track of energy use in Town buildings to understand use and be able to compare impacts of future improvements.	Low	0	Ongoing	Municipal	Town Property Committee	
Consider adopting the IECC 2021 "Stretch" building and energy efficiency code.	Low	0	Medium	Municipal	Codes	
Conduct energy audits of Town buildings with an Efficiency Maine approved contractor. Prioritize efficiency improvements to lower energy consumption and operating costs.	Low	$$	Medium	Municipal	ACRC/Town Property Committee	
Install EV charging locations at town hall/fire barn.	Low	$$	Short	Municipal	ACRC	
Waste Efficiency						
Create a resident education & outreach program.	High	$	Short	Municipal	Recycling	
Create a Town Waste Efficiency Ordinance.	High	0	Short	Municipal	Recycling	
Invest in the Town's Composting Program.	Medium	$$	Medium	Municipal	Recycling	
Housing & Built Environment						
Map all private drives and incorporate this information into emergency services and planning.	High	$	Short	Municipal	AFD/ Roads Committee	
Develop shoreline erosion control standards. This could include native plantings or other natural stabilization measures.	High	$$	Medium	Municipal	ACRC/Codes/ Planning Board	
Adopt Low Impact Design standards for stormwater management, for both public and private infrastructure.	Medium	$	Medium	Municipal	ACRC/Codes/ Planning Board	
Continue to participate in the National Flood Insurance Program	Medium	0	Ongoing	Municipal	Codes	

Implementation Table

	Priority	Estimated Cost	Length of Time to Accomplish	Scale	Competence	Funding Opportunities
Governance: Regional Cooperation						
Coordinate with regional planning agencies and stay updated on ongoing projects, services, and collaborative programs.	High	0	Ongoing	Municipal/ Regional	ACRC/Others	
Consider regional renewable energy opportunities including solar, wind, and tidal.	High	0	Ongoing	Municipal/ Regional	ACRC/Others	
Consider regional transportation models including EV buses, ride sharing, commuting options.	Medium	$ - $$$	Long	Regional	ACRC/Others	
Attend regional training opportunities and report back to the appropriate committees.	Low	$	Ongoing	Municipal	ACRC/Others	
Consider inter-municipal cooperation.	Low	0	Ongoing	Municipal/ Regional	ACRC/Others	
Governance: Town Policies & Ordinances						
Evaluate budget and incorporate consideration of climate change impacts into the Town's financial values.	High	0	Ongoing	Municipal	ACRC	
Incorporate predicted climate change impacts for Arrowsic into all applicable plans the community creates in the future, including comprehensive plans, open space plans, etc.	High	0	Ongoing	Municipal	ACRC/Others	
Adopt a purchasing standard for Town equipment, requiring new purchases to meet efficiency standrads, such as Energy Star rated appliances.	Low	0	Short	Municipal	ACRC	
Conduct an energy audit of Town buildings. Add foam insulation if needed	Low	$$	Medium	Municipal	ACRC	
Evaluate Town operations and develop operation policies that encourage water and energy conservation.	Low	0	Ongoing	Municipal	ACRC	

Arrowsic Climate Action Plan
Public Meeting Report

Date: September 26th 6 - 8 pm

Location: Arrowsic Fire Barn

Participants: 46, including ACRC members

Everyone was welcomed by the chair of the Arrowsic Climate Resilience Committee co—chair, Jody Jones. She introduced the consultants from Viewshed, Judy Colby-George and Madeline Tripp. Judy then gave a brief introduction to the Climate Action Plan, the planning process so far, and how the feedback of this meeting will be used to prioritize the implementation of actions in the plan. Participants then broke out into five groups of 6-10 people for the interactive portion of the meeting.

Discussion Takeaways

After these discussions, each group shared the top three words they used during their discussions, as well as the main topic they discussed. The word cloud below represents the words that were reported, with larger words being mentioned more.

Participants shared that their conversations centered around topics like groundwater resources, infrastructure (communications and roads), and marshes. There were also discussions on how to support the most vulnerable in the community. Another topic of discussion was about how to

frame success, when so many actions/tasks seem overwhelming. It will be important to prioritize where capacity and resources are used and provide a clear implementation plan.

The following sections provide more detailed responses from the notes and individual packets collected from each participant.

Exercise 1 - Thinking about the Climate Action Plan

Groups were asked to discuss the following questions at their table and record their thoughts and ideas.

1. *How do you define Climate Action?*

2. *What is the significance of Climate Action for the community of Arrowsic?*

Defining Climate Action:

- Response to impending change—both prepare for climate change and stop emissions.
- Intentional, proactive actions in response to scientific based changes in climate
- Issues are often interconnected—restoring marshes results in better flood protection for infrastructure. Need to prioritize actions that will have the greatest impacts.
- Mitigation of the impacts to our lives and the environment.
- Building a more sustainable future.
- Prevention of further temperature increase through stopping emissions now.

Needs/Concerns:

- Timeline for actions
- Strengthen local communication.
- Collaboration with neighboring communities
- Keep scope of actions manageable
- Do not redo work that has already been done.
- Collective, community-wide thinking/discussion/action
- Burnout in volunteer base, small population, and changing demographics make capacity building even more important. How can the Town enlist help—contracting work out, securing funding, collaborating with regional projects.
- Lack of control over state/regional jurisdictions
- Data on groundwater is important.
- Make sure that appropriate committees are pulled into planning and implementation planning.
- Ensure that plant life can survive and thrive in changing climate.

Values and Ideas:

- Align with goals for state of Maine
- Individual action matters, but also collaborating with neighboring communities.
- Prioritizing safety, and then protecting people's net worth (property, wells, septic)

- Access for first responders
- Protecting marshes, wildlife, and ecosystem function
- Include consideration of vulnerable groups, such as those who will need help during a power outage.
- Consider microgrids and creating an electrical grid capable of islanding.
- Strengthen communication between neighbors, first responders, etc.
- Roads, especially to Midcoast Hospital
- What's needed for human-created environment (rising tide and causeway)
- Need timeline for actions.
- Strengthen local communication.

Exercise 2 – Topic Prioritization

Groups were asked to spend some time discussing the broader topics/categories discussed in the Climate Action Plan and then vote on the ones they felt were most urgent or important, as well as any topics they felt were missing. Each participant was given three dots to distribute among the topics however they liked.

Roads & Bridges was the topic that received the most votes, followed by Groundwater Resources and Coastal Erosion and Marsh Migration. Many groups connected actions adapting to marsh migration to the resilience of transportation infrastructure. Several groups also highlighted the importance of maintaining roads to the ability of emergency services to respond/provide care. This underscores the urgency felt about the effect of sea level rise on roads, and how barriers to access undermine the community's resilience during emergencies. Every topic received at least some votes, and many groups discussed the interconnectedness of each of these topics. See the following chart for the full results.
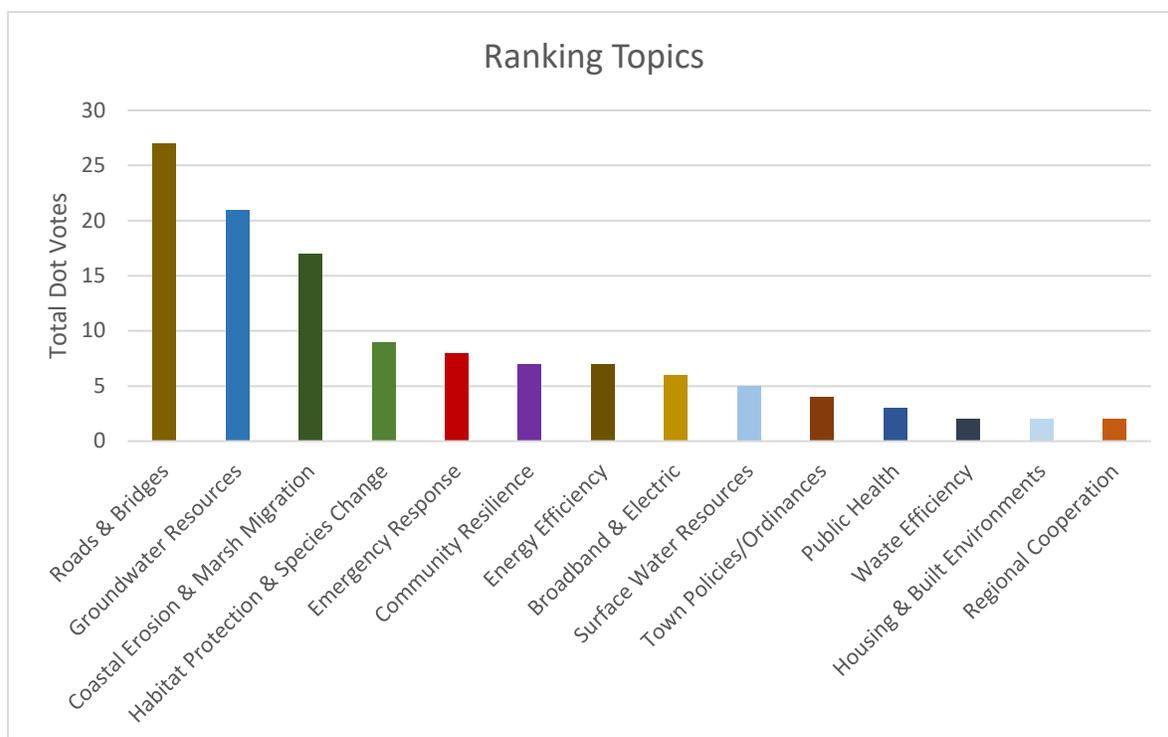
These rankings can be used to inform the organization and prioritization of each of the topics/issues that the plan addresses. Based on these results, the topics were reordered in the list below. Common themes were kept together (infrastructure, environmental resources, etc.) to preserve the progression of the sections. These results will also be used to prioritize the implementation table.

Infrastructure	**Roads & Bridges**
	Broadband & Electric
Water Resources	**Groundwater Resources**
	Surface Water Resources
Environmental Resources	**Coastal Erosion & Marsh Migration**
	Habitat Protection & Species Change
Response & Resilience	**Emergency Response**
	Community Resilience
	Public Health
Efficiency	**Energy Efficiency**
	Waste Efficiency
Housing & Built Environments	**Housing & Built Environments**
Governance	**Regional Cooperation**
	Town Policies/Ordinances

Exercise 3 – Prioritizing Actions

Finally, individuals were asked to select their top two actions from the recommendations in each section of the plan. Then, the groups came together to discuss their thoughts about the actions, as well as any additional actions or changes they wanted to suggest.

Below are the results tallied from the meeting packets that were collected at the end of the meeting, organized by section. These rankings will be used to create the implementation plan and to decide what actions are prioritized.

1 Surface Water Resources		Total	% of section votes
1.1	Prioritize conservation and management of significant freshwater habitat.	20	32.8%
1.2	Educate community members on best practices for limiting runoff, including maintaining healthy native plant buffers.	20	32.8%
1.3	Require new development to incorporate Low-Impact Development standards, limit the amount of impervious surfaces allowed.	13	21.3%
1.4	Restrict pesticide use on town owned property and roadways.	8	13.1%

2 Groundwater Resources		Total	% of section votes
2.1	Collaborate with regional efforts to understand impacts of saltwater intrusion.	23	39.7%
2.2	Update the existing 1989 Wellhead study. Capture location, depth, recharge rate, mineral levels (i.e. potassium), well history.	21	36.2%
2.3	Educate and encourage residents to adopt water conservation measures.	9	15.5%
2.4	Encourage homeowners to implement water recycling systems.	5	8.6%

3 Environmental Resources: Habitat Protection & Species Change		Total	% of section votes
3.1	Prioritize conservation of the most vulnerable habitat types in Arrowsic, such as riparian areas and land adjacent to salt marshes	22	37.9%
3.2	Adopt Stream Smart culvert requirements in new road projects and subdivisions.	15	25.9%
3.3	Understand Implications and work to reduce populations of potentially damaging species (e.g., woolly adelgid, green crabs)	8	13.8%
3.4	Conduct a natural resource inventory. Maintain data in a GIS format so it can be monitored, updated, and visualized over time.	7	12.1%
3.5	Encourage participation in existing citizen science projects to monitor species changes.	4	6.9%
3.6	Conduct more detailed soil studies to understand the impacts of climate change on the soil characteristics and plants they can support.	2	3.4%

4 Environmental Resources: Coastal Erosion & Marsh Migration		Total	% of section votes
4.1	Identify and conserve open land adjacent to priority wetlands.	28	52.8%
4.2	Consider adding a community science site to document change over time at priority wetlands.	19	35.8%
4.3	Study boat speeds around the island and impacts to the shoreline. Consider speed limit modifications.	6	11.3%

5 Waste Efficiency		Total	
5.1	Create a resident education & outreach program.	22	48.9%
5.2	Invest in the Town's Composting Program.	14	31.1%
5.3	Create a Town Waste Efficiency Ordinance.	9	20.0%

6 Transportation & Infrastructure: Broadband & Electric		Total	% of section votes
6.1	Consider diversifying energy sources through community solar initiatives, especially projects that enable "islanding" during an outage.	28	54.9%
6.2	Petition Central Maine Power to reinforce lines in Arrowsic.	16	31.4%
6.3	Implement Broadband Plan for Town.	7	13.7%

7 Transportation & Infrastructure: Roads & Bridges		Total	% of section votes
7.1	Incorporate resilience to sea level rise into the Capital Improvement Plan, including installing culverts able to handle 3.9 ft of sea level rise by 2100, implementing stormwater management and/or raising road surfaces as a part of normal road improvements.	15	22.7%
7.2	Coordinate with Georgetown and Maine Department of Transportation on road improvement projects.	15	22.7%
7.3	Create an emergency response plan for flood scenarios and incorporate sea level rise and the Federal Emergency Management Act's Flood Insurance Rate Maps (FIRM) into emergency planning.	13	19.7%
7.4	Adopt the Maine Coastal Program's Coastwise Approach and Maine Audubon's Stream Smart Crossing Guidelines as standard practice for culvert and bridge improvements. Identify vulnerable crossings and apply for DEP improvement funds.	11	16.7%
7.5	Encourage marsh restoration and resilience practices, both on Town lands (area near bridge) and on private properties.	11	16.7%
7.6	Educate private road owners about sea level rise impacts and Stream Smart culverts and other best practices for resilient road design.	1	1.5%
7.7	Create standards for new subdivisions roads that are candidates for Town adoption, which require incorporating sea level rise in the design process (including culvert design).	0	0.0%

8 Housing & Built Environments		Total	% of section votes
8.1	Develop shoreline erosion control standards for the Town. This could include native plantings or other natural stabilization measures.	16	30.2%
8.2	Map all private drives and incorporate this information into emergency services and planning.	14	26.4%
8.3	Adopt Low Impact Design standards for stormwater management, for both public and private infrastructure.	13	24.5%
8.4	Continue to participate in the National Flood Insurance Program	10	18.9%

9 Public Health		Total	% of section votes
9.1	Create a system for residents to report information about the spread of pests and disease in the community	11	22.0%
9.2	Coordinate with the AFD to ensure that vulnerable people are contacted during heat waves, power outages, or other emergencies.	23	46.0%
9.3	Understand various options for reducing populations of disease-carrying pests. Create programs to control the populations of these pests while balancing water quality standards.	16	32.0%

10 Community Resilience		Total	% of section votes
10.1	Develop a system to encourage neighbors to check in on neighbors during emergencies, and to provide aid to people who need it. This could include a phone tree or a "buddy program" to pair individuals in need with a check-in partner/neighbor.	25	43.9%
10.2	Maintain and strengthen channels of communication between committees. Consider implementing regular meetings or email updates between committee chairs.	15	26.3%
10.3	Incorporate chances for public input and workshops into community planning and projects at every possible step.	9	15.8%
10.4	Re-invigorate the Food Co-op.	6	10.5%
10.5	Have an annual upcycle/recycle party	2	3.5%

11 Governance: Regional Cooperation		Total	% of section votes
11.1	Consider regional renewable energy opportunities including solar, wind, and tidal.	23	40.4%
11.2	Coordinate with regional planning agencies and stay updated on ongoing projects, services, and collaborative programs.	14	24.6%
11.3	Consider regional transportation models including EV buses, ride sharing, commuting options.	11	19.3%
11.4	Consider inter-municipal cooperation.	7	12.3%
11.5	Attend regional training opportunities and report back to the appropriate committees.	2	3.5%

	12 Governance: Town Policies/Ordinances	Total	% of section votes
12.1	Incorporate predicted climate change impacts for Arrowsic into all applicable plans the community creates in the future, including comprehensive plans, open space plans, etc.	24	49.0%
12.2	Evaluate budget and incorporate consideration of climate change impacts into the Town's financial values.	9	18.4%
12.3	Conduct an energy audit of Town buildings. Add foam insulation if needed	5	10.2%
12.4	Evaluate Town operations and develop operation policies that encourage water and energy conservation.	5	10.2%
12.5	Conduct a Town-wide greenhouse gas inventory.	4	8.2%
12.6	Adopt a purchasing standard for Town equipment, requiring new purchases to meet efficiency standards, such as Energy Star rated appliances.	2	4.1%

	13 Energy Efficiency	Total	% of section votes
13.1	Provide information to residents about the savings available through Efficiency Maine credits for energy audits, insulation, and efficient appliance upgrades.	15	25.9%
13.2	Developing bike lanes/paths to encourage non-auto travel.	15	25.9%
13.3	Create guidance for weatherization of existing houses and structures and aid for weatherization for vulnerable households.	10	17.2%
13.4	Consider adopting the IECC 2021 "Stretch" building and energy efficiency code.	6	10.3%
13.5	Install EV charging locations at town hall/fire barn.	6	10.3%
13.6	Keep track of energy use in Town buildings to understand use and be able to compare impacts of future improvements.	4	6.9%
13.7	Conduct energy audits of Town buildings with an Efficiency Maine approved contractor. Prioritize efficiency improvements to lower energy consumption and operating costs.	2	3.4%

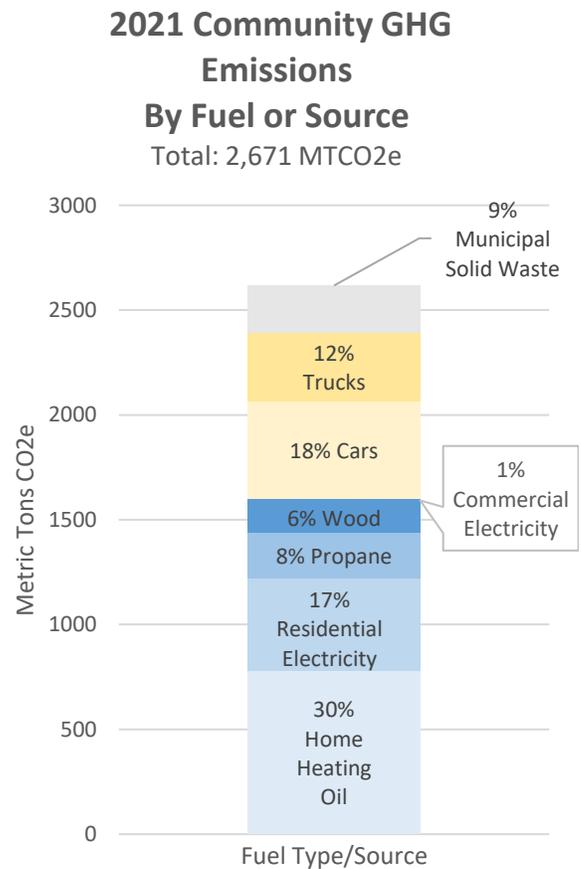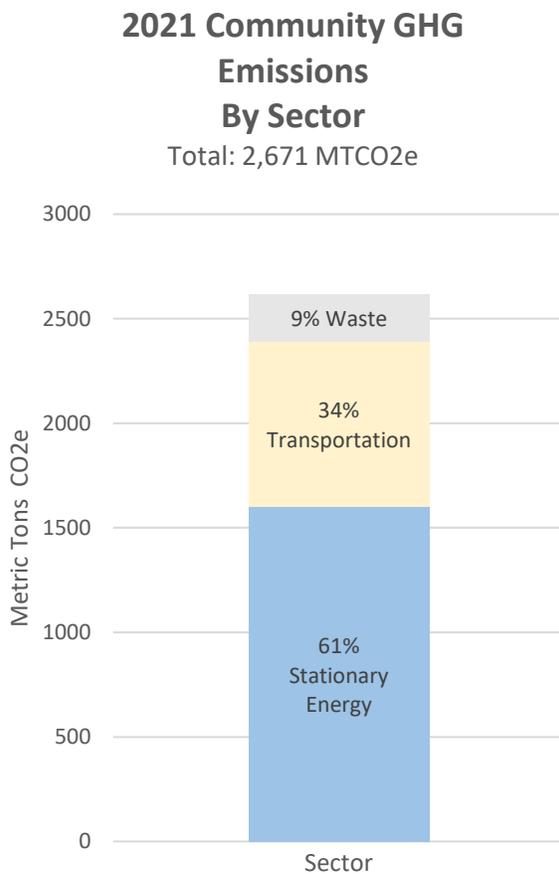| 14 Emergency Response		Total	% of section votes
14.1	Conduct a confidential survey of vulnerable households (e.g., older adults, people with life-sustaining equipment that uses electricity, those with mobility difficulties, etc.) to inform emergency response.	16	26.7%
14.2	Identify priorities for investment and identify funding opportunities to support these projects.	13	21.7%
14.3	Develop a non-emergency communications plan to incorporate updates from the AFD into Town communications and generate community awareness of AFD's volunteer needs.	8	13.3%
14.4	Create a Community Emergency Response Team (CERT).	6	10.0%
14.5	Designate an emergency alert official to join the Integrated Public Alert and Warning System (IPAWS).	6	10.0%
14.6	Create an Addressing Ordinance to set standard requirements for address signage for houses.	5	8.3%
14.7	Map private drives to make emergency response more efficient.	3	5.0%
14.8	Designate funding in the Town Budget for providing standardized/approved address stickers/ signs or create a program for residents to purchase signs from the town.	2	3.3%
14.9	Create an Addressing Committee.	1	1.7%

Arrowsic 2021 Green House Gas Emissions

Creating a green houses gas (GHG) emissions inventory involves collecting data on activities that produce or contribute to greenhouse gas emissions such as fuel consumption, energy use, and waste generation. For Arrowsic, two types of inventories were completed.

<u>Community-wide GHG Emissions Inventory</u> which provides a snapshot of emissions generated by people living, working and visiting Arrowsic.

<u>Municipal GHG Emissions Inventory</u> which focused on energy use by Arrowsic's municipal buildings.

Results - Community-Wide Inventory:
- The primary drivers of Arrowsic's GHG emissions are from the following sectors: stationary energy, transportation, and waste. These sectors can be broken down by the fuel type or source of emissions, and indicate that the two largest contributors are vehicles (30%) and residential heating oil (30%). These results are shown in the graphs below.


2021 Community GHG Emissions By Sector
Total: 2,671 MTCO2e

(Metric Tons CO2e)
- 9% Waste
- 34% Transportation
- 61% Stationary Energy

2021 Community GHG Emissions By Fuel or Source
Total: 2,671 MTCO2e

(Metric Tons CO2e)
- 9% Municipal Solid Waste
- 12% Trucks
- 18% Cars
- 1% Commercial Electricity
- 6% Wood
- 8% Propane
- 17% Residential Electricity
- 30% Home Heating Oil

- Total metric tons of carbon dioxide emissions (MTCO2E) breakdown as follows:

Fuel Type/Source	MTCO2e
Stationary Energy	
Residential Heating Oil	782
Residential Electricity	438
Propane	220
Wood	145
Commercial Electricity	14
Transportation	
Cars	467
Trucks	327
Municipal Solid Waste	224
TOTAL	**2,617**

- Transportation data reflects trips by cars and trucks within Arrowsic, and to and from adjacent towns, and adjacent counties. This gives a reasonable picture of the regular trips by drivers to and from Arrowsic and moving within town borders. A total of 1,904,570 vehicle miles[1] were driven in 2021.
- Average daily traffic to and from Bath and Brunswick accounted for 44% of the total mileage, with an estimated 164 average daily trips between Arrowsic and Bath, and an estimated 89 average daily trips between Arrowsic and Brunswick.

Results – Municipal Inventory:

- Arrowsic uses propane and electricity to power their municipal operations. Total emissions do not make a significant contribution to Arrowsic's total community GHG emissions. Breakdowns of the GHG emissions are as follows:

2021 Municipal GHG Emisssions
Total: 7.1 MTCO2e
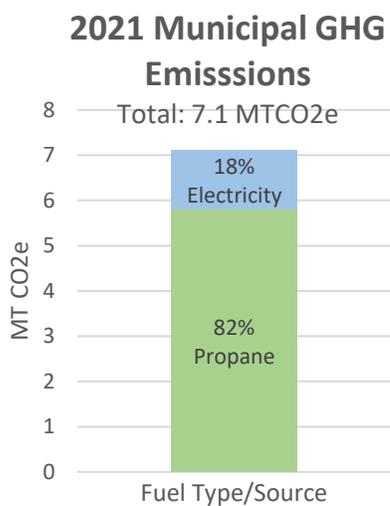
Fuel Type/Source	MTCO2e
Stationary Energy	
Propane	5.8
Electricity	1.3
TOTAL	7.1

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1 Vehicle Miles Traveled (VMT) measures the amount of travel for all vehicles in a geographic region over a given period of time, typically a one-year period.

Methodology:

This inventory was based on a protocol developed by the Southern Maine Planning and Development Commission[2] and modified to fit Arrowsic as a small, mainly residential community. The inventory excluded some sectors commonly found in a community-wide inventory such as an in-depth survey of commercial/industrial energy use, commercial vehicles, and commercial/industrial waste because emissions under these categories would be insignificant because of the low level of activity within these sectors.

The year 2021 was used as the baseline year because that was the most recent year the majority of the data was available.

Calculations were done using ClearPath, a leading online software platform for completing greenhouse gas inventories.

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[2] Greenhouse Gas Inventory Protocol for Southern Maine Cities and Towns. Southern Maine Planning and Development Commission, September 2021.