New England
Climate Adaptation
PROJECT

Stakeholder Assessment
Wells, Maine

PRODUCED BY:
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About the MIT Science Impact Collaborative

The Massachusetts Institute of Technology Science Impact Collaborative (MIT SIC) is a research group focused on developing and testing new ways of harmonizing science, politics and public policy in the management of natural resources and resolution of environmental disputes. MIT SIC's tools and approaches include collaborative adaptive management, joint fact-finding, scenario planning, collaborative decision-making and multi-stakeholder engagement, and the use of role-play simulation exercises.

MIT SIC was established in 2003 with initial support from the United States Geological Survey. Today, the research group has numerous partners and supporters, ranging from the U.S. National Estuarine Research Reserve System to the Dutch research organization TNO. By engaging in community-based action research projects, MIT SIC researchers—including doctoral students, masters students, and faculty from the MIT Department of Urban Studies and Planning—train emerging environmental professionals while simultaneously testing the latest environmental planning methods and providing assistance to communities and policy-makers who seek our help.

Visit the MIT Science Impact Collaborative website for more information: http://scienceimpact.mit.edu

About the Consensus Building Institute

The Consensus Building Institute (CBI) is a not-for-profit organization founded in 1993 by leading practitioners and theory builders in the fields of negotiation and dispute resolution. CBI's experts bring decades of experience brokering agreements and building collaboration in complex, high-stakes environments — and possess the deep understanding required to tackle negotiation and collaboration challenges in our practice areas. CBI's Founder, Managing Directors, and many of our Board members are affiliated with the Program on Negotiation at Harvard Law School and the MIT-Harvard Public Disputes Program.

Visit the CBI website for more information: http://www.cbuilding.org

About the Wells National Estuarine Research Reserve

The National Estuarine Research Reserve System (NERRS) is a network of 28 areas representing different biogeographic regions of the United States that are protected for long-term research, water-quality monitoring, education and coastal stewardship. The reserve system is a partnership program between the National Oceanic and Atmospheric Administration (NOAA) and the coastal states. Reserve staff work with local communities and regional groups to address natural resource management issues, such as non-point source pollution, habitat restoration and invasive species. Through integrated research and education, the reserves help communities develop strategies to deal successfully with these coastal resource issues. Reserves provide adult audiences with training on estuarine issues of concern in their local communities. They offer field classes for K-12 students and support teachers through professional development programs in marine education. Reserves also provide long-term water quality monitoring as well as opportunities for both scientists and graduate students to conduct research in a "living laboratory".

The Wells National Estuarine Research Reserve works to expand knowledge about coasts and estuaries, engage people in environmental learning, and involve communities in conserving natural resources, all with a goal of protecting and restoring coastal ecosystems around the Gulf of Maine. The Wells Reserve protects 2,250 acres of salt marsh, freshwater wetland, beach, dune, forest, and field.

Visit the Wells Reserve website for more information:
http://www.wellsreserve.org/

Executive Summary

The purpose of this document is to capture the opinions of diverse Wells stakeholders about the possible local impacts of climate change and the intensity of their concerns, as well as the extent of current local action and potential barriers and opportunities to climate change adaptation. Climate change adaptation refers to a suite of actions that a community may take to reduce its vulnerability and increase resilience to the potential impacts of climate change. This report was used to guide the New England Climate Change Adaptation Project in developing a role-play simulation that focuses on climate change risks and stakeholder dynamics that are relevant to Wells.

This stakeholder assessment summarizes the findings of 15 stakeholder interviews carried out by Erica Simmons, a graduate research assistant with the MIT Science Impact Collaborative, with support from the MIT Science Impact Collaborative, the Consensus-Building Institute, Wells Reserve, and the Town of Wells. Staff from the Wells Reserve and the Town of Wells helped to identify a list of stakeholders that represented a range of relevant viewpoints in Town about climate change and adaptation. The semi-structured interviews focused on interviewees' knowledge and concern about climate change risks and potential adaptation actions. This assessment is a portrait of their perceptions and opinions.

This stakeholder assessment focuses on three main areas:

- Climate Change-Related Concerns and Identified Risks summarizes the climate change impacts that stakeholders discussed. This section includes stakeholders' perceptions of risks and opportunities from climate change.
- Local Activity summarizes the current actions of Town, regional, State, Federal, and non-governmental actors related to climate change adaptation in Wells.
- Opportunities and Challenges for Moving Forward summarizes the primary opportunities and challenges which stakeholders discussed that affect Wells' ability to take adaptive actions.

Climate Change-Related Concerns and Identified Risks

The most often-stated climate change-related concerns that interviewees mentioned are beach erosion and threats to coastal property from sea level rise and intensified storms. Every stakeholder mentioned these risks and agreed that they were the Town's primary climate change vulnerabilities. Because coastal tourism is Wells' primary industry, stakeholders expressed concern about both property loss and infrastructure damage, and the effects of these impacts on the Town's economy and fiscal health. Some stakeholders also mentioned concern about negative impacts on the Town's marshes, declining water quality due to increased runoff, and increased diseases resulting from warmer temperatures and the spread of disease vectors, such as Lyme disease-bearing ticks.

Local Activity

Currently, the Town of Wells does not have many programs explicitly addressing climate change adaptation. However, there are various efforts underway at the regional and state agency level to address and plan for sea level rise and other climate change impacts. The Town's recent Draft Harbor Plan states that the Town should consider sea level rise projections in planning harbor infrastructure. In the Southern Maine region, the Southern Maine Regional Planning Commission is working to coordinate local data gathering and planning efforts on climate change adaptation, particularly through the Sea Level Adaptation Working Group (SLAWG) and the Coastal Hazard Resiliency Tools Project (CHRT), a partnership with the Maine Geological Survey. State and federal agencies, such as the Maine Emergency Management Agency (MEMA), the Maine Floodplain Management Program, the Maine Department of Environmental Protection (DEP), the Federal Emergency Management Agency (FEMA), and the U.S. Environmental Protection Agency (EPA) also play regulatory and/or support functions in adaptation-related efforts.

Opportunities and Challenges for Moving Forward with Adaptation

The most commonly mentioned obstacle cited to moving forward with climate change adaptation is a lack of knowledge about or belief in climate change among Wells residents. Interviewees stated that up to half of the town does not believe that climate change poses a risk to Wells, which makes it difficult to build local political will for adaptation actions. As a result, stakeholders generally agreed that the most important next step for moving forward with adaptation planning in Wells is to increase residents' understanding of climate change risks and enhance the level of political support for adaptation options through outreach and educational opportunities. Other primary obstacles that interviewees identified were financial constraints, which make costly actions difficult, and state and federal regulatory constraints.

Some stakeholders said that recent research and data-gathering activities by the Maine Geological Survey and Southern Maine Regional Planning Commission, such as the Sea Level Adaptation Working Group (SLAWG) and the Coastal Hazard Resiliency Tools Project (CHRT) provide new opportunities for action by providing technical assistance and a forum for municipalities to discuss potential adaptation actions. Other stakeholders emphasized that there are untapped opportunities for collaborations between municipalities in Southern Maine through collaboration on emergency service provision or public utilities such as water and sewage services. A few stakeholders also focused on the opportunity to pursue projects with benefits in addition to reducing climate change risk, such as encouraging economic development in areas that are less vulnerable to flooding or increasing infrastructure's resilience to climate change as well as other types of hazards.

Project Overview

The Massachusetts Institute of Technology Science Impact Collaborative is working with four National Estuarine Research Reserve System (NERRS) sites, and the Consensus Building Institute to test an innovative way to help coastal communities understand and prepare for the potential impacts of climate change. With a grant from the NERRS Science Collaborative, the team is engaging four New England communities – Wells, Maine; Dover, New Hampshire; Barnstable, Massachusetts; and Cranston, Rhode Island – in testing the use of role-play simulations as a means to educate the public about climate change threats and to help communities explore ways of decreasing their vulnerability and enhancing their resilience. One of the NERRS sites is the Wells Reserve at Laudholm in Maine. The nearby community they have chosen to engage is the Town of Wells. The project partner in Wells is the Wells Town Manager.

The purpose of this stakeholder assessment is to reveal the different attitudes and perspectives of key groups of people in Wells regarding managing the risks of climate change impacts. Of particular interest to the team is stakeholders' level of concern about climate change risks and what they think should be done to manage these risks. Since climate change risks will be managed within the context of other risks and opportunities, we are also interested in understanding the top priorities of Wells stakeholders, whether they are directly related to climate change or not. This assessment will guide the project team in developing a role-play simulation that will include roles and perspectives that are relevant in the context of in Wells' local decision-making.

With assistance from staff at the Town of Wells and the Wells Reserve, the project team developed an initial list of approximately 20 potential interviewees, which expanded as interviewees recommended other stakeholders to interview. The interviewees were selected to represent a variety of different stakeholder groups, from elected officials and Town staff to public utilities providers, business owners, environmental advocates, and property owners. Over the course of approximately six weeks, Erica Simmons, a graduate student research assistant from MIT, interviewed 15 different stakeholders in Wells. For more information about

Stakeholder Group	Number of Interviews
Town Government (Staff)	4
Town Government (Elected)	1
Regional Government (Staff)	2
State Government (Staff)	1
Business	1
Environmental Organization	2
Science / Engineering / Consulting	2
Property Owners	1
Education	1
Total Interviews	*15*

Figure 1: Interviewees by Stakeholder Group

Erica, see the acknowledgements page. A complete list of the interviewees is included in Appendix A. The following table shows the breakdown of interviewees based on the stakeholder group categories they were selected to represent.

The interviews took place in-person and over the phone and lasted approximately one hour. The interview questions began with brief questions about the interviewees and their connection to Wells, then focused on local climate change-related risks, local and regional activities underway to reduce climate-related risks, and local decision-making. Interviewees were told that statements would not be attributed to them and that they would have a chance to review the document before it was finalized. During the course of the interview, interviewees were shown a table of climate change projections for temperature and asked about their reactions to those forecasts. The full set of interview questions is listed in Appendix B. The table of projections and how they were produced is included in this report as Appendix C.

Key Findings

This section reflects perspectives shared by participants during the interview process on a range of themes. Their perspectives may be contradictory in some cases and largely overlap in others. The statements are an expression of viewpoints, understandings, and opinions. The assessment is not an attempt to create an independent set of "facts" on these issues, but rather captures a range of views, interests, and values on the topics discussed. The different sub-sections here seek to capture the range of views, indicating when there seemed to be broad agreement and when opinions were more varied. Statements in this section represent the perspective of the interviewees, not the project team.

Town Profile

Situated on the southern coast of Maine, Wells is home to just under 10,000 year-round residents. However, as a popular beach vacation spot, the population of the town triples during the summer and fall to approximately 40,000 people. In 2010, the racial makeup of the year-round population was 98.5% Caucasian, 1.2% Latino or Hispanic, 0.9% Native American, 0.8% Asian and 0.8% African American. The 2010 median household income was $62,896, and 3.2% of families and 5.3% of individuals were below the poverty line. Industries in Wells include tourism, commerce, resource extraction (quarrying and logging), and commercial fishing. Wells is home to an ecologically diverse estuary and two federal nature preserves, the Wells National Estuarine Research Reserve, managed jointly by NOAA and the Laudholm Trust, and the Rachel Carson National Wildlife Refuge, managed by the U.S. Fish and Wildlife Service. Wells is notable for its sandy barrier beaches and marsh system, a unique ecological setting in the state of Maine.

Key Players

In the course of interviews, stakeholders discussed who they believe is doing adaptation-related work, or who they believe should be involved in managing climate change risks. This section describes a list of agencies, organizations, and stakeholder groups who interviewees said play or will play an important role in adaptation actions in Wells. Note, this is not intended to be a comprehensive list of all individuals and organizations that will play a key role in climate change adaptation.

Many interviewees think that government agencies have an important role to play in adaptation efforts, although many interviewees also emphasized the importance of personal responsibility for resilience and questioned the extent to which government can address the problem. Interviewees mentioned several departments within the Town of Wells.

- **Planning Department** for their role in land use planning, permitting, floodplain management, and public education
- **Code Enforcement Department** for their role enforcing development requirements, including in the shoreland zone
- **Highway Department** for their role in managing the Town's road infrastructure

- **Police, Fire, and Emergency Management departments** for their role in emergency response
- **Harbormaster** for role managing Wells Harbor
- **Town Manager** for role in fiscal management and policy development
- **Board of Selectmen** for their role in legislative efforts

A more limited number of interviewees were aware of some of the non-governmental or regional governmental actors that play a key role in local infrastructure.

- **Kennebunk Kennebunkport Wells Water District:** provides municipal water service to parts of Wells. (The more developed coastal and central areas of Wells are served by KKWWD, while more rural inland development is generally served by private wells.)
- **Wells Sanitary District:** provides sewage treatment for the Town of Wells.

Interviewees mentioned an array of public and non-profit organizations with an active role in environmental protection, stewardship, and education:

- **Wells Conservation Commission** for their role in land preservation and environmental stewardship
- **Wells Reserve at Laudholm (NOAA NERRS and the Laudholm Trust)** for their role managing the Wells Reserve, conducting coastal and estuarine research, and providing environmental education and technical assistance
- **United States Fish and Wildlife Service (USFWS)** for their role managing the Rachel Carson National Wildlife Refuge
- **Maine Coast Heritage Trust,** a non-profit land trust, for their role in purchasing open space land
- **Great Works Regional Land Trust,** a non-profit land trust, for their role in purchasing open space land
- **Wells-Ogunquit Community School District** for their role in environmental education

Stakeholders also mentioned an array of regional, state, and federal governmental agencies involved in programs and policies related to hazards and the environment that would be important to involve in local adaptation activities.

- **Southern Maine Regional Planning Commission (SMRPC)** for their role in providing planning resources and technical assistance to local municipalities and facilitating regional collaboration
- **Maine Floodplain Management Program (Department of Agriculture)** for their role in administering the National Floodplain Insurance Program and developing shoreland zoning regulations within the State of Maine
- **Maine Department of Environmental Protection (DEP)** for their role in regulating stormwater and coastal infrastructure, such as seawalls and the Wells Harbor

- **Maine Geological Survey (MGS)** for their role in researching coastal hazards and providing technical assistance to local governments
- **Federal Emergency Management Agency (FEMA)** for their role with Flood Insurance Rate Maps, hazard mitigation, and flood recovery efforts
- **Environmental Protection Agency (EPA)** for their role in stormwater and wastewater regulations

Many interviewees think it is important to have business stakeholders and community organizations involved in adaptation efforts, as well. Those organizations mentioned frequently include:

- **Wells Chamber of Commerce**
- **Wells Rotary Club**
- **Wells Lions Club**
- **St. Mary's Church**

In addition, some interviewees noted the importance of involving people who live and work in vulnerable areas in adaptation efforts. Property owners in Drake's Island, Moody Beach, and Wells Beach have organized neighborhood associations. In addition, Save Our Shores (S.O.S.) Maine is a statewide organization devoted to protecting coastal property in Maine. Stakeholders indicated that, due to coastal property owners' vulnerability, it is important to include these organizations in adaptation planning. However, because a substantial proportion of Wells' year-round, voting population lives inland, some interviewees expressed a need to include inland residents, as well. At this time, inland residents in Wells do not appear to be well organized; interviewees did not discuss active neighborhood associations except for on the coast.

Many interviewees said they think it is important to get youth and schools involved in climate change adaptation efforts. While young people may not be key players in decision-making in the near-term, interviewees said it is important that they be aware of climate change risks and adaptation. This perspective seems to come from two different logics. Some interviewees acknowledge that climate change is something that our society will have to deal with for a long time to come, so there is the need to get the next generation prepared. On the other hand, this perspective may be driven by a logic that climate change risks are a long ways off, so they are something to be dealt with by future generations, rather than something to be dealt with today.

Level of Concern about Climate Change Risks

Stakeholders in Wells exhibit wide-ranging levels of concern regarding climate change risks, from very concerned to not at all concerned. In general, interviewees working in the public sector, science and engineering, or environmental services expressed a higher level of concern about climate change impacts than other interviewees did. However, there are exceptions to this trend. Some public sector interviewees did not express substantial concern, while certain business owners and property owners expressed high levels of concern due to their perceived vulnerabilities to climate change risks.

Many stakeholders said they are very concerned about climate change impacts, especially the increased risk of flooding along the coast; the most concerned interviewees tended to be people who are responsible for public services that have been or will be affected by climate change, business and property owners that have already experienced disruptions or property damage due to a climate-related event, and people who work in the environmental services industry. When asked what could be done to prepare for climate change, the general sentiment from most stakeholders was that there is very little the Town could realistically do, particularly to protect coastal properties.

The majority of interviewees stated that a substantial percentage (up to 50%) of the Town's residents do not believe that climate change is taking place. We contacted multiple people who were thought to hold this perspective, but these stakeholders were either unwilling or unable to participate in interview. As a result, we were not able to talk to any stakeholders representing the viewpoint that climate change is not occurring.

Some of the interviewees we talked with questioned whether the causes of climate change are anthropogenic, but they did recognize that climatic patterns have already changed in Wells, commenting on warmer weather, warmer oceans, and more intense storms. A number of interviewees said that they avoid using language about climate change when discussing climate risks with the public. Instead, they talk about how to manage severe weather and coastal hazards, without discussing climate change explicitly. A few stakeholders who work in environmental services described how they start conversations about climate change adaptation by stating at the outset that they are not concerned with talking about the causes of climate change, only about its effects, such as sea level rise and increasingly intense storms, to avoid alienating their potential audience. "A lot of people may not believe that climate change is anthropogenic, but they do agree that sea levels have been rising, and they are willing to talk about that," said one interviewee.

When shown climate change projections (see Appendix C), some private and public sector stakeholders described this information as "eye-opening." They tended to pay special attention to sea level rise projections, extreme precipitation projections, and the projected number of additional days above 90 degrees Fahrenheit. Others did not find the projections particularly surprising, saying they have seen similar climate change projections before. Interviewees who work in science and engineering and environmental services were more likely to have seen similar projections, as had some public sector stakeholders.

When asked whether and how Wells should manage climate change risks, some interviewees expressed concern that the high-emissions scenario in the long term was beyond what they believed Wells could respond to, especially in terms of sea level rise which would result in large portions of the coast being inundated. A few stakeholders who own property near waterways expressed concern that, if the high-end projections came true, their properties would not be safe. One stakeholder stated that the sea level rise and extreme precipitation projections made them think about selling their house.

Others expressed confidence that the Town would be able to adapt incrementally to the effects of climate change, at least in the short and medium term. Some stakeholders expressed an optimism that Maine's residents are already resilient due to the state's culture of rural self-reliance, indicating that individuals in Maine would be able to adapt to climate change impacts more easily than residents of more urban states. A few interviewees made statements about how climate change would affect the character and identity of Maine – such as, "looks like it'll feel a lot more like North Carolina up here." A few interviewees stated that climate change may also have economic benefits for Wells, especially if warmer weather extends the "shoulder season" (the periods of spring and autumn when tourists visit outside of the summer peak), or if more summer residents decide to live in Wells year-round because it has warmer winters and less snow than at present.

Identified Climate Change Risks and Vulnerabilities

During interviews, interviewees were asked to reflect on what they think are the greatest climate change risks facing Wells, as well as what they see as Wells' greatest vulnerabilities to climate change. The responses and concerns that emerged throughout the interviews are described here.

Beach Erosion

The economy of Wells depends heavily on tourism, with its beaches and coastal marshes as primary attractions. Wells has a barrier beach system with sandy beaches. The barrier beaches in Wells are heavily built up with residential development, including many high-value homes for year-round and summer residents. Over the past decades, Wells has experienced substantial beach erosion, which threatens the town's tourist economy and the safety of homes along the shore. In addition to the economic impacts of beach erosion, the potential loss of Wells' beaches threatens the identity of the town, since the beaches are a key part of what makes Wells unique. Therefore, many residents listed beach erosion as one of their primary concerns.

Sea Level Rise, Intense Storms, and Flooding

Flooding of low-lying coastal areas and areas along inland streams was one of the biggest concerns expressed by interviewees. All stakeholders interviewed expressed concerns about threats to coastal properties from intense storms and/or sea level rise. All interviewees expressed concerns that the neighborhoods along Wells' barrier beaches are already vulnerable to storms the town has experienced in the past decade. If sea level rises and storms become more frequent and/or more intense, interviewees stated, these properties would be even more at risk. Several interviewees expressed concern that under the long-term, high-emissions projections for sea level rise, they could not see how the coastal areas of Wells could be preserved, unless the Town were to build a very costly, engineered solution like a sea wall or tide gate. Several interviewees expressed concern about how the Town would handle rebuilding in the aftermath of a severe storm, and whether the Town would be able to rebuild in a way that would make it less vulnerable.

Beach erosion and coastal flooding have been particularly severe during recent intense storms, such as the Mother's Day storm in 2006 and the Patriot's Day storm in 2007. Several interviewees observed a recent increase in intense storms, remarking that Wells has had multiple 100-year storms in the past decade. These threaten physical damage to coastal homes and to the Town's infrastructure along the coast, such as roads and sewer infrastructure. They also increase the Town's needs for emergency preparedness and response services. In addition, the Town faces a larger threat to its fiscal position due to coastal flooding: approximately two-thirds of the Town's land valuation is between the Atlantic Ocean and Route 1, and a significant loss of property value along the coast would threaten the Town's ability to fund government services throughout Wells. Therefore, different stakeholders in Wells are concerned about flooding for different reasons.

Water Quality

A smaller number of stakeholders interviewed expressed concerns about preserving Wells' water quality. Increased runoff from storms and more winter precipitation as rain rather than snow could cause more sedimentation of Wells' waterways and marshes. More intense storms could also overwhelm the town's capacity for stormwater management, leading to more stormwater discharges that would compromise water quality.

Extreme Temperatures

A smaller segment of interviewees are concerned about extreme temperatures. Because Wells is on the coast, people noted that its temperatures would likely remain relatively moderate compared to inland communities. Interviewees also noted that Maine may become comparatively more attractive, as communities farther south become hotter. Most interviewees did not express strong concern about the effects of extreme hot days in Wells, but some expressed sadness that hotter temperatures would make Wells feel like a different place. Some also expressed concern that increased temperatures could change what plants grow in the region and what types of wildlife are present.

A few interviewees expressed concern about the potential impacts of higher ocean temperatures, particularly on the economic viability of the local fishing industry. They also noted that they have already observed, anecdotally, some changes in fish populations in the Gulf of Maine near Wells.

Health

A few stakeholders expressed concerns about pests and vector borne diseases increasing as a result of warmer weather and more standing water resulting from increased precipitation. In particular, interviewees mentioned the increasing prevalence of Lyme-disease-bearing ticks, which have become a concern in Maine.

Current Local Adaptation Efforts

When asked what adaptation-related activities are currently underway in Wells and the surrounding area, most Interviewees were able to identify and discuss past and current local activities intended to either reduce Wells' vulnerability to climate change impacts or raise awareness of potential climate change impacts. However, several interviewees stated that they had no knowledge of adaptation activities underway in Wells. Of those interviewees, some were concerned about their lack of knowledge, thinking this did not bode well for adaptation efforts, while others assumed that town officials were addressing the town's needs, even if they themselves were not aware of these efforts. Stakeholders mentioned the following activities underway today related to climate change adaptation.

Town of Wells

- The Town's Draft Wells Harbor Management Plan, currently in development, calls for consideration of sea level rise projections when siting and designing harbor infrastructure.
- The Town of Wells has developed plans to dredge Wells Harbor and place the sand along the town's beaches to combat beach erosion. The Town recently secured federal funding for this project.
- After recent severe storms, the Town's Highway Department has reviewed its design standards for roads, bridges, and culverts to evaluate their vulnerability.
- The Fire Department, Police Department, and Emergency Management Department continue to play a response role in storms, and they are "sharing lessons learned" after intense storms to improve their response.

Regional Government and Nearby Towns

- The Southern Maine Regional Planning Commission and the Maine Geological Survey have organized the Sea Level Adaptation Working Group (SLAWG), which works with local municipalities in the Saco Bay Region, north of Wells, to research towns' vulnerabilities to sea level rise and provide technical assistance and advice on policy options to mitigate the risks of sea level rise. Saco, Scarborough, Old Orchard Beach, and Biddeford are the communities participating in SLAWG.
- Based on the work of SLAWG, the MGS and SMRPC have developed the Coastal Hazard Resiliency Tools Project (CHRT), which provides similar vulnerability analysis and policy advice to other municipalities in Southern Maine. The following cities and towns have collaborated with CHRT: Ogunquit, York, Kennebunk, Portland, and South Portland. While some of these municipalities abut Wells, to date Wells has not participated in CHRT.
- Based on SLAWG analyses, the Town of Saco updated their zoning ordinance to require a 2-foot freeboard (i.e., requiring newly constructed or repaired homes within the FEMA 100-year flood zone to be elevated to 2 feet above the 100-year flood elevation).
- The Town of Ogunquit has worked with CHRT to analyze the vulnerability of its coastal infrastructure. It prepared a vulnerability study of its sewage treatment plant and is

considering decommissioning the plant as a result. Ogunquit is currently analyzing options to replace the plant, including potentially hooking into Wells' sewage treatment plant.

- York and South Portland are rewriting their comprehensive plans to include a chapter on sea level rise.
- The City of Portland has passed a resolution to study the potential economic impacts of sea level rise and of potential adaptation strategies.

State of Maine

In 2009, the Maine Department of Environmental Protection and the University of Maine's Climate Change Institute produced a report analyzing the potential impacts of climate change on the state and initiated a stakeholder process around climate change adaptation. The final reports for these projects can be found on the Climate Change Institute's website: http://climatechange.umaine.edu/research/publications/climate-future.

However, interviewees generally said that today the State of Maine does not have any programs explicitly addressing climate change adaptation. A few interviewees expressed frustration at the lack of political support for climate change adaptation efforts under the current gubernatorial administration. Interviewees did indicate that certain State agencies are doing work related to risk management that, if the opportunity arose, could be directly tied to managing climate change risks. For example, the Maine Department of Agriculture's Floodplain Management Program plays a role in flood risk reduction efforts through enforcement of shoreland development regulations, development of flood zone maps, and administration of the National Flood Insurance Program, and the Maine Emergency Management Agency (MEMA) plays a role in disaster preparedness and recovery. While climate change projections haven't yet been built into these agencies programs, interviewees indicated that these efforts are closely connected to and present opportunities for climate change risk management.

Public and Non-Profit Environmental Organizations

The Wells Conservation Commission, Wells Reserve (NOAA and Laudholm Trust), Rachel Carson Refuge (U.S. Fish and Wildlife Service), and the Maine Coast Heritage Trust are all working to preserve and manage open space land in Wells, particularly along the town's marshes and waterways. Some stakeholders stressed the importance of land conservation to protect the resilience of the Town's ecological systems in the face of a changing climate. One environmental services stakeholder also said that their organization has begun to run "bath tub models" to consider how sea level rise will affect potential land purchases before acquiring properties.

The town's environmental organizations are also actively involved in environmental education and outreach efforts related to climate change. For example, the Wells Reserve offers educational programs for the general public and training programs for local governments and resource managers about climate change adaptation and other environmental management issues. In January of 2013, they organized a three-day workshop on climate change adaptation planning.

Interviewees also mentioned that the Wells High School teaches environmental science classes that incorporate discussion of local environmental science and stewardship, and that including climate change in these classes is one way to increase residents' awareness of how climate change will affect Wells.

Maine Sea Grant, a NOAA-funded program that provides local university extension services on coastal and marine issues, has also conducted environmental education and outreach around adaptation. In 2011, Maine Sea Grant received a two-year grant from NOAA for the "Climate Variability and Coastal Community Resilience: Testing a National Model of State-based Outreach" project. This project involved stakeholder outreach to private property owners along the coast, including in Wells and adjoining communities. As part of this project, Maine Sea Grant also released a video documentary – Building a Resilient Coast: Maine Confronts Climate Change – and a manual for property owners – the Maine Property Owner's Guide to Managing Flooding, Erosion & Other Coastal Hazards.

Proposed Ways to Manage Risk

Over the course of the interviews, most stakeholders made statements about how they think climate change risks should be managed in Wells. Interviewee sentiments about whether and how to manage the risks that climate change presents for Wells are presented below.

Emergency Response and Preparedness

Most stakeholders thought about climate change adaptation primarily in terms of emergency management, which they generally considered to be something that the town already does well. They did recognize that there might be a greater demand for emergency services in the future.

Flood Risk Management

Many Wells residents expressed concern that there is very little that the town can do to protect coastal areas from sea level rise or rising seas combined with intensified storms. A number of stakeholders asked what would happen if a major storm caused severe property damage along the coast: would people be allowed to rebuild, and on what terms? Very few stakeholders said that they thought there were viable solutions to this problem. One local government stakeholder suggested diversifying the town's economy so that it was less fiscally reliant on coastal tourism development. A number of interviewees mentioned the possibility of "hard" engineering solutions, such as a new seawall, but no one interviewed treated this as a realistic possibility. Stakeholders who did mention seawalls saw them as infeasible, prohibitively expensive, or antithetical to the natural beach character that makes Wells an attractive destination. They also mentioned that state regulations prohibit the construction of new sea walls. A number of town officials spoke of elevating coastal roads and upgrading culverts to handle runoff during larger storms. Another adaptation possibility that some stakeholders discussed was new flood mitigation regulations for new construction or substantial repairs, such as Saco's extra freeboard ordinance. However, multiple stakeholders acknowledged that land use regulations are politically difficult to pass in Wells because of Maine's strong property rights culture and the objection of many residents to new regulations on development.

Education and Awareness

Almost all interviewees emphasized education and awareness as the most important step in preparing Wells residents, businesses and leaders for climate change adaptation. For some stakeholders, this is because a large proportion of the population does not believe that climate change is a pressing concern. These stakeholders believe that they need greater public awareness and support before the town can spend resources or enact regulations geared toward reducing vulnerability to climate change. Others stressed the importance of education and awareness, saying they see climate adaptation as primarily a personal, rather than government, responsibility. These interviewees generally said they think individuals should begin taking actions to increase their own resilience, such as buying generators to prepare for power outages.

Overview of Town Interests and Concerns

Climate change adaptation can't happen in a vacuum, but rather will occur amid existing decision-making, planning, and risk management efforts. To help our team better understand other concerns and issues in the Town of Wells, interviewees were asked what their top priorities were for Wells to address in the next five to ten years. This section describes some of the other top priorities for Wells, as described by interviewed stakeholders.

Jobs and Economic Development

Interviewees generally agreed that jobs and economic development are a major priority in Wells. For example, the Town of Wells is pursuing economic development opportunities, such as working with Sustain Southern Maine, a partnership for regional economic development, on a Centers of Opportunity pilot project for mixed-use infill development near the Wells Transportation Center.

Growth Management

Wells is one of the fastest-growing communities in Maine. This rapid growth has created challenges for Wells, as it has struggled to accommodate growth without straining its ability to provide services. Environmental interviewees expressed a concern about how to preserve land from sprawl development, saying that those focused on economic development and the preservation of private property rights have resisted additional regulations on development. The Town of Wells has begun the process of updating its Comprehensive Plan for 2015, which will address some of these issues.

Land Conservation

Multiple interviewees stated satisfaction with Wells' land conservation efforts through land purchase. Wells is one of few communities in Southern Maine to play an active role in purchasing conservation lands through its Conservation Commission. In this sense, they are seen as a regional leader. In addition to the Town's conservation purchases, the Maine Coast Heritage Trust and the Great Works Regional Land Trust are also working to preserve land in the region, and the federal government manages two nature preserves on Wells' coastal estuaries: the Wells Reserve at

Laudholm (NOAA NERRS) and the Rachel Carson National Wildlife Refuge (U.S. Fish and Wildlife Service). Environmental stakeholders expressed a particular concern with preserving land near streams and marshes to protect water quality.

Affordable Housing

One interviewee mentioned a concern for affordable housing for Wells' year-round residents in the context of rapid population growth and high demand for summer housing.

Traffic Management

Several interviewees expressed concerns about traffic, especially during the tourist season. Route 1, which connects Wells to Kennebunk to the north and Ogunquit to the South, becomes especially congested in the late spring, summer, and early fall, due to the region's increased summer population and large number of tourist visitors. Residents expressed frustration that the region experiences more traffic than it can accommodate. However, some also expressed dissatisfaction with a recent road-widening project along Route 1 for negating the small-town feel of Wells. Wells is also on Amtrak's Downeaster line, and town officials have expressed a desire to encourage more visitors to use public transportation and shuttles.

Local Services

Many of the interviewees who serve in Wells' local government said that their top priority is to provide effective and efficient services to Wells residents within constrained financial resources. Many local government stakeholders expressed a desire for more effective and efficient collaboration and consolidation of services between neighboring town governments and public service providers (e.g., utilities districts), although they observed challenges in realizing this vision due to Maine's "strong-town" form of local government.

Coastal Neighborhoods

A few stakeholders mentioned other issues that coastal neighborhood residents are concerned with that are not climate change-related. Particularly, they noted that many coastal residents express more concern about traffic and parking by non-residents than they do about coastal hazards such as beach erosion and flooding. They explained that there can be tensions between coastal property owners and tourist development, and that many residents want to limit the development of tourist infrastructure to maintain the residential feel of their neighborhoods.

Wells Harbor

Multiple interviewees mentioned the Wells Harbor as a key concern in Wells. Wells Harbor, where the Webhannet River flows into the Atlantic Ocean, is a federal navigation project of the U.S. Army Corps of Engineers that can accommodate up to 150 vessels with lengths up to 44 feet. The harbor is used for commercial fishing, a private marina, and recreational boating. The harbor area also has a recreational park and restaurant. The harbor was last dredged in 2001, after a lengthy federal permitting process. However, the harbor is rapidly silting in, and interviewees expressed a concern that it will soon be unusable if it is not dredged. The Town has obtained permits to dredge and recently secured federal funding. Loss of the harbor would negatively impact the fishing and tourism industries.

Opportunities and Challenges for Adaptation

Interviewees were asked what they see as the greatest challenges and opportunities for Wells moving forward with climate change adaptation and managing climate change risk. This section presents interviewee responses to these questions, as well as their thoughts on opportunities and challenges that emerged during other parts of the interviews.

Challenges

Almost every interviewee said that a lack of knowledge about or belief in climate change was the biggest challenge to climate change adaptation in Wells. Interviewees said that up to half of the town's population does not believe that climate change is a threat, and that this lack of consensus among residents that there is a problem means that the Town does not have the political support for investing resources to address it. Although we were not able to interview anyone who represented this view, stakeholders cited particular people or groups that have expressed climate skepticism. Another reason cited by a few stakeholders for a lack of political support for climate change adaptation actions in Wells is a strong property rights culture that makes adaptation options based on land use or development regulations difficult.

After a lack of belief in climate change, the two most commonly mentioned obstacles to adaptation mentioned by interviewees were financial constraints and regulatory constraints. Stakeholders stated that they think many adaptation options will be costly, and the Town has limited tax revenue. They said that there is very little financial or political support for adaptation from the state government, and they expressed skepticism about their ability to get federal funding. It took the Town multiple years to secure federal funding to dredge Wells Harbor.

In terms of regulatory constraints, multiple stakeholders said it took years to get federal permits for harbor dredging, so they expect regulatory processes to prevent them from enacting engineering-based solutions that would require state or federal approval. Some stakeholders also mentioned feeling constrained by state environmental regulations that have made it impossible to build new seawalls and have made it difficult to obtain permits to repair existing ones.

Opportunities

When asked what it would take to overcome obstacles to climate change adaptation in Wells, many interviewees said it would take a catastrophic storm, reflecting considerable pessimism about the Town's ability to build political consensus for action before it faces a compelling need. However, many stakeholders mentioned Hurricane Sandy as an opportunity for public engagement around climate change adaptation, noting that Sandy heightened concern about the risk of severe storms on the Northeast coast. Public sector stakeholders also hoped for the opportunity to learn by watching how coastal communities in New Jersey and New York rebuild and what strategies they use to reduce their vulnerability in the future.

Some stakeholders also stated that the Maine Geological Survey's and University of Maine's research on sea level rise and flooding potential, through providing data and scientific knowledge about risks, has created an opportunity to rethink local infrastructure and development, as well as to potentially stimulate multi-stakeholder dialogue about how to address these risks.

A few stakeholders also said there is an opportunity for greater collaboration between municipalities than is currently taking place. They mentioned the possibility of collaborating on services like water infrastructure or emergency management, rather than duplicating efforts or working at cross-purposes.

The biggest opportunity that stakeholders emphasized was the opportunity for outreach and education. Stakeholders cited the New England Climate Adaptation Project, CHRT workshops, and NERRS training courses as important opportunities to create greater understanding and support for adaptation efforts. Because stakeholders perceived a lack of knowledge or belief in climate change as one of the primary challenges to taking adaptation actions, they believed the most important step now is education.

Interviewees did not mention many opportunities for new policies or adaptation actions. A few stakeholders mentioned the opportunity to connect adaptation to other projects and policies that have benefits beyond simply reducing climate change risks. For example, interviewees indicated that the Town's Centers of Opportunity economic development project at the Wells Transportation Center has the simultaneous benefits of encouraging economic growth and focusing new development away from the vulnerable coast. Another example cited by an interviewee was the way in which public utilities' actions to reduce single points of failure and create resilience due to post-9-11 security concerns have also made their services more resilient to storms and other hazards. Such co-benefits, or "no regrets" solutions, may be a major opportunity for adaptation action in the future, according to a couple interviewees.

Appendix A. List of Interviewees

Name	Title	Organization(s)	Stakeholder Category
Sue Baker	State Floodplain Coordinator	State of Maine	State Government
Jonathan Carter	Town Manager	Town of Wells	Town Government
Keith Fletcher		Wells Conservation Commission, Great Works Regional Land Trust	Environment
Robert Foley	Chair	Town of Wells Board of Selectmen	Town Elected Official
Norm Labbe	Superintendent	Kennebunk Kennebunkport Wells Water District	Utilities Provider
Mike Livingston	Town Planner / Engineer	Town of Wells	Town Government
Christopher Mayo	Harbormaster	Town of Wells	Harbor / Waterfront
Beth Mokas	Summer Resident, Wells Reserve Volunteer		Coastal Property Owners
Daniel Moore	Fire Chief / Director of Emergency Management	Town of Wells	Emergency Management
Cheryl Oakes	High School Teacher	Wells-Ogunquit CSD	Education
Paul Schumacher	Director	Southern Maine Regional Planning Commission	Regional Government
Peter Slovinsky	Marine Geologist	Maine Geological Survey	State Government / Scientist
Tin Smith	Stewardship Coordinator	Wells Reserve at Laudholm (NERRS)	Environment / Scientist
Ryan Wingard	Engineer	Wright-Pierce	Engineering / Consulting
Scott & Brandy Worthing	Business Owner	Webhannet River Boatyard	Business / Recreation

Appendix B. Interview Protocol

General Background

1. Please confirm your name, title, and affiliation.
2. Could you briefly explain what your organization does?
3. What is your connection to Wells?
4. Briefly, what are the top issues you would like to see your community address in the next five to ten years?

Local Risks

5. In what ways might climate change affect your community in the next few decades?
6. What specific climate change risks or impacts are you most concerned about? If none, why?
    a. Prompt, if needed: First level impacts: sea level rise, coastal flooding, increased intensity of storm events, drought, temperature increase
    b. Second level impacts: beach erosion, property value loss, water shortages, impacts on agriculture, increased risk of disease (West Nile virus, etc.), etc.
7. Here's a map of the town. Could you mark on the map areas or locations you think are most vulnerable to the climate change risks we have been discussing?
8. How prepared do you believe your community is to handle the impacts you have named?

Local Activity, Context & Politics

9. What is your connection to climate change adaptation work, if any?
10. Are there actions underway (currently or in the planning stages) to reduce the vulnerability of your community to climate change risks?
    a. If so, what are they?
11. What obstacles does your community face when working to reduce climate change risks?
    a. Prompt: lack of technical information; lack of financial resources; lack of state or federal guidance; lack of political leadership at local level; lack of awareness, etc.
12. What would it take to overcome the obstacles that your community and other communities are likely to face in reducing vulnerability to climate change risks?
    a. Prompt: Assistance from federal government; public education; partnerships with local universities, etc.
13. What do you think are the biggest opportunities for taking action in your community?

Data

14. We have been looking through federal and state forecasts of climate change risks facing your town. I'd like to show you a few numbers. Do you have any preliminary reactions to these forecasts?
15. What data or information about climate change risks would be most helpful to your community at this point?

Decision-making

16. We are going to organize some community meetings to talk about climate change risks that may be facing your town. Who do you suggest we invite?
17. Are there specific organizations in your community who might want to co-host such an event?

Other

18. Who else do you think I should talk to about these issues?

Appendix C: Downscaled Climate Projections for Wells, ME

These projections were generated as output from four different global climate models (GCM) that have been well-established and evaluated in the peer-reviewed scientific literature: the US National Oceanic and Atmospheric Administration's Geophysical Fluid Dynamics Laboratory (GFDL) CM2.1; the United Kingdom Meteorological Office's Hadley Centre Climate Model version 3 (HadCM3); and the National Center for Atmospheric Research's Parallel Climate Model (PCM) and Community Climate System Model Version 3 (CCSM3). These models have different climate sensitivities, where sensitivity refers to the amount of temperature change resulting from a doubling of atmospheric C02 concentrations relative to pre-industrial times. GFDL, CCSM3, and HadCM3 have medium sensitivity; and PCM has a low sensitivity.

Each global model produces output in the form of geographic grid-based projections of daily, monthly, and annual temperatures, precipitation, and other climate variables. Global climate models operate on the scale of hundreds of miles, which is too coarse a resolution to distinguish changes across different towns and cities in a given region, such as New England. However, scientists used state-of-the-art statistical downscaling models to capture historical relationships between large-scale weather features and local climate, and use these to translate future projections down to the scale of local weather station observations. In this project we used a relatively new statistical downscaling model, the Asynchronous Regional Regression Model[1]. We use the projections downscaled to the meteorological station in Portland, ME because it is the closest station to Wells.

Two different climate change scenarios drove the projections from the global climate models: a high emissions scenario (A1fi) and low emissions scenario (B1). The high emissions scenario assumes that the world will experience economic growth dependent primarily on fossil fuels and that atmospheric concentrations of carbon dioxide reach 940 parts per million by 2100. The low emissions scenario assumes that economies will shift to cleaner, less fossil-fuel intensive technologies, and that atmospheric concentrations of carbon dioxide reach 550 parts per million by 2100[2]. The purpose of choosing a high emissions and a low emissions scenario is to create a likely range of future climate change that Wells may experience during the 21st century.

The projections are also presented in three time frames: short term, medium term, and long term. The short term refers to the time period between 2010 and 2039, the medium term refers to the time period between 2040 and 2069, and the long term refers to the time period between 2070 and 2099. The historical baseline refers to the years 1980 to 2009. We average the results of the historical baseline period and climate projections over 30 years. This period is long enough to filter out any interannual variation or anomalies, and short enough to show longer climatic trends.

1 More information on the statistical downscaling method used is provided in: Stoner, AMK, K Hayhoe, X Yang and DJ Wuebbles (2012) An asynchronous regional regression model for statistical downscaling of daily climate variables. *Int. J. Climatol.* DOI: 10.1002/joc.3603.

2 The emissions scenarios and GCM simulations used in this report consist of models that contributed to phase 3 of the Coupled Model Intercomparison Project (CMIP3). These are the results presented in the Intergovernmental Panel on Climate Change (IPCC) Third (2001) and Fourth (2007) Assessment Reports. More recent scenarios combined with CMIP5 climate projections were recently released (September 2013) in the IPCC Fifth Assessment Report.

Climate Change Projections for Wells, ME (Change from Historical)

Indicators	Historical 1980-2009	Change from historical (+ or -)					
		Short Term 2010-2039		Medium Term 2040-2069		Long Term 2070-2099	
		Low Emissions	High Emissions	Low Emissions	High Emissions	Low Emissions	High Emissions
Temperature (F)							
Average annual minimum temperature	37.0	2.0	2.1	3.0	4.8	3.8	7.7
Average winter minimum temperature	16.5	2.9	3.0	4.0	5.9	5.0	9.4
Average summer minimum temperature	57.1	1.7	2.0	2.8	4.3	3.5	6.9
Average annual maximum temperature	55.6	2.1	2.1	3.4	5.1	4.3	8.5
Average winter maximum temperature	34.2	2.2	1.9	3.0	4.0	3.8	6.5
Average summer maximum temperature	76.5	2.5	2.7	4.4	6.7	5.4	10.8
Temperature Extreme *(days per year)*							
colder than 32 °F	147	-11	-11	-17	-30	-21	-47
hotter than 90 °F	4	2	4	8	21	11	45
Precipitation (in)							
Annual average	46.2	1.9	0.9	2.6	3.2	4.0	5.5
Winter average	10.2	1.2	1.3	1.8	1.7	2.5	3.7
Summer average	10.5	-0.9	-0.9	-0.7	-0.3	-1.5	-0.2
Extreme Precipitation *(events per year)*							
1" in 24 hrs	10.9	1.7	2.2	2.3	2.5	2.6	4.0
2" in 48 hours	4.6	2.2	2.1	2.9	3.4	3.6	5.2
Extreme Precipitation *(events per decade)*							
4" in 48 hours	9.0	0.4	-2.8	0.4	2.9	3.0	4.6
Sea Level Rise *(Increase relative to the year in feet)*		0.5	0.8	1.0	1.7	2.0	4.7

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