Maine Prepares for Climate Change
2019 Update

The Maine Interagency Climate Adaptation Work Group

Department of Agriculture, Conservation and Forestry

Department of Defense, Veterans, and Emergency Management:

Maine Emergency Management Agency

Department of Environmental Protection

Department of Health and Human Services:

Maine Center for Disease Control and Prevention

Department of Inland Fisheries & Wildlife

Department of Marine Resources

Department of Transportation

Governor's Energy Office

Maine Historic Preservation Commission

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I. Introduction

This report was developed for the Commissioners and organizational leadership of the departments, agencies, and offices participating in the Maine Interagency Climate Adaptation work group (MICA). The report raises awareness of actions being taken by the State on resiliency, improves communication across state agencies, and provides information on future state-level work to interested stakeholders. Information gathered by the work group can be used to create a guide for future activities of the work group for Commissioners' and leadership's consideration.

MICA is comprised of staff representing State of Maine governmental agencies, coordinated by the Department of Environmental Protection (DEP). MICA's function is to share information between agencies and work collaboratively on issues related to climate adaptation and resiliency. Initial interagency coordination was established in 2013 at the request of Governor Paul LePage. The Environmental and Energy Resources Work Group (EERWG) produced the first *Maine Prepares* report released September 2014, which is the basis for the 2018 and 2019 update reports. Each participating agency acts in accordance with their individual authorizing statutes, and fulfills any applicable mandates independently of MICA.

This report includes a summary of current and completed activities and recommended future activities; and reports progress on identified needs from previous interagency reports.

Additional MICA-Related Resources

Climate Clearinghouse:
https://www.maine.gov/dep/sustainability/climate/index.html
Maine-focused, online reference library and directory, designed to provide relevant information to become more resilient, and to provide links to sites where more specific content and organizations can be reached.

Maine Adaptation Toolkit:
https://www.maine.gov/dep/sustainability/climate/adaptation-toolkit.html
A centralized source for information on implementing adaptation measures or strategies (in Clearinghouse).

I. Introduction

List of agency acronyms used in the report:

State Entity	Acronym
Department of Agriculture, Conservation and Forestry	DACF
Department of Defense, Veterans, and Emergency Management – Maine Emergency Management Agency	DVEM-MEMA or MEMA
Department of Environmental Protection	DEP
Department of Health and Human Services – Maine Center for Disease Control	DHHS-CDC or Maine CDC
Department of Inland Fisheries & Wildlife	DIFW
Department of Marine Resources	DMR
Department of Transportation	DOT
Department of Public Safety	DPS
Efficiency Maine Trust	EMT
Governors Energy Office	GEO
Public Utilities Commission	PUC
Maine Historic Preservation Commission (Maine's State Historic Preservation Office)	MHPC
Non-State Entity	**Acronym**
Department of Energy	DOE
Environmental Protection Agency	EPA
Federal Highway Administration	FHWY
Federal Emergency Management Agency	FEMA
Department of Housing and Urban Development	HUD
National Oceanic and Atmospheric Administration	NOAA
National Weather Service	NWS
University of Maine	UMaine
U.S. Army Corps of Engineers	USACE
U.S. Coast Guard	USCG
U.S. Fish and Wildlife Service	USFWS
U.S. Geological Survey	USGS

II. Key Terms

To improve communication across state agencies, MICA identified a need for the use of common climate-related terminology and definitions. To develop the following, in 2017 MICA reviewed definitions used by the U.S. Environmental Protection Agency, U.S. Global Research Program, National Oceanic and Atmospheric Administration, Housing and Urban Development, Federal Emergency Management Agency, Intergovernmental Panel on Climate Change, United Nations Framework Convention on Climate Change, and the United Nations Office for Disaster Risk Reduction. These working definitions are intended for use within the context of MICA discussions and this report:

Adaptation is an adjustment in natural or human systems that adequately and appropriately capitalizes on beneficial opportunities or reduces negative effects due to a changing climate.

Climate is the average weather condition at a given place over a period. For example, meteorologists often make comparisons against a 30-year period, called a climate normal. Long-term climate is usually defined as a century or more.

Climate Change is a difference in the climate over multiple decades or longer. Long-term variations in climate can result from both natural and human factors.

Greenhouse Gases are any gases that absorb heat in the atmosphere, including but not limited to water vapor, carbon dioxide, methane, nitrous oxide, and ozone.

(Climate) Mitigation is a human intervention intended to reduce the rate of climate change.

(Hazard) Mitigation is any sustained action taken intended to reduce or eliminate the long-term risk to human life and property from natural hazards.

Resilience is the capacity to prepare for, respond to, and rapidly recover from significant hazard events with minimal damage to social well-being, the economy, and the environment.

Weather is the atmospheric condition at any given time or place, measured from variables such as wind, temperature, humidity, air pressure, cloudiness, and precipitation. Weather can vary from hour-to-hour, day-to-day, and week-to-week.

III.   Inventory of State Climate Activities

The work group has updated the 2018 inventory of climate-specific and related state activities. This inventory identifies activities that are occurring within the natural resource, historic preservation, and energy agencies in Maine's state government that address or respond to observed changes in the state's climate. The initial inventory completed in 2014 by the EERWG established the baseline of information that is currently maintained by MICA.

Each activity includes the title of the program, group, project, or initiative; the lead, partner, or contact agency; a summary of the scope of work; link to where further information can be accessed if available; and the status of work as of the reporting period. The 2017 status covers the period from the initial 2014 report to end of 2017. The 2018 status covers the calendar year January to December 2018. A status of 'ongoing' describes long-term work or work that is anticipated to be long-term. A status of 'initiated', 'in development', 'in progress', 'intermittent', 'on hold', or 'complete' describes short-term work or an aspect of a larger ongoing activity.

List of headings for sections and sub-section of the Inventory of State Climate Activities:

A. Mitigation
    i.   Planning, Monitoring, and Reporting
    ii.   Reducing Emissions of Energy Sources
    iii.   Efficiency and Conservation
    iv.   Transportation
    v.   Natural Resources and Resource Recovery

B. Research and Analysis
    i.   Physical Environment (Air; Coastlands & Saltwater; Inlands & Freshwater)
    ii.   Habitats and Species (Saltwater, Freshwater, and Terrestrial Systems)
    iii.   Working Landscapes (Agriculture & Forestry)
    iv.   Built Environment and Critical Infrastructure (Energy, Communication, Transportation, Water Utilities, and Stormwater)
    v.   People and Communities (Buildings & Homes, Community Planning, Public Health & Services, Social Vulnerability)

C. Adaptation
    i.   Natural Environment – Habitats, Species, Open Spaces, Working Landscapes, and Waterfront
    ii.   Built Environment – Infrastructure
    iii.   People and Communities

D. Preparedness
E. Raising Awareness
F. Grants and Loans

III. Inventory of State Climate Activities - Mitigation

A. Mitigation

GUIDING QUESTIONS: WHAT IS BEING DONE TO REDUCE THE RATE OF CHANGE? HOW CAN GREENHOUSE GAS EMISSIONS BE REDUCED AND CARBON STORAGES AND SINKS BE INCREASED?

i.   Planning, Monitoring, and Reporting

Maine Climate Action Plan   **Lead Agency:**   **DEP**

In 2003, Maine established goals for the reduction of Greenhouse Gas (GHG) emissions statewide (38 M.R.S. § 576). The Maine Climate Action Plan was adopted in 2004 to meet the reduction goals specified in Maine law. The action plan contains recommended options that will allow the state to meet the reduction goals through cost-effective strategies and actions, and that allow for sustainably managed forestry, agriculture, and other natural resources to sequester greenhouse gas emissions.

Links:
https://www.maine.gov/dep/sustainability/climate/mitigation-actions.html
https://www.maine.gov/dep/sustainability/climate/MaineClimateActionPlan2004.pdf
https://www.maine.gov/dep/commissioners-office/environmental_trends.html (Greenhouse Gas)

Status 2017: Ongoing.

Status 2018: Ongoing.

On January 24, 2018, the DEP received a citizen petition (Citizen Petition for Rulemaking to Require the Maine DEP to Fulfill its Statutory, Constitutional, and Public Trust Obligations to Reduce Greenhouse Gas Emissions Along a Trajectory that is Based on the Best Climate Science and that will Reduce the Impacts of Climate Change in Maine) to initiate rulemaking under 5 M.R.S. § 8055. The GHG Petition was signed by 696 registered voters, and the Petition was verified and certified as required by Maine law. Pursuant to 5 M.R.S. § 8055, the DEP was required to initiate rulemaking.

The Petitioners' proposed rules sought GHG emission reductions of at least 8 percent each year, which correlates to Maine reducing its GHG emissions to approximately 75 percent below 2003 levels by the year 2035. The proposals would: (1) create a new "Greenhouse Gas Emissions Standards" rule which would establish a statewide GHG emissions limit for each year beginning in 2020, and would require submission of GHG emissions reduction plans for certain stationary sources and vehicle fleets; (2) establish a new rule addressing sulfur hexafluoride (SF6 - a greenhouse gas) emissions from gas-insulated electrical switch gear; and (3) amend ten existing rules to incorporate GHG emissions standards and cross-reference the new Greenhouse Gas Emission Standards rule. For proposed amendments to Chapters 146, 148, 150 and 305, the Petitioners proposed language establishing emissions limits for GHGs, but left blank the actual numerical limits. DEP did not receive recommendations for the numerical limits, and did not adopt the proposed rules prior to expiration of the statutory rulemaking period.

III. Inventory of State Climate Activities - Mitigation

Economic Impact Modelling of GHG Emissions Reductions for Fossil Fuel Electric Generating Units	**Lead Agency:**	**DEP**

Through participation in the Regional Greenhouse Gas Initiative (RGGI), DEP also supports economic impact modeling of reductions in carbon emissions from power generating facilities, and shares the results with other states to enable more informed decisions regarding future GHG emissions reductions through the RGGI program.

Status 2017: Ongoing.

Status 2018: Ongoing.

GHG Emissions Reporting	**Lead Agency:**	**DEP**

Certain facilities with air emission licenses are required to report annually (38 M.R.S. § 575) on GHG emissions under DEP's Chapter 137, Emission Statements.

Link: http://www.maine.gov/dep/air/emissions/index.html

Status 2017: Ongoing. Affected facilities statewide in 2014, 2015, 2016, and 2017 were 148, 143, 135, and 129 respectively.

Status 2018: Ongoing. Data from 2010 to 2017 show a continual year-to-year decline in the number of affected facilities statewide. Each year several facilities have reduced their licensed facility wide potential to emit below the reporting thresholds for Ch. 137. The primary reasons are from fuel switching from solid or liquid fuels to natural gas.

Biennial Report on Progress Towards Greenhouse Gas Emissions Reductions	**Lead Agency:**	**DEP**

Biennial reporting on progress toward GHG reduction goals is completed by statutory mandate under 38 M.R.S. § 578 in response to the Climate Action Plan.

Link: https://www.maine.gov/dep/sustainability/climate/mitigation-actions.html

Status 2017: Ongoing. Currently the state is on track to meet its statewide goals. As reported in the Sixth Biennial Report on Progress toward Greenhouse Gas Reduction Goals, Maine has continued to decouple economic growth and emission reductions. The report states, "since 1990, Maine's real Gross Domestic Product (GDP) grew from $37.1 billion to $50.9 billion in 2013. During the same period, energy consumption declined from 446,468 billion Btu to 400,990 billion Btu."

Status 2018: Ongoing. Currently the state is on track to meet its statewide goals. As reported in the Seventh Biennial Report on Progress toward Greenhouse Gas Reduction Goals, "DEP's analysis of energy consumption, industrial processes, agriculture, and waste management data for the most recent years available, 2014 and 2015, found that Maine is on track to meet the medium-term goal of reducing greenhouse gas (GHG) emissions to 10% less than 1990 levels by 2020, as set forth in 38 M.R.S. §576. Gross statewide GHG emissions increased from the initially measured levels in 1990, reaching a peak in 2002. By 2009, emissions were below 1990 levels, reaching a low in 2012. Since 2012, emissions have increased slightly but remain at least 10% lower than 1990 levels.

III. Inventory of State Climate Activities - Mitigation

DEP's analysis indicates:

- 90% of GHG emissions in Maine are the result of energy consumption, largely produced by combustion of petroleum products. Annual emissions in this source category have been reduced by nearly 30% since 2002 and 7% since 2010.
- Annual carbon dioxide (CO_2) emissions from the electric power sector have decreased by 73% since they peaked in 2002 largely by replacing high carbon fuels with natural gas.
- Statewide CO_2 emissions remain at least 10% lower than 1990 levels in large part because of the use of lower carbon fuels such as natural gas and increased efficiencies.
- The transportation sector was responsible for 52% of Maine's GHG emissions in 2015, an increase from the historical average of 42%.
- Maine created 21% less GHG emissions per billion Btu (BBtu) of energy in 2015 than in 2002.
- In 2015, Maine's annual GHG emissions per million dollars of state gross domestic product (GDP) were 36% less than in 1990."

Several facilities in Maine that produced GHG emissions have closed since creation of the Maine Climate Action Plan in 2004.

Annual Reporting of Greenhouse Gas Emission Reductions / Efficiency Maine Trust Annual Report	**Lead Agency:** EMT **Partner Agencies:** DEP, PUC, GEO

GEO, through its participation on the Efficiency Maine Trust (EMT) Board of Directors, guides the development and implementation of energy efficiency strategies across all sectors (residential, commercial, industrial), which reduce emissions of GHGs. Specific GHG reductions are measured in many of these programs and reported by Efficiency Maine in its annual report.

Link: http://www.efficiencymaine.com/docs/FY2016-Annual-Report.pdf

Status 2017: Ongoing.

Status 2018: Ongoing.

Annual Report on GHG Emission Reductions of the Regional Greenhouse Gas Initiative	**Partner Agencies:** PUC, DEP, EMT

The PUC, EMT, and the DEP publish an annual report on the status of the RGGI program, including GHG emissions reductions that occur due to Maine's participation in RGGI. While the RGGI program was established to reduce emissions in the fossil fuel fired electric generation sector, the report also includes data on GHG emissions from all of Maine's economic sectors.

Links:
https://www.maine.gov/dep/publications/reports/index.html

Status 2017: Ongoing.

Status 2018: Ongoing.

III. Inventory of State Climate Activities - Mitigation

Comprehensive State Energy Plan	**Lead Agency:**	**GEO**
	Partner Agencies:	**DEP**

The Maine Comprehensive State Energy Plan (2 M.R.S. § 9) provides strategies for addressing the state's energy challenges, including reducing energy costs; encouraging cost-effective renewable energy production; reducing the state's oil dependence; and lowering GHG emissions. The plan is required to be updated biennially. It includes information regarding the status of wind energy development, as well as discussion of the interaction between energy planning and GHG reduction goals. DEP and GEO work together to assemble plan updates in the areas of wind energy development and GHG reductions.

Links:
http://www.maine.gov/energy/publications_information/index.html
http://legislature.maine.gov/legis/statutes/2/title2sec9.html

Status 2017: Ongoing. Approximately 90% of the state's GHG emissions originate from energy consumption. GEO is developing a stakeholder-driven update, using the Maine Energy Roadmap Steering Committee, which is funded by a separate DOE grant; therefore, the 2017 update has been postponed until 2018.

Status 2018: Work continues to complete the Comprehensive Plan update, expected to be released in early 2019.

Maine Energy Roadmap Steering Committee	**Lead Agency:**	**GEO**
	Partner Agency:	**DEP**

GEO is spearheading a two-year, stakeholder-driven, comprehensive energy planning process, called the Energy Planning Roadmap. The objectives of the Roadmap are: to achieve energy and cost savings in the residential, commercial, industrial, and transportation sectors; to reduce pollution and GHG emissions; and to support the growth of a robust state and regional energy market and workforce. The Maine Energy Roadmap Steering Committee, comprised of energy industry experts, is providing overall strategic guidance for the project. In addition, the project team is facilitating numerous stakeholder and interagency discussions which will inform final policy recommendations.

Status 2017: Initiated 2016. Two-year process scheduled for completion in early 2018: Statewide energy baseline almost complete; defining methods to measure progress and success.

Status 2018: In progress. Final report to be released in early 2019.

New England Governors and Eastern Canadian Premiers (NEG/ECP) - Mitigation	**Lead Agency:**	**DEP**
	Partner Agencies:	**DACF, DIFW, DOT**

In 2001, eleven states and provinces within the NEG/ECP, including Maine, developed a *Regional Climate Change Action Plan* (RCCAP). Each NEG/ECP jurisdiction participates in the process, but is responsible to govern its own outcomes from these regional initiatives.

Links:
http://www.coneg.org/negecp
http://www.coneg.org/regional-climate-initiative

Status 2017: Ongoing.

III. Inventory of State Climate Activities - Mitigation

Resolution 37-3: in 2013, the NEG/ECP adopted a resolution "Concerning Transportation". Cross-reference Section III. A. Mitigation "Alternative Fueled Freight".
Resolution 39-1: in 2015, the NEG/ECP adopted a resolution "Concerning Climate Change". A 2030 reduction marker was adopted along with development of possible joint actions for strategies, polices, and measures to achieve the marker.
Resolution 41-2: in 2017, the NEG/ECP adopted a resolution "Concerning the Regional Climate Change Action Plan". The 2017 RCCAP was created as an update to the 2001 plan.
Status 2018: Ongoing. 42nd conference in Vermont on August 12-14, 2018.
Resolution 41-2: Implementation of RCCAP with progress report due to NEG/ECP at 2020 meeting.

ii.   *Reducing Emissions of Energy Sources*

Regional Greenhouse Gas Initiative   **Lead Agency:**   **DEP**

RGGI is the first mandatory market-based program in the United States intended to reduce carbon dioxide emissions resulting from electric power generation. Nine northeastern states, including Maine, have cooperated since 2006 in implementing the program, which has resulted in a reduction in electric power sector emissions of over 50% through 2016 (was previously 45% through 2014).

Link: http://www.rggi.org/

Status 2017: Ongoing. RGGI completed a scheduled program review.

Status 2018: Ongoing. Model rule finalized. Possible addition of new participating states.

Emissions Offset Categories / Reducing   **Lead Agency:**   **DEP**
Carbon Emissions from Licensed Sources

A RGGI CO_2 offset allowance represents a project-based GHG emissions reduction outside of the capped electric power generation sector.

Link: https://www.rggi.org/market/offsets

Status 2017: Ongoing. Offset categories in RGGI include landfill methane capture and destruction; reduction in emissions of sulfur hexafluoride (SF_6); sequestration of carbon due to reforestation; improved forest management or avoided conversion; reduction or avoidance of CO_2 emissions from natural gas, oil, or propane end-use combustion due to end-use energy efficiency; and avoided methane emissions from agricultural manure management operations. CO_2 offset allowances may be used to satisfy up to 3.3 percent of a regulated power plant's compliance obligation.

Status 2018: Ongoing. No offset projects currently operating in Maine. Due to relatively low CO_2 allowance prices, there has been no demand for CO_2 offset allowances for the projects currently operating in Maine.

III. Inventory of State Climate Activities - Mitigation

National Emission Standards for Hazardous Air Pollutants (NESHAP) for Industrial, Commercial, and Institutional Boilers (and Process Heaters)	Lead Agency:	DEP

EPA has promulgated regulations to reduce hazardous air pollutants from boilers and process heaters. DEP assists in compliance outreach for these regulations and incorporates requirements into air licenses. These rules require tune-ups for almost all boilers, energy assessments for larger boilers, and promote the use of natural gas.

Links:
https://www.epa.gov/stationary-sources-air-pollution/compliance-industrial-commercial-and-institutional-area-source
https://www.epa.gov/stationary-sources-air-pollution/industrial-commercial-and-institutional-boilers-and-process-heaters

Status 2017: Ongoing.

Status 2018: Ongoing. DEP continues to provide outreach for these regulations through licensing and compliance activities.

Non-Transmission Alternatives	Lead Agency:	PUC

Maine has a statutory requirement that the PUC consider non-transmission alternatives before approving certain infrastructure upgrades.

Link: http://legislature.maine.gov/legis/statutes/35-A/title35-Asec3132.html

Status 2017: Ongoing.

Status 2018: Ongoing.

Green Power Program	Lead Agency:	PUC

The Maine Green Power Program is a voluntary renewable energy option that allows electricity ratepayers to match their electricity usage with Maine-made renewable energy. Administered as a premium on electric bills.

Link: http://www.maine.gov/mpuc/greenpower/

Status 2017: Ongoing.

Status 2018: Ongoing.

State/Ratepayer Financial Support for Reducing Energy Demand/Increasing Renewable Electricity Generation	Lead Agency:	PUC
	Partner Agencies:	EMT, GEO

There are several state and/or ratepayer subsidy programs with goals to increase renewable electricity generation in the state and to support economic development. These programs were established by the Legislature over several years. GEO monitors the legislative process pertaining to these programs, and participates on the Board of Directors at EMT. These programs include:

1) Renewable Portfolio Standard (RPS)	Lead Agency:	PUC

Requirement that electricity suppliers obtain a percentage of their electricity supply from renewable sources.

III. Inventory of State Climate Activities - Mitigation

Link: http://legislature.maine.gov/legis/statutes/35-A/title35-Asec3210.html

Status 2017: Ongoing.

Status 2018: Ongoing.

2) **Community Renewable Pilot Program**   **Lead Agency:**   **PUC**

Provides ratepayer-funded subsidies for certain community-based renewable electricity generation.

Link: http://legislature.maine.gov/legis/statutes/35-A/title35-Asec3604.html

Status 2017: Program closed to new projects. Existing projects continue to be developed.

Status 2018: Existing projects must be operational by end of 2018 to qualify for subsidy. Not all approved projects became operational.

3) **Long-term Contracts for renewable energy**   **Lead Agency:**   **PUC**

The PUC has authority to enter into long-term contracts for selected renewable energy generation projects that provide ratepayer benefits. Several types of renewable electricity generation could qualify for a long-term contract.

Link: http://legislature.maine.gov/statutes/35-A/title35-Asec3210-C.html

Status 2017: Ongoing.

Status 2018: Ongoing.

4) **Long-term, above-market energy contracts for tidal and offshore wind demonstration projects**   **Lead Agency:**   **PUC**

Provides developers a long-term, ratepayer-funded subsidy to develop new tidal and offshore wind technology. RFPs issued and projects chosen.

Link: http://www.mainelegislature.org/ros/LOM/LOM124th/124R2/PUBLIC615_ptA.asp

Status 2017: Ongoing. Existing projects.

Status 2018: Ongoing. Existing projects.

5) **Above-market financial support for biomass electric generation**   **Lead Agency:**   **PUC**

State taxpayer support granted to selected generators for up to two years, through 2018.

Links:
http://legislature.maine.gov/legis/bills/bills_127th/chapters/PUBLIC483.asp
https://mpuc-cms.maine.gov/CQM.Public.WebUI/Common/CaseMaster.aspx?CaseNumber=2016-00084

Status 2017: Initiated contracts.

Status 2018: In progress.

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6) **Net Energy Billing (NEB)**   **Lead Agency:**   **PUC**

   NEB, or net metering, provides a ratepayer-funded subsidy to electricity customers who generate their own renewably generated electricity. Customers must apply for the benefit.

   Links:
   http://legislaure.maine.gov/legis/statutes/35-A/title35-Asec3209-A.html
   http://www.maine.gov/tools/whatsnew/index.php?topic=puc-pressreleases&id=729614&v=article08

   Status 2017: Ongoing.

   Status 2018: Ongoing.

iii.   Efficiency and Conservation

Efficiency Maine Trust's Triennial Plan   **Lead Agency:**   **EMT**

                                         Partner Agencies: **PUC, GEO**

EMT's Triennial Plan (35-A M.R.S. § 10104) implements strategies and programs that increase the installation of cost-effective energy efficiency improvements; increase deployment of more energy-efficient heating systems; and reduce energy costs for all Mainers. This plan is developed and executed on a three-year basis as approved by the PUC.

Links:
http://legislature.maine.gov/legis/statutes/35-A/title35-Ach97sec0.html
http://legislature.maine.gov/legis/statutes/35-A/title35-Asec10120.html

Status 2017: Ongoing.

Status 2018: Ongoing. Fourth Triennial Plan (FY2020-FY2022) submitted to PUC for approval.

Limited Renewable Energy Programs   **Lead Agency:**   **EMT**

                                         Partner Agencies: **GEO**

EMT administers limited renewable energy/energy efficiency research, development, and/or demonstration projects using a combination of electric and natural gas ratepayer funds, RGGI auction proceeds, and Forward Capacity Market revenues.

Links:
http://legislature.maine.gov/legis/statutes/35-A/title35-Ach97sec0.html
http://legislature.maine.gov/legis/statutes/35-A/title35-Asec10120.html
https://www.efficiencymaine.com/docs/Notice-of-Award_RFP-EM-010-2018.pdf (three renewable energy community demonstration projects in affordable housing projects awarded in 2018)
https://www.efficiencymaine.com/docs/Notice-of-Award_RFP-EM-011-2018.pdf (two load management innovation pilot projects awarded in 2018)

Status 2017: Ongoing. No new projects awarded in 2017.

Status 2018: Ongoing. Five projects awarded in 2018.

III. Inventory of State Climate Activities - Mitigation

Energy Efficiency Deployment Strategies **Lead Agency:** **GEO**
for high-energy-cost areas

GEO in partnership with the Island Institute. Program goal is to increase energy efficiency in rural, remote and island communities.

Link: http://www.islandinstitute.org/program/energy/energy-efficiency

Status 2017: Ongoing. This program is supported by DOE Grant for 2017-2018.

Status 2018: Ongoing. Grant period extended into 2019 to perform additional state and national outreach.

Environmental Leader Program **Lead Agency:** **DEP**
(Business) / Small Business Assistance
Program

DEP encourages various energy efficiency projects throughout its work. The Office of Innovation and Assistance provides in-person and online technical assistance in response to telephone and email requests from landowners, businesses, developers and others, including consideration of potential effects of changes in the climate. The Office administers the Environmental Leader (EL) program that provides resources and training to industry sectors and recognizes voluntary efforts of lodging establishments, restaurants, and grocers in reducing their environmental impact and footprint.

Link: http://www.maine.gov/dep/assistance/greencert/index.html

Status 2017: Ongoing. DEP is in the process of updating the EL Program, and will include adding climate response and adaptation to the electronic certification workbooks, beginning with hospitality. DEP is partnering with Manomet and University of Southern Maine (USM) on this updating process.

Status 2018: Ongoing. DEP continues to update materials to make program participation easier and more comprehensive, including its work with USM and Manomet. A draft update to the hospitality workbook has been completed.

iv.   Transportation

Electrifying Transportation **Lead Agency:** **DOT**
Partner Agencies: **DEP, EMT, GEO**

This effort began in 2016 as a partnership between Maine and Quebec to develop an electric vehicle charging corridor between the state and the province. The corridor was proposed to facilitate tourism considering Quebec's five-year transportation electrification strategy.

Links:
http://maine.gov/mdot/vw/
http://transportselectriques.gouv.qc.ca/wp-content/uploads/CIAO-050-LG2-MTQ-Rapport2016ENv2.1_.pdf

Status 2017: Ongoing. An expansion of this effort, to include charging infrastructure along additional state highway corridors, was considered for funding with part of the Volkswagen emissions testing settlement.

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Status 2018: Ongoing. Maine's plan for use of Volkswagen mitigation funds approved, applications submitted, and first round of mitigation projects approved. DOT designated Efficiency Maine Trust as administrator of the Volkswagen settlement funds intended for installation of electric vehicle charging stations along Maine's highway corridors. Efficiency Maine Trust issued an RFP and selected a contractor for Phase I, which includes installing fast charging and Level 2 infrastructure at seven locations including the Maine Turnpike Authority's travel plazas.

GHG Emission Standards for New Vehicles	**Lead Agency:**	**DEP**

As part of participation in the California Low Emission Vehicle program, the State of Maine adopted the California Air Resources Board GHG emission standards for new vehicles commencing with 2009 model year passenger cars, light duty trucks and medium duty passenger cars. For each model year, the sales-weighted average of the calculated CO_2 exhaust mass emissions must not exceed the fleetwide standard. The standards can be found at California Code of Regulations, Title 13, section 1961.3.

Links:
https://www.arb.ca.gov/msprog/levprog/levprog.htm
https://www.arb.ca.gov/msprog/levprog/cleandoc/cleancomplete_lev-ghg_regs_10-17.pdf.
https://www.maine.gov/dep/air/rules/index.html (Reference Chapter 127)

Status 2017: Ongoing. Joint rulemaking was issued by EPA and NHTSA for a coordinated federal GHG emission reduction and fuel economy program for light-duty vehicles beginning with model year 2017. California allowed auto manufacturers to comply with the federal standards as an alternative compliance with California's GHG regulations for the 2017-2025 model years.

Status 2018: Ongoing. The federal government has started a rulemaking process to freeze the GHG standards at the 2020 level through model year 2026. California has started a rulemaking process to no longer allow the federal program "deemed to comply" with the California GHG emissions standards.

Alternative Fueled Freight	**Lead Agencies:**	**DEP, DOT**

In 2013 NEG/ECP tasked the Transportation Air Quality Committee to facilitate widespread adoption of alternative fuel vehicles (AFV) to reduce GHGs. DEP and DOT support NEG/ECP's work through efforts to continue toward the 2020 goal of 5 percent AFV penetration; developing a proposal for a framework that will facilitate interoperability of AFV refueling and recharging; identifying corridors in the region that would facilitate AFV travel; and compiling a regional profile of the light-duty fleet.

Status 2017: Ongoing. Early stages of research and data collection, including identifying alternative fuel vehicle refueling and recharging stations.

Status 2018: Ongoing.

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EPAs SmartWay Program **Lead Agency:** **DEP**

The purpose of this voluntary program is to help businesses move goods in the cleanest and most efficient way possible. The Office of Innovation and Assistance provides in-person and online technical assistance in response to telephone and email requests from landowners, businesses, developers and others, encouraging improved fuel efficiency, reduced idling times, and other cost-effective options that reduce CO2 emissions.

Link: http://www.maine. gov/dep/assistance/SmartWay/index.html

Status 2017: Ongoing.

Status 2018: Ongoing. DEP continues to provide support for the SmartWay program providing materials and outreach to interested partners and stakeholders.

Enhanced Motor Vehicle Inspection Program **Lead Agency:** **DEP**

The DEP administers the enhanced motor vehicles inspection program that took effect January 1, 1999. The program requires that gasoline-powered motor vehicles registered in Cumberland County undergo an enhanced inspection, including a gas cap pressure test and an Onboard Diagnostics inspection.

Link: http://www.maine.gov/dep/air/mobile/enhancedautoinsp.html

Status 2017: Ongoing.

Status 2018: Ongoing.

v. *Natural Resources and Resource Recovery*

Climate Mitigation through Forestry Management **Lead Agency:** **DACF**

The Bureau of Forestry provides guidance and technical assistance to landowners to encourage them to actively manage woodlands to maintain them in a healthy, resilient condition. Maine's Healthy Forests Program promotes active forest management by woodland owners in southern Maine; the Woodswise Incentives Program helps woodland owners practice long term stewardship of their forest land, primarily through cost-sharing woodland management plans; Project Canopy supports healthy, well-managed urban and community forests by planting and maintaining trees in public spaces; managing town-owned woodlands; planting trees to mitigate storm-water overflow and retention; and encouraging installation of low impact development projects to increase green infrastructure as a viable alternative to grey infrastructure. The Bureau also assists woodland property owners in navigating the Tree Growth Tax Law, a current use taxation program which encourages long term forest ownership and active management.

Links:
http://www.maine.gov/dacf/mfs/projects/healthy_forests/index.html
http://www.maine.gov/dacf/mfs/policy_management/woodswise/index.html
http://www.maine.gov/dacf/mfs/policy_management/project_canopy/
http://www.maine.gov/dacf/mfs/policy_management/woodswise/tree_growth_tax_law.html

Status 2017: Ongoing.

Status 2018: Ongoing.

III. Inventory of State Climate Activities - Mitigation

Sustainable Materials Management **Lead Agency:** **DEP**

DEP's Sustainability Unit in the Materials Management Division provides a comprehensive and coordinated approach to environmental stewardship and management of the materials we utilize. The Sustainability Unit promotes waste reduction, reuse, recycling and composting initiatives to ensure the efficient use of material resources. Staff provide technical assistance, education, data tracking and management, oversight of extended producer responsibility recycling programs, and annual small grants to develop programs and infrastructure to divert solid waste from disposal. Diverting materials into productive reuse avoids the generation and release of greenhouse gases associated with the extraction of virgin materials and refinement into commodity materials, and from landfill disposal. Composting creates amendments that enrich the growing and carbon sequestration capacities of Maine soils.

DEP also is part of the review process for solar farms sited on closed landfills. Solar power developers and municipalities see construction of solar farms on the State's approximately 400 closed municipal landfills as a win-win situation: the closed landfills are put back into productive use, the annual maintenance mowing required for the cap maintains solar gain, and routine inspections of the landfill cap and power system can be accomplished at the same time.

Links:
http://www.maine.gov/dep/sustainability/bottlebill/index.html
http://www.maine.gov/dep/homeowner/fluorescent.html
http://www.maine.gov/dep/waste/productstewardship/index.html
http://www.maine.gov/dep/waste/recycle/index.html
http://www.maine.gov/dep/sustainability/compost/index.html
http://www.maine.gov/dep/news/news.html?id=814432 (DEP Awards Grants to Support Recycling and Organics Management Initiatives)
https://www.maine.gov/dep/commissioners-office/environmental_trends.html (Pounds of Electronics Collected, Municipal Solid Waste Recycled)

Status 2017: Ongoing.

Status 2018: Ongoing.

On September 24, 2018, DEP awarded grants to support recycling and organics management initiatives. These projects are targeted to divert waste from disposal by expanding composting and recycling opportunities across Maine. DEP received 7 proposals requesting over $112,000, and will award over $88,000 to fund 6 of the projects. This is the first time DEP is providing grants to help businesses, institutions and municipalities address solid waste management challenges. DEP plans to issue the next request for grant proposals in early 2019.

Through approval of five (5) solar farms on closed landfills, DEP has clarified the design requirements and approval process for such installations. An additional nine (9) municipalities have approached DEP regarding solar farms on their closed landfills.

III. Inventory of State Climate Activities – Research and Analysis

B. Research and Analysis

GUIDING QUESTIONS: WHAT IS IMPACTED BY CLIMATE? WHAT CHANGES ARE BEING OBSERVED?

i.   Physical Environment – Air, Land, Water

Physical Environment – Air

Air Quality Forecasting   **Lead Agency:**   **DEP**

DEP is currently modifying models used in air quality planning to incorporate updated meteorological parameters, such as increased average temperatures, to better predict ozone levels in model projections.

Links:
http://www.maine.gov/dep/air/ozone/
https://www.maine.gov/dep/commissioners-office/environmental_trends.html (Ozone)

Status 2017: Ongoing.

Status 2018: Ongoing.

Atmospheric Deposition Mapping   **Lead Agency:**   **DEP**

DEP identifies and maps the locations where air pollutants such as acid rain and mercury are deposited, to enable monitoring of effects on activities and on the environment. The distribution of these pollutants can also be used to inform modeling of other airborne pollution, such as ozone.

Links:
http://www.maine.gov/dep/air/air_quality/ar_step01.php
http://nadp.isws.illinois.edu/data/sites/map/?net=MDN

Status 2017: Ongoing.

Status 2018: Ongoing.

Physical Environment – Coastlands & Saltwater

On-line Coastal Sand Dunes Geology Maps   **Lead Agency:**   **DACF**

The Maine Geological Survey (MGS) maintains an online catalog of maps of the state's dunes based on air photography, LiDAR imagery, and field surveys. Maps are complete for the entire coast. The maps delineate Erosion Hazard Areas (EHA) as well as existing extent of front and back dune areas. EHA designation includes consideration of climate-related sea level rise and potential for inundation.

Link: http://www.maine.gov/dacf/mgs/pubs/online/dunes/dunes.htm

Status 2017: Ongoing.

Status 2018: Ongoing.

III. Inventory of State Climate Activities – Research and Analysis

Beach Monitoring Program   **Lead Agencies:**   **DACF, DMR**

MGS conducts the Maine Beach Mapping Program which, over decades of data collection, shows the response of beaches to sea-level rise and changing frequency of coastal storms. The State of Maine Beach Profiling Project (SMBPP) uses trained volunteers to collect monthly beach profiles from a designated starting point shore-perpendicular to roughly the low water line. SMBPP is funded and managed by MGS, UMaine, Maine Sea Grant, and the Maine Coastal Program (MCP). These efforts are summarized at the biennial State of Maine Beaches Conference and the biennial update on *State of Maine's Beaches* report.

Link:
https://www.maine.gov/dacf/mgs/explore/marine/beaches17/contents.htm

Status 2017: Ongoing.

Status 2018: Ongoing.

Coastal Hazards including Sea, Lake, and Overland Surge from Hurricanes Modeling   **Lead Agency:**   **DACF**

Link: http://www.maine.gov/dacf/mgs/hazards/coastal/index.shtml

Status 2017: Complete. See Appendix A. Completed Activities.

Increasing resilience and reducing risk through application of nature based coastal infrastructure practices in New England   **Lead Agency:**   **DACF**

                                       Partner Agency: **DEP, DMR**

This 2-year NOAA-funded Regional Resilience Grant is an extension of the work completed as part of an earlier project. Develop regional and state-level monitoring protocols for furthering concepts of living shorelines in New England. Design, permit, construct, and monitor demonstration treatment "living shoreline" types in Casco Bay, ME. Develop information, workshops, and regulatory guidance for living shorelines in Maine and New England.

Links:
https://www.maine.gov/dacf/mgs/explore/marine/living-shorelines/project_living_shoreline_dst_summary_slides.pdf

https://www.maine.gov/dacf/mgs/explore/marine/living-shorelines/
https://www.maine.gov/dacf/mgs/explore/marine/living-shorelines/workshop.shtml

Status 2018: In progress.

Coastal Resilience and Restoration   **Lead Agency:**   **DMR**

                                       Partner Agencies: **DACF**

The Bureau of Ocean Energy Management (BOEM) and the State of Maine are evaluating offshore sand resources for coastal resilience and restoration planning. DMR and DACF are developing seafloor maps that identify and locate potential areas of sand resources and benthic habitat, both within state waters as well as on portions of the Outer Continental Shelf managed by BOEM. Mapping data are available to the public online through the Maine Coastal Atlas. The overall goal is to have available geologic and benthic habitat resources data accessible for planners

and managers. This research will help ensure that activities including offshore dredging and beach nourishment are conducted in a sustainable manner that is compatible with natural sediment transport and biological processes.

Links:
https://www.maine.gov/dmr/mcp/planning/mcmi/index.htm
https://www.maine.gov/dmr/mcp/coastalatlas/index.htm

Status 2017: Ongoing.

Status 2018: Ongoing.

Coastal Zone Data Acquisition	**Lead Agency:**	**MEGIS**
	Partner Agencies:	**DACF, DMR, DOT**

This effort is a collaboration between the Maine Office of GIS, DOT, other state agencies, and federal agencies to acquire detailed elevation data in southern Maine coastal areas. The acquired LiDAR data facilitates modeling of sea-level rise, storm surge, tsunami impacts, and riverine flooding. While the intent is to acquire such detailed elevation datasets statewide, currently only most coastal counties are completed.

Link: http://www.maine.gov/megis/projects/lidar.shtml

Status 2017: Ongoing.

Status 2018: Ongoing. On-land coastal LiDAR is complete, but the group is seeking support for bathy-LiDAR for the nearshore environment.

Northeast Regional Association of Coastal Ocean Observing Systems (NERACOOS)	**Lead Agency:**	**DMR**

NERACOOS Climatologies resource shows real-time data from a buoy network where users can review historical daily data and compare it to current conditions, which is helpful to track changes in temperature over time. Boothbay has temperature records dating back to 1905 and is the oldest record in the Gulf of Maine.

Link: http://www.neracoos.org/datatools/climatologies_display

Status 2017: Ongoing. Maine is observing increases in maximums, as well as changes in the time of year that warm periods are occurring, within years and the rate of change is accelerating. 2012 was the warmest year on record, and in the last 12 years we have had 10 of the warmest years on record.

Status 2018: Ongoing.

Maine Ocean and Coastal Acidification (MOCA) Partnership	**Partner Agencies:**	**DEP**

DEP is a member of the voluntary Maine Ocean and Coastal Acidification (MOCA) partnership. MOCA is a partnership formed in March 2016 seeking (1) to implement recommendations of the Ocean Acidification Study Commission authorized by the 126th Legislature, as set forth in the study commission's report and (2) to coordinate the work of governmental agencies and private organizations and citizens who are studying and implementing means to reduce the impacts of or help adapt to ocean and coastal acidification.

III. Inventory of State Climate Activities – Research and Analysis

Link: https://www.seagrant.umaine.edu/extension/maine-ocean-and-coastal-acidification-partnership

Status 2017: Ongoing. The MOCA partnership teamed with the Regional Association for Research in the Gulf of Maine group to facilitate the group's annual science meeting's focus on Ocean and Coastal Acidification: Causes and Potential Consequences for Ecological and Sociological Systems in the Gulf of Maine at their annual science meeting in October, 2017.

Status 2018: Ongoing. MOCA held a summer meeting on June 12th at Bowdoin College which showcased current research on the impacts of ocean acidification on sub-adult lobsters. It's winter meeting was held November 29th at the State House in Augusta.

New England Coastal Acidification Network	**Partner Agencies:**	**DEP, DMR, DACF**

DEP participates in the New England Coastal Ocean Acidification Network (NECAN).

Links:

http://www.necan.org/

http://www.necan.org/sites/default/files/Ocean%20and%20coastal%20acidification%20off%20New%20England%20and%20Nova%20Scotia_0.pdf

https://nepis.epa.gov/Exe/ZyPURL.cgi?Dockey=P100UDMR.txt (Guidelines for Measuring Changes in Seawater pH and Associated Carbonate Chemistry in Coastal Environments of the Eastern United States [URL/Download])

Status 2017: Ongoing. The group developed a "state of the science" report that covered related ocean acidification (OA) key research and monitoring needs, which was published in 2015. June 2018, the EPA Office of Research and Development Completed the peer and administrative reviewed *Guidelines for Measuring Changes in Seawater pH and Associated Carbonate Chemistry in Coastal Environments of the Eastern United States.* The guidance document for OA parameter monitoring could help standardize efforts by agencies that are collecting information related to OA and is anticipated to impact water quality by improving the scientific basis of actions under the Clean Water Act. This will be accomplished by providing information to citizen scientists, states, tribes, and existing water quality laboratories who wish to initiate or improve measurements of seawater carbonate chemistry.

Status 2018: Ongoing.

Ocean Acidification Monitoring and Research	**Lead Agency:**	**DEP**

DEP monitors and assesses marine waters of the state for attainment of designated uses, which include those directly linked to the impacts from ocean acidification (OA), such as the propagation of shellfish, and generally, protection of aquatic life. DEP continues to measure pH during discrete sonde sampling and by unattended sonde over durations from weeks to months, but none of these datasets enable detection of OA impacts.

III. Inventory of State Climate Activities – Research and Analysis

Link: http://www.midcoastconservancy.org/wp-content/uploads/2017/01/MCOA-report-Final-small-vers.-17nov15.pdf

Status 2017: Intermittent. As funding allows.

In 2014, 2015, and 2016 DEP funded nutrient analysis for the Maine Coastal Observing Alliance's estuarine water quality monitoring efforts, and as a pilot project in the summer of 2015, DEP staff field-tested pH monitors at several coastal mud flat locations in conjunction with the Hancock County Soil and Water Conservation District (HCSWCD). The Marine Unit also continues to pursue monitoring efforts as related to eutrophication, currently with eelgrass as the currently most relevant biological indicator. This work has been focused in Casco Bay most recently but continues coastwide, as influenced by wastewater discharge permit renewals. Monitoring work may help understand the relative differences between estuaries; data before, during and after rainfall events; and data from incoming tides when low pH waters from offshore are pushed up into estuaries.

Pending the release of a EPA guidance document for OA parameter monitoring, DEP will determine feasibility of incorporating OA parameters into our seasonal monitoring efforts in the short (2018) and longer term.

Status 2018: Intermittent.

DEP's Marine Unit funded analysis of 2017 total nitrogen samples as part of MCOA's continued monitoring efforts. The DEP's Marine Unit contributed pH and related parameter data from multiple Midcoast Maine sites to UMaine faculty funded by NOAA to address "Low pH in coastal waters of the Gulf of Maine: A data synthesis-driven investigation of probable sources, patterns and processes involved."

Three long term monitoring sites were established by the DEP's Marine Unit within Casco Bay to study eelgrass health (as important indicators of eutrophication, warming waters and rising seas) and to enable future collaborative research. Cross-reference Section III. B. Research and Analysis "Eelgrass Mapping".

Physical Environment – Inlands & Freshwater

Cooperative Snow Survey	Lead Agency:	DACF
	Partner Agencies:	DEP

The Maine Cooperative Snow Survey collects, interprets, and distributes information on the depth and water content of Maine's snowpack in the late Winter and early Spring, when the danger of flooding in Maine's rivers and streams is greatest. The data are analyzed by staff from MGS and the USGS, and maps are prepared showing the water content in snowpack for the State, and comparison to long-term records for snowpack. These surveys are an important part of understanding climate change-related impacts to snowpack. Cross-reference Section III. D. Preparedness "River Flow Advisory Commission".

Link: http://www.maine.gov/rfac/rfac_snow.shtml

Status 2017: Ongoing.

Status 2018: Ongoing.

III. Inventory of State Climate Activities – Research and Analysis

Soil Water-Balance Project   Lead Agency: DACF

Cooperative project with the USGS to develop a soil water-balance model that can be used across the entire state to predict groundwater recharge from data on land use, soil types, and local climate data. Over time, the model can be used to analyze climate change-related impacts to groundwater recharge.

Status 2017: Ongoing.

Status 2018: Ongoing. In final calibration phase. The model was built in the first year of the project and is now being calibrated against two dozen watersheds across the state. Completion expected in early 2019.

Groundwater Monitoring Networks   Lead Agency: DACF
                                                        Partner Agency: DEP

DACF and DEP are cooperating with the USGS to enhance the groundwater level monitoring network in Maine. Long-term records will allow analysis of climate impacts to groundwater.

Links:
https://cida.usgs.gov/ngwmn/
http://www.maine.gov/dep/water/groundwater/
http://www.maine.gov/dep/water/monitoring/index.html
http://www.maine.gov/dep/gis/datamaps/index.html#blwq

Status 2017: Ongoing. Thirty existing long-term monitoring wells in the DEP database were selected for inclusion in the national network. The new wells that complement the existing USGS network in Maine in terms of geographic distribution and type (bedrock and surficial) are being vetted for inclusion in the national database.

Status 2018: Ongoing. Current activities include verifying location and physical characteristics of the wells.

Maine Interagency Stream Temperature Monitoring and Modeling Network   Lead Agency: DIFW
                                                        Partner Agency: DMR, DEP

The Maine Water Temperature Working Group (MWTWG) was established in 2014 to develop a coordinated stream temperature monitoring network that can be integrated with regional and national efforts. The group is composed of multiple state agencies, academics, NGOs, tribes, and federal agencies. The MWTWG has developed standardized monitoring protocols, conducted a comprehensive inventory of existing data for current and past water temperature monitoring efforts, and is monitoring stream temperature in >240 stations statewide.

Status 2017: Ongoing.

Status 2018: Ongoing. Currently, the MWTWG is coordinating equipment and training needs, deploying a statewide temperature sensor network, and working with USGS to utilize a web-based database to store sensor location and water temperature data and to model water temperatures across Maine.

Establishing A Long-Term Stream Temperature Monitoring Program   Lead Agency: DEP

Establishing a long-term monitoring program will help track changes over time and can serve as a climate indicator. Staff additionally coordinate with USGS and participate in a

EPA New England regional monitoring network as well as a statewide workgroup for continuous stream temperature monitoring. Information gathered through the DEP monitoring efforts could be shared with, and compliment, these other activities.

Status 2017: Ongoing. In 2017, DEP staff installed water temperature monitoring equipment in twelve streams in Maine. Set up originally as 12 sites; 3 per region.

Status 2018: Ongoing. In 2018 one additional site was added. Currently manage temperature loggers at 10 sites and collectively have 20 total sites.

ii.   *Habitats and Species – Saltwater, Freshwater, and Terrestrial Systems*

Habitats and Species – Saltwater

Marsh Migration Community of Practice	**Partner Agencies:**	**DMR, DACF**

The Northeast Regional Ocean Council (NROC) sponsored an initiative in 2014-15 to advance the effective use of models of marsh migration in the context of management and policy.

Link: https://www.northeastoceancouncil.org/committees/ocean-and-coastal-ecosystem-health/marsh-migration-group/ (workshop materials and publications)

Status 2017: Ongoing

Status 2018: Ongoing

Modeling the Effects of Sea-Level Rise on Coastal Habitats	**Lead Agency:**	**DACF**
	Partner Agencies:	**DIFW, DOT**

Link: http://www.maine.gov/dacf/mnap/assistance/coastal_resiliency.html

Status 2017: Complete. Portal online. See Appendix A. Completed Activities.

Measuring the Response of Coastal Marshes to Sea-level Rise	**Lead Agency:**	**DMR**
	Partner Agencies:	**DIFW, DACF**

The Maine Coastal Program (DMR) is working with its partners to monitor changes in salt marsh elevation over time using Rod Surface Elevation Tables (RSETs). Precise measures of sediment elevation in wetlands are necessary to determine rates of elevation change, particularly relative to sea level rise, and to gain an understanding of the processes responsible for elevation change.

Status 2017: In development. In 2017, DIFW worked with DMR to identify coastal salt marshes under conservation for installation of sediment elevation tables. Eight locations on Wildlife Management Areas were selected for installation and monitoring activities in DIFW coastal management regions.

Status 2018: Ongoing. 27 individual RSETs have been installed in nine marshes spanning the state. Maine Coastal Program worked with many partners to select these study locations, install the long-term monitoring equipment, and perform the first salt marsh elevation readings in 2018. Over the coming years, DMR will gather data from the RSETs to determine changes in marsh elevation. Additionally, we will collect information at each site about plant communities, sedimentation rates, water depth, and other environmental factors.

III. Inventory of State Climate Activities – Research and Analysis

Modeling the Effects of Sea- Level Rise on Public Transportation Assets	**Lead Agency:**	**DOT**
	Partner Agency:	**DACF**

DOT received funding from the FHWA to conduct a vulnerability and criticality assessment of the public transportation assets in the six participating communities. Cross-reference communities in Section III. B. Research and Analysis "Modeling the Effects of Sea- Level Rise on Coastal Habitats".

Status 2017: Ongoing. Effort will be integrated into the overall project and DOT will be using the local relationships and network developed through the DACF project to deliver the municipal outreach component of their grant. Project partners at the local level include farmers, fishermen, municipal officials, schools, and other interested citizens.

Status 2018: Complete.

Establishing Protocols for Assessment of Tidal Crossings, Creating Guidance for Restoration at Tidal Crossings, Development of Coastwise Training Tool	**Lead Agency:**	**DMR**
	Partner Agencies:	**DACF, DIFW, DOT**

The Maine Coastal Program (DMR) is working to update the dated Return the Tides inventory of tidal crossings, developing a consistent method for properly assessing the crossings, protocols for restoration at crossings and creating an analog to the Stream Smart Training Program called Coastwise. Coastwise will be used to inform municipalities and private landowners about restoration.

Status 2018: In progress.

Eelgrass Mapping	**Lead Agencies:**	**DEP, DMR**
	Partner Agencies:	**DACF, DIFW**

DEP coordinated aerial mapping of eelgrass in Casco Bay (2013), which continue annually based on specific project needs and to document changes in eelgrass beds that are the sites of long term monitoring. Some of these data layers are shared with MEGIS and are publicly available, others made available by request.

Link: http://www.cascobayestuary.org/responding-dramatic-declines-eelgrass/

Status 2017: Ongoing. Aerial mapping of smaller embayment's of Casco Bay in 2014-2017. Similar mapping efforts proposed in coming years. Funding and participant dependent.

Status 2018: Ongoing.
DMR, with partners, received MOHF funds to assess different methods of measuring the extent and health of eelgrass beds. DEP's Marine Unit and partners (Casco Bay Estuary Partnership, DACF's Submerged Lands Program, The Nature Conservancy, and DIFW (State Wildlife Grant)) enabled low tide aerial photography acquisition and eelgrass delineation in Casco Bay in June 2018. The mapping and ground-truthing of eelgrass coverage in Casco Bay was completed in partnership with DIFW and Casco Bay Estuary Partnership. By end of 2018 or early 2019, imagery and a GIS layer showing eelgrass distribution and percent cover will be publicly available via MEGIS.

Additionally, an eelgrass mapping methods project lead by the DMR and funded in part by the Maine Outdoor Heritage Fund will compare various technologies, including aerial imagery by plane, multispectral imagery acquired by drone, side scan and multibeam sonar to assess

feasibility, advantages and disadvantages for eelgrass mapping and health assessments on an eelgrass meadow or small embayment scale. Data synthesis and white paper creation are anticipated in late 2018-early 2019.

Piscataqua River/Great Bay Estuary eelgrass mapping, as coordinated by the Piscataqua Region Estuary Partnership (PREP) and planned for summer 2018, is postponed until 2019.

Saltmarsh Birds   **Lead Agency:**   **DIFW**

Species nesting just a few inches above the surface of the marsh are inherently vulnerable to tidal flooding.

With even moderate sea-level rise, model projections suggest a complete annual loss of tidal marsh habitat of up to 1.5%, greatly reducing nesting opportunities for saltmarsh birds.

Links:
https://www.tidalmarshbirds.org/
http://www.tidalmarshbirds.org/wp-content/uploads/downloads/2016/02/Maine-SHARP-summary.pdf (Summary findings for Maine from range-wide survey)

Status 2017: Ongoing; research phase complete. DIFW partnered with researchers at three universities (U. of Delaware, U. of Connecticut, and U. of Maine) and completed range-wide (Maine to Virginia) surveys of the abundance and distribution of saltmarsh bird species, as well as research focused on survival, fecundity, and population viability in 2015.

Status 2018: Ongoing; management strategies to be implemented. Project partners have been discussing management action priorities in recent years, but DIFW is not aware of any management actions currently being implemented in the state. Tidal marsh bird management plans are likely of interest to DOT and other related state agency stakeholders because the most severe bird population declines occur in marshes with tidal marsh restrictions. Additional research being conducted at Rachel Carson National Wildlife Refuge.

Atlantic States Marine Fisheries   **Lead Agency:**   **DMR**
Commission

For over 75 years, the Commission has served as a deliberative body for the Atlantic coastal states, coordinating the conservation and management of 27 nearshore fish species. Each state is represented on the Commission by three Commissioners: the director of the state's marine fisheries management agency, a state legislator, and an individual appointed by the state's governor to represent stakeholder interests. These Commissioners participate in deliberations in the Commission's main policy arenas: interstate fisheries management, fisheries science, habitat conservation, and law enforcement. Through these activities, the states collectively ensure the sound conservation and management of their shared coastal fishery resources and the resulting benefits to the fishing and non-fishing public.

Link: http://www.asmfc.org/

Status 2017: Ongoing.

Status 2018: Ongoing.

III. Inventory of State Climate Activities – Research and Analysis

Northeast Regional Ocean Council   **Lead Agencies:**   **DACF, DMR**
(Integrated Sentinel Monitoring Network)

The Integrated Sentinel Monitoring Network for Change in Northeast U.S. Ocean and Coastal Ecosystems (ISMN) initiative is a joint project of NERACOOS and Northeast Regional Ocean Council (NROC), which was established based on a pressing regional need to establish an integrated network to observe and interpret changes in the ecosystem (Runge, et. al 2012). It is envisioned that this network will inform researchers, managers, and the public about ecosystem vulnerabilities and impacts, and support an ecosystem-approach to management framework that promotes human and ecosystem resiliency from climate change and related stressors. This effort involves reviewing existing data, and developing criteria for indicators and sentinel sites to monitor estuarine, benthic and pelagic organisms. Planning and science staff from DMR and DACF participate.

Links:
http://www.neracoos.org/sentinelmonitoring/database
http://www.neracoos.org/sites/neracoos.org/files/documents/ISMN_Plan_Edition1_final_2.pdf
http://www.neracoos.org/sites/neracoos.org/files/documents/Sentinel/Northeast_Sentinel_Monitoring_IOOC_CommunityWhitePaper_Rung_etal_2012.pdf (Runge, et. al 2012)

Status 2017: Ongoing. The completed science and implementation plan identifies a suite of ecosystem variables and indicators, existing monitoring efforts and gaps for three specific ecosystem habitats, pelagic, benthic, estuarine and nearshore. The plan also outlines a governing body to implement and analyze ecosystem trends, as well as a data management plan for how to integrate these disparate monitoring efforts.

Status 2018: Ongoing. Implementation of selected activities is ongoing; funding is being sought.

Maine-New Hampshire Trawl Survey   **Lead Agency:**   **DMR**

The Maine-New Hampshire Inshore Trawl Survey is a resource assessment survey performed along the coastal waters of Maine and New Hampshire. Bi-annual surveys, spring and fall, have been conducted since the fall of 2000. This survey is a collaborative research project using a commercial fishing vessel as the platform. The boat's owner, captain, and crew have been actively involved in the design and implementation of this survey.

An ongoing NOAA bottom trawl survey conducted since the 1960s shows changes in species abundance and location over time. There has been a dramatic change in that the areas where some species' greatest concentrations abundance are found have moved from south to north. Landing numbers have followed these changes in abundance location. Landings have also move further offshore (20-30 miles) where lobsters were previously not found.

Link: http://www.maine.gov/dmr/science-research/projects/trawlsurvey/index.html

Status 2017: Ongoing.

Status 2018: Ongoing.

Summer Survey for Northern Shrimp   **Lead Agency:**   **DMR**

Maine is at southern limit of the Northern Shrimp distribution. Temperature is known to affect recruitment. For example, during a cold year, there would be strong recruitment, and during a warm year, there would be weak recruitment. A recruit is the larvae that settles from the water column to the surface and has an increase in survival rate.

III. Inventory of State Climate Activities – Research and Analysis

Link: http://www.maine.gov/dmr/science-research/species/shrimp/index.html

Status 2017: On hold. There has been weak recruitment in recent years. Shrimp fishery has been closed for the last three years.

Status 2018: On hold. Shrimp fishery remains closed.

Lobster Sea Sampling   **Lead Agency:**   **DMR**

DMR sea sampling program is the largest at-sea sampling program for lobster in the northeast. Time-series of catch rates and biological data have been used in numerous investigations of width/length relationships, fecundity, size-at-maturity, sex ratio, geographic variation, growth, V-notch composition, and selectivity. Data from the sea sampling program contribute directly to the Atlantic States Marine Fisheries Commission (ASMFC) American lobster stock assessment.

From the 1950s thru 1980s, the Maine lobster harvest was relatively stable at around 20 million pounds per year. In the last 25 years, lobster landings have risen exponentially, and the value ranks nationally in the top two or three among state lobster fisheries every year. It employs more people directly harvesting than almost any other fishery in the U.S. The number of trips made by harvesters annually exceeds all the other fisheries from Georgia to Massachusetts combined.

Link: http://www.maine.gov/dmr/science-research/species/lobster/seasampling.html

Status 2017: Ongoing. Many communities are inviting DMR to aid in their comprehensive plan development.

Status 2018: Ongoing.

Lobster Settlement Survey   **Lead Agency:**   **DMR**

Surveys of the Maine juvenile lobster population were started in the Midcoast region (Zone E) in 1989 by researchers at UMaine and the Bigelow Laboratory for Ocean Sciences. In 2000, the settlement surveys were expanded to cover all seven of Maine's lobster management zones in order to create a statewide settlement index. In 2005, DMR fully took over the monitoring effort in Maine. Settlement surveys using the same methodologies employed in Maine are conducted throughout New England and Maritime Canada. In 2012, data from these various groups was brought together in a single publicly accessible database, the American Lobster Settlement Index (or ALSI). This collaborative provides standardization in sampling methods and facilitates data analysis across all sampling programs. Using this type of fishery-independent survey, researchers at UMaine and DMR hope to track juvenile populations and generate predictive models of future landings.

Link: http://www.maine.gov/dmr/science-research/species/lobster/settlement.html

Status 2017: Ongoing.

Status 2018: Ongoing.

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Habitats and Species – Freshwater & Terrestrial

Climate Change and Biodiversity in Maine: Vulnerability of Habitats and Priority Species	**Lead Agency:**	**DIFW**
	Partner Agencies:	**DACF**

Link:
https://www.manomet.org/sites/default/files/publications_and_tools/2013%20BwH%20Vulnerability%20Report%20CS5v7_0.pdf

Status 2017: Complete. See Appendix A. Completed Activities.

Climate Maps for Vulnerable Habitats and Species	**Lead Agency:**	**DIFW**

DIFW is currently developing a 'climate change' map to identify locations where climate-vulnerable areas and important wildlife habitats overlap. This analysis could help inform mitigation measures for some of Maine's most at risk wildlife species and habitats.

Status 2017: Ongoing.

Status 2018: Ongoing.

Identifying Priority Amphibian and Reptile Conservation Areas	**Lead Agency:**	**DIFW**

The Priority Amphibian and Reptile Conservation Area (PARCA) project is a national initiative to develop a network of focus areas that contain some of the high value specialized habitats required by these groups and that are also resilient to anticipated climate change impacts. As a member of a northeastern research team (including UMaine), the DIFW has helped to identify scientific criteria for identifying PARCAs, drawing on the concepts of species rarity, richness, and landscape integrity.

Links:
http://parcplace.org/
http://www.maine.gov/ifw/docs/2017%20Research%20and%20Management%20Report_FINAL_9-5-17.pdf

Status 2017: Ongoing.

Status 2018: Ongoing.

Invasive Freshwater, Wetland and Terrestrial Plants	**Lead Agency:**	**DACF, DEP**

DACF/MNAP and DEP/Invasive Aquatic Species Program collaborate with land trusts, lake associations and municipalities on invasive plant prevention, early detection, long-term monitoring and control. MNAP also works with private landowners, depending on funding available to do so. Range expansions and extended growing seasons may increase the burden on State and local agencies and organizations working to prevent and manage invasive plants to mitigate the impacts on native species.

Links:

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https://www.maine.gov/dacf/mnap/features/invasive_plants/invasives.htm
https://www.maine.gov/dep/water/invasives/index.html

Status 2017: Ongoing.

Status 2018: Ongoing.

Priority Species Research	**Lead Agency:**	**DIFW**

DIFW actively conducts research on habitat relationships and limiting factors for priority fish and wildlife species. This ongoing research helps DIFW anticipate the potential effects of climate change and adapt its management practices appropriately.

Links:

http://www.maine.gov/ifw/fish-wildlife/fisheries/reports-publications.html
http://www.maine.gov/ifw/fish-wildlife/wildlife/endangered-threatened-species/index.html

Status 2017: Ongoing.

Status 2018: Ongoing.

An Assessment of Maine's Endangered and Threatened Species	**Lead Agency:**	**DIFW**

A tool employed by DIFW to achieve its mandate for conserving all species of fish and wildlife found in Maine is a periodical review of the state's listings of Endangered and Threatened Species. DIFW considers species vulnerability to climate change as one of many potential threat factors when proposing revisions to the State Endangered and Threatened Species list.

Link:

http://www.maine.gov/ifw/fish-wildlife/wildlife/endangered-threatened-species/index.html

Status 2017: Ongoing.

Status 2018: Ongoing.

Moose	**Lead Agency:**	**DIFW**

Maine is home to the densest population of moose in the lower 48 states due to the availability of large tracts of forested habitat that produce the substantial forage base essential to moose productivity. While Maine's moose population remains strong, it is still important to understand adult female and calf survival rates considering potential effects of climate change, parasites, habitat, winter tick, and predation.

Link:

http://www.maine.gov/ifw/fish-wildlife/wildlife/species-information/mammals/moose.html

Status 2017: Ongoing.

Status 2018: Ongoing.

Canada Lynx Conservation and Management	**Lead Agency:**	**DIFW**

The Canada Lynx is a northern boreal species adapted to living in areas with deep snow and abundant snowshoe hare. Over the last 14 years, DIFW, USFWS, and the UMaine have been studying lynx habitat use and population status in Maine. Data collected will help inform

management of lynx in a changing climate.

Link: http://www.maine.gov/ifw/fish-wildlife/wildlife/species-information/mammals/canada-lynx.html

Status 2017: Ongoing.

Status 2018: Ongoing.

Rusty Blackbird Conservation and Management	**Lead Agency:**	**DIFW**

Rusty Blackbirds are the northernmost ranging of the blackbird species, reaching the southern edge of their boreal breeding range in Maine and New Hampshire.

This species has suffered range-wide population declines of more than 80% over the last four decades and a significant range retraction in Maine to occupy only the most northern and western areas of the state. Research efforts over the last decade have failed to identify a definitive mechanism for the decline, but habitat loss on the breeding grounds, both from deforestation and climate related loss of wetlands is of concern.

Link: http://www.maine.gov/ifw/fish-wildlife/wildlife/species-information/birds/songbirds.html

Status 2017: Ongoing. Completed previous research. Beginning in 2017, DIFW staff partnered with NH Audubon to continue research on the New England population of Rusty Blackbirds, tracking breeding territory occupancy, and productivity. NH Audubon documented the first ever case of bird blow fly parasitism in Rusty Blackbird nestlings in 2015. These species of bird blow flies are more typical in species nesting farther south than Maine and NH and may be a relatively new climate-related pressure for these birds. DIFW and NH Audubon staff will continue to explore the effects of these parasites on nestling survival in hopes of identifying another possible mechanism for this species' decline.

Status 2018: Ongoing. DIFW staff continued partnership with NH Audubon to continue research, additionally now tracking nestling health. Plans for continued field work in 2019.

Bicknell's Thrush	**Lead Agency:**	**DIFW**

The Bicknell's Thrush is one of North America's rarest and most localized breeders. They are listed as special concern in Maine and recently petitioned for (but denied) listing under the federal Endangered Species Act. With more than 20% of the global population breeding in Maine, the state's responsibility to this species is high. Until recently, information on this species in Maine has been limited to data collected as part of Vermont Center for Ecostudies Mountain Birdwatch Program and DIFW ecoregional survey efforts (1998-2005).

Link(s): https://mountainbirds.vtecostudies.org/birds/bicknells-thrush/

Status 2018: Ongoing. UMaine Master's research project commenced. DIFW is currently partnering with faculty and students from UMaine, Weyerhauser Forestry, and the Naval Facilities Command in Redington. The project goal is to investigate populations of breeding Bicknell's on harvested landscapes (Kibby Mtn. and surrounding areas) versus unharvested landscapes (Redington Mtn. and surrounding areas), identify multi-scale habitat use of commercial timberlands, develop Maine specific forest management recommendations for the species, and inform distribution-wide habitat use models for the state. The latter is especially important given

that climate change is expected to result in substantial declines of the spruce-fir forest community this species depends on [during the breeding season].

| **Maine Bird Atlas** | **Lead Agency:** | **DIFW** |

Maine conducted its first breeding bird atlas between 1978 and 1983. With the conclusion of the first atlas 33 years ago, and the lack of any state-wide assessment of wintering birds, our comprehensive understanding of bird diversity and distribution in the state is now dated. A contemporary bird atlas was identified in Maine's 2015 State Wildlife Action Plan as a conservation priority.

To address the mission of DIFW to preserve protect and enhance wildlife populations for use and enjoyment by current and future generations, the need exists to improve our understanding of the abundance and distribution of Maine's birds. Data collected as part of this project will provide a comprehensive understanding of the distribution and use of resources by Maine's birds and will be invaluable in guiding future species status assessments, priority species' needs, and identifying and conserving high value wildlife habitats. In addition, it will provide a more complete, solid set of abundance and distribution data to be utilized as a baseline for future comparisons.

Links: https://www.maine.gov/birdatlas

Status 2017: Initiated project planning. DIFW has partnered with the Maine Natural History Observatory, Maine Audubon, and Biodiversity Research Institute on this project.

Status 2018: Underway. First field season completed with help of professional staff, seven hired point count (abundance sampling) technicians, and over 650 volunteers; data publicly available via ebird.org; web-based volunteer effort tracking portal in development.

| **Dragonflies and Damselflies Conservation and Management** | **Lead Agency:** | **DIFW** |

Insects in the Order Odonata, dragonflies and damselflies, are a conspicuous component of Maine's diverse wildlife and serve an important role in both aquatic and terrestrial ecosystems in Maine. This two-year assessment identified which species of this Order are most critical to consider for regional conservation actions, thereby helping Maine and other states strategically focus limited conservation resources on the most imperiled species.

Links:
http://mdds.umf.maine.edu/
http://www.maine.gov/ifw/fish-wildlife/wildlife/species-information/invertebrates/damselfly-dragonfly.html
http://www.maine.gov/ifw/docs/2017%20Research%20and%20Management%20Report_FINAL_9-5-17.pdf

Status 2017: Ongoing.

Status 2018: Ongoing.

| **Brook Trout Conservation and Management** | **Lead Agency:** | **DIFW** |

Maine remains the last stronghold for wild Eastern Brook Trout in the United States. As a committed partner to the Eastern Brook Trout Joint Venture, the DIFW collaborates on multiple

research and assessment projects, including identifying strategies to mitigate climate change impacts to brook trout habitat by expanding habitats and accessibility to proximal habitats as much as possible by addressing stream/river connectivity issues.

Link: http://www.maine.gov/ifw/fish-wildlife/fisheries/wild-brook-trout.html

Status 2017: Ongoing.

Status 2018: Ongoing.

iii.   *Working Landscapes – Agriculture & Forestry*

| **Forest Service, Maine Healthy Forests Program** | **Lead Agency:** | **DACF** |

A healthy forest provides habitat for wildlife, clean water and air, recreational opportunities, and economic vitality to families. Healthy forests are important to our Maine way of life. This program looks at climate-related impacts to forests, and how to manage forests to address and adapt to the changing conditions.

Link: http://www.maine.gov/dacf/mfs/projects/healthy_forests/index.html

Status 2017: Ongoing.

Status 2018: Ongoing.

| **Forest Inventory Program** | **Lead Agency:** | **DACF** |

The Forest Inventory Program monitors current and changing forest landscapes and documents changes at a landscape scale across time. The systematic survey of all Maine's forests allows comparison with surrounding jurisdictions. The data sets extend back to 1959 to allow long-term monitoring of changing abundance and relative growth rates of various species. Representative subsets of plots are used to track insect and disease syndromes and evidence of expansion of invasive and/or exotic plants.

Link: http://www.maine.gov/dacf/mfs/forest_health/index.htm

Status 2017: Ongoing.

Status 2018: Ongoing.

| **Insect & Disease Management Program** | **Lead Agency:** | **DACF** |

The Insect and Disease Management Program allows prediction of probable pest impacts beyond historic ranges; provides Maine's forest landowners and residents information to enable timely response to threats; and works with researchers at the UMaine and the United States Forest Service to conduct research on new or intensifying pest problems, many of which have been exacerbated by changing weather patterns, such as warmer winter minimum temperatures and wetter spring weather.

Status 2017: Ongoing.

Status 2018: Ongoing. A current focus is Emerald Ash Borer.

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Agriculture, Integrated Pest Management & Cooperative Agricultural Pest Survey (CAPS)	**Lead Agency:**	**DACF**

The Cooperative Agricultural Pest Survey (CAPS) program conducts science-based national and state surveys targeted at specific exotic plant pests, diseases, and weeds identified as threats to U.S. agriculture and/or the environment. These surveys represent a second line of defense against the entry of harmful plant pests and weeds. The number of exotic pests threatening the state has increased partly because of climate variability. New pests that have been introduced into the country, and into the state of Maine, e.g. hemlock woolly adelgid, are easily expanding their ranges due to favorable climate conditions that allow faster development times and reduced temperature-related mortality. The CAPS Program aids in tracking invasive species, and provides early detection of harmful exotic plant pests to minimize impacts on our agricultural and natural resources.

Link: http://www.maine.gov/dacf/php/caps/index.shtml

Status 2017: Ongoing.

Status 2018: Ongoing.

iv. *Built Environment and Critical Infrastructure (Energy, Communication, Transportation, Water Utilities, Stormwater)*

Rainfall Data for Stormwater Management	**Lead Agency:**	**DEP**

In response to predictions of increasing frequency and intensity of storm events, DEP is taking a cross-media approach to incorporating consideration of the impacts of more frequent rainfalls (soils may be wetter/saturated more often prior to a storm event), as well as to increased rainfall amounts and durations (increasing surface water flow), in its stormwater rules. Research of rainfall tables for use in Chapter 500 (for Stormwater Management) is coordinated between the Water and Land Bureaus, and uses of DEP's Stormwater Management rule is incorporated across departmental program areas for project review, design guidelines, and guidance information. Cross-reference Section III. C. Adaptation "Storm Modeling and Guidance Information for Project Design and Review".

Links:
http://precip.eas.cornell.edu/
http://www.maine.gov/sos/cec/rules/06/096/096c500.docx

Status 2017: Ongoing.

Status 2018: Ongoing.

Wastewater Utility Vulnerability Evaluation	**Lead Agency:**	**DEP**

DEP reviews wastewater treatment facilities' capacities and outfalls as part of any improvement projects, and in anticipation of increased rainfall and rising sea-levels. Evaluation of a facility's capacity, including its ability to handle storm events and stormwater, can aid in assessing the vulnerability of associated infrastructure, such as pipes in proximity to water bodies. DEP assists

with Combined Sewer Overflow (CSO) abatement, which is a required consideration in the design and operation of wastewater facilities.

Status 2017: Ongoing.

Status 2018: Ongoing.

Improving Aquatic Connectivity	**Lead Agency:**	**DMR**
	Partner Agencies:	**DACF, DEP, DOT, DIFW**

The Stream Connectivity Working Group is a multi-agency consortium with the goal of encouraging statewide identification of priority aquatic resources for conservation and restoration activities that will benefit brook trout and other fish and aquatic wildlife. One product of this effort has been the field identification and mapping of in-stream barriers to aquatic organism passage due to poorly designed and/or malfunctioning stream crossings and impoundments. In addition to state agencies, this working group includes non-government organizations, non-profits, and federal agencies actively working on stream habitat restoration.

Link: https://webapps2.cgis-solutions.com/MaineStreamViewer/

Status 2017: Ongoing.

Status 2018: Ongoing. DOT has institutionalized these practices as a regular part of their bridge and culvert design. DIFW continues to identify poorly designed and malfunctioning stream crossings on State-owned Wildlife Management Areas, prioritize these for replacements and upgrades, and conduct reviews of impoundments for feasibility of increasing stream connectivity.

Aquatic Resource Management Strategy	**Partner Agencies:**	**DACF, DEP, DIFW, DMR, DOT**

Links:
https://www.maine.gov/mdot/publications/
https://www.maine.gov/mdot/publications/docs/brochures/pocket_guide_stream_smart_web.pdf (Stream Crossing Pocket Guide)

Status 2017: Complete. See Appendix A. Completed Activities.

v. *People and Communities (Buildings & Homes, Community Planning, Public Health & Services, Social Vulnerability)*

Weathering Maine: Mapping Threats to Maine Historic Resources	**Lead Agency:**	**MHPC**

The Maine Historic Preservation Commission is developing a GIS map locating properties listed in the National Register of Historic Places and as National Historic Landmarks within layers illustrating various threats from climatic change. This is offered as a planning tool for researchers, property owners and governmental officials.

Link: To be determined.

Status 2018: In process. The site will be posted in January 2019.

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Sustainability for Maine's Coastal Heritage: Creating a Midden Minder Network and Database	**Agency to Contact:**	**MHPC**

Working at over a score of the more than 2,000 known shell midden (pre-European) archaeological sites, this demonstration project led by UMaine's Senator George J. Mitchell Center for Sustainability Solutions uses scientists, students, tribal representatives, conservation educators/stewards, and community volunteers, to monitor middens being eroded by sea level rise. The project includes developing recording techniques to monitor erosion rates, prioritizing site significance, and entering information into MHPC site files and a database at UMaine.

Link:
https://umaine.edu/mitchellcenter/road-to-solutions/road-to-solutions-sustainability-maines-coastal-cultural-heritage-creating-maine-midden-minder-network-database/

Status 2018: Initiated. Grant application approved. Initial meetings with land trusts (property owners). Initial archaeological field survey on Damariscotta River Association property.

Maine Healthy Beaches Program	**Lead Agency:**	**DEP**

The Maine Healthy Beaches Program was established to ensure that Maine's salt-water beaches remain safe and clean. The Maine Healthy Beaches Program works with diverse partners and provides a unified, quality-assured structure for monitoring, assessment and public notification of water quality conditions at 63 coastal beaches from Kittery to Mount Desert Island. Beyond routine beach monitoring during the summer months, the program builds local capacity to identify, eliminate and prevent pollution sources through a collaborative process focused on sharing resources and solving problems. The effectiveness of these efforts is reflected in local actions to monitor, assess and restore ecosystem health in Kittery, York, Ogunquit, Kennebunk, Kennebunkport, Biddeford, Saco, Old Orchard Beach, South Portland, Portland, Rockport, Camden, Lincolnville, Bar Harbor and on Mount Desert Island.

Links:
http://www.mainehealthybeaches.org/index.html
https://www.maine.gov/dep/commissioners-office/environmental_trends.html (Healthy Beach Days)

Status 2017: Ongoing. Coastal water quality improved in both 2016 and 2017 compared to previous years with 97.9% and 99.2% of total beach days free of beach advisories or closures. Source tracking efforts to identify problems such as illicit discharges, and efforts to get people to pick up dog waste and pump out boats correctly have contributed to improvements in beach water quality. Less rainfall in 2016 and 2017 due to drought conditions also contributed as there was a decreased potential for wet weather/stormwater runoff and bacteria.

Status 2018: Ongoing. Monitoring work has been completed for the 2018 season and analyses are ongoing. One closure was reported in 2018 at East End Beach in Portland, ME as a precaution following an illicit discharge of partially treated effluent into Casco Bay from the local wastewater treatment facility.

Nutrient Modeling in Land and Water Environments & Regional Monitoring Network	**Lead Agency:**	**DEP**

DEP modeling of nutrients in land and water environments enables better understanding of phenomena such as algae blooms in lakes, "red tide" contamination of clam beds in the coastal

wetlands, and growth patterns in working forests across the state. Cross-reference Section III. B. Research and Analysis "Rainfall Data for Stormwater Management" and Section III. C. "Storm Modeling and Guidance Information for Project Design and Review".
Link: https://www.maine.gov/dep/commissioners-office/environmental_trends.html (Lake Clarity, Invasive Aquatic Plants)
Status 2017: In progress.
Status 2018: In progress.

Cyanotoxin Research in Maine's Lakes	**Lead Agency:**	**DEP**
	Partner Agencies:	**DHHS-CDC**

In 2008, DEP began a multi-year targeted study of Maine lakes that regularly support algal blooms, to gain insight into the scope of cyanotoxin (microcystin) occurrence in Maine. Results indicated that lakes having the worst blooms indeed produced microcystin concentrations that exceeded World Health Organization criteria. .

Links:
https://www.maine.gov/dep/water/lakes/cyanobacteria.html (a list of lakes at risk of having an algal bloom is available at the bottom of the webpage)
Status 2017: Ongoing.

Since 2014, DEP has been conducting an ongoing probabilistic study on lakes > 150 acres in surface area in more populated counties to assess the risk for microcystin exposure to shoreline residents who use lake water for household use, animals that drink lake water, and, those recreating in and on Maine lakes. Lakes known to support algal blooms continue to be monitored to define worst case scenario conditions and characterize toxin production during the bloom. Extreme weather events that result in more intense stormwater runoff, which carries nutrients into Maine lakes, and may fuel the development of bloom conditions earlier in the growing season, and initiate blooms in previously clear lakes. Conversely, extremely dry years can result in concentration of nutrients and algal blooms within lakes particularly in shallow lakes due to lack of flushing and evaporation, and in lakes that experience internal recycling of phosphorus. The study will likely continue into 2020. These data are being shared with the Maine CDC, with the goal being to serve as the basis for statewide advisory issuances.

In 2015, UEPA released 10-day Health Advisory thresholds for microcystin and in 2016, issued draft criteria for swimming.
Status 2018: Ongoing. In the last few years, a few lakes that had never supported algal blooms have experienced their first bloom.

Cyanotoxin Study in Water Supplies from Maine's Lakes and Ponds	**Lead Agency:**	**DHHS-CDC**

Maine CDC Drinking Water Program staff are assessing the impacts of Harmful Algal Blooms on drinking water derived from lakes and ponds.
Link: Report will be posted on the Maine CDC Drinking Water Program website when completed.
Status 2017: Ongoing. A preliminary 2016 study indicated that the cyanotoxins associated with these blooms are present at low levels in many source lakes and ponds in the state. A more in-

depth study of the presence and temporal evolution of cyanotoxins in raw and treated water began in June 2017 and will continue through the end of the calendar year. Anticipate project completion in spring 2018.

Status 2018: Nearing Completion. Cyanotoxins in Drinking Water Report – in final review. Anticipated release in 12/18.

Harmful Algal Bloom Monitoring	Lead Agency:	DMR

DMR monitor levels of marine biotoxins in the shellfish of the State of Maine. Samples are collected statewide between March and October. When a toxin is found at levels near or above where human illness may occur, closures to the harvest of shellfish areas are implemented. Maine has historically had high levels of Paralytic Shellfish Poison (PSP), more commonly known as "Red Tide" during the warmer periods of the year.

Link: http://www.maine.gov/dmr/shellfish-sanitation-management/programs/biotoxinmonitoring.html

Status 2017: Ongoing.

Status 2018: Ongoing.

Reducing the Duration of Shellfish Closures with Rain Gauges	Lead Agency:	DMR

Severe rainfall events trigger harvesting closures of shellfish growing areas. DMR has partnered with local organizations to install rain gauges in priority watersheds. More accurate, local rainfall data can assist DMR with opening flats more quickly.

Link: http://www.wccog.net/rain-gauges.htm

Status 2017: Initiated. Partnership with Washington County Council of Governments.

Status 2018: Ongoing. Seeking additional partners.

Improving Water Use Information	Lead Agency:	DACF

Cooperative program with the USGS to improve water use information for Maine over twelve categories with three tiers of detail. Improved information will allow analysis of trends in water use and potential impacts related to climate change.

Link: https://water.usgs.gov/watuse/

Status 2017: Ongoing. The Maine Geological Survey completed a survey of agricultural water users during 2017, with good participation across crop types and geography. Other water use sectors will be addressed in future years.

Status 2018: Ongoing.

Source Water Risk Analysis	Lead Agency:	DHHS-CDC

In 2016, Source Water Risk Analysis Reports were created to identify potential sources of contamination to water supplies that have direct intakes in rivers or sand/gravel wells in close proximity to rivers. Maine CDC Drinking Water Program staff are reviewing these reports to identify water utilities, with a high potential contamination risk, that would benefit from emergency spill response exercises.

Status 2017: Ongoing.

Status 2018: Ongoing.

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Water Resource Investigations	**Lead Agency:**	**DACF**
	Partner Agencies:	**DHHS-CDC**

Link: https://pubs.usgs.gov/sir/2014/5235/

Status 2017: Complete. See Appendix A. Completed Activities.

Building Resilience Against Climate Effects from Vector-Borne and Heat-Related Disease	**Lead Agency:**	**DHHS-CDC**

Since 2010, Maine CDC has used funding from the US Centers for Disease Control (CDC) Climate and Health Program to better understand the potential impact of climate change on public health, complete climate adaptation plans for both vector-borne diseases and extreme heat, and begin implementing vector-borne disease and heat illness intervention activities. Maine CDC has applied CDC's BRACE framework (Building Resilience Against Climate Effects) to address concerns about the increase in vector-borne diseases over the last decade, and to increase public health preparedness for extreme heat events.

Status 2017: Ongoing.

Status 2018: Ongoing.

Mosquito-Borne Illnesses Detection	**Lead Agency:**	**DHHS-CDC**

Mosquito-borne illnesses are becoming more common with the first locally acquired case of West Nile virus (WNV) in a Maine resident detected in 2012, and the first locally acquired case of Eastern Equine Encephalitis (EEE) in a Maine resident detected in 2014. Maine's climate models suggest that extreme precipitation events may become more common, creating conditions that could result in larger mosquito populations, which in turn could lead to increases in mosquito-borne diseases.

Links:
WNV: http://www.maine.gov/dhhs/mecdc/infectious-disease/epi/vector-borne/west-nile/index.shtml
EEE: http://www.maine.gov/dhhs/mecdc/infectious-disease/epi/vector-borne/eee/index.shtml

Status 2017: Ongoing. Maine identified cases of both WNV and EEE in 2015 and experienced an EEE death. Detections of mosquito-borne viruses in non-human samples has also increased over the last several years. The potential emergence of Zika virus within the US is a concern, as Maine is at the northernmost end of the range for the host vector, the *Aedes albopictus* mosquito, and is therefore at risk for local outbreaks.

Status 2018: Ongoing.

Climate Forecast Predictions for the Lyme Disease Tick Vector	**Lead Agency:**	**DHHS-CDC**

Status 2017: Complete. See Appendix A. Completed Activities.

Mapping Lyme Disease at the Town Level	**Lead Agency:**	**DHHS-CDC**

Maine CDC compiled and geo-coded Lyme disease incidence data at the town level to respond to

frequent public records requests, provide actionable data for Lyme reduction and tick control activities at the local level, and to support modeling of projected future disease burden.

Link: https://data.mainepublichealth.gov/tracking/ (click 'Go to Data Portal,' then Tickborne Diseases icon)

Status 2017: Ongoing.

Status 2018: Ongoing.

Enhancing the Tick-Borne Disease Surveillance System	**Lead Agency:**	**DHHS-CDC**

Link: http://www.maine.gov/dhhs/mecdc/infectious-disease/epi/publications/2015-Lyme-Surveillance-Report.pdf

Status 2017: Complete. See Appendix A. Completed Activities.

Building Resilience Against Extreme Heat Events	**Lead Agency:**	**DHHS-CDC**

Link: https://climatechange.umaine.edu/wp-content/uploads/sites/439/2018/08/Maines_Climate_Future_2015_UpdateFinal-1.pdf

Status 2017: Complete. See Appendix A. Completed Activities.

Statistical Modeling to Evaluate the Heat-Morbidity/Mortality Response Curve for Maine	**Lead Agency:**	**DHHS-CDC**

Link: http://www.sciencedirect.com/science/article/pii/S0013935116312609

Status 2017: Complete. See Appendix A. Completed Activities.

Air Conditioning Prevalence Survey	**Lead Agency:**	**DHHS-CDC**

Maine CDC developed survey questions to elicit data on air conditioning prevalence, documenting the low prevalence of air conditioning in Maine relative to the northeast region. These questions are asked of Mainers every few years as part of Maine's Behavioral Risk Factors Surveillance Survey, a statewide survey of health and behavior. Air conditioning prevalence data is available on the Maine Tracking Network data portal.

Link: https://data.mainepublichealth.gov/tracking/ (click 'Go to Data Portal,' then the Heat Illness icon)

Status 2017: Ongoing.

Status 2018: Ongoing. In late 2018, question wording was modified to include heat pumps used for cooling in the definition of 'air conditioner.' Air conditioning prevalence questions will again be asked in 2019.

Heat Illness and Heat-Related Morbidity Investigation	**Lead Agency:**	**DHHS-CDC**

Maine CDC investigated the current burden of heat illness and heat-related morbidity in Maine to identify high risk groups. Heat-related hospitalizations, emergency department visits, and deaths

are summarized, and demographic, geographic, and occupational risk factors are identified. Heat illness data is available on the Maine Tracking Network data portal.

Link: https://data.mainepublichealth.gov/tracking/ (click 'Go to Data Portal,' then the Heat Illness tab)

Status 2017: Ongoing.

Status 2018: Ongoing.

Syndromic Surveillance System for Heat Illness	**Lead Agency:**	**DHHS-CDC**

Maine CDC developed and implemented a syndrome for heat illness within the existing syndromic surveillance system to establish a near real-time monitoring system for outbreaks of heat illness during a heat event. This syndrome is monitored every summer during periods of high heat to identify and respond to significant increases in heat-related illnesses.

Status 2017: Ongoing.

Status 2018: Ongoing.

III. Inventory of State Climate Activities – Adaptation

C. Adaptation

GUIDING QUESTIONS: WHAT IS BEING DONE TO BUILD RESILIENCE TO CLIMATE IMPACTS? HOW CAN VULNERABILITIES BE REDUCED AND BENEFICIAL OPPORTUNITIES BE INCREASED?

Maine 2010 State Adaptation Plan	**Lead Agency:**	**DEP**
	Partner Agencies:	**DACF, MEMA, CDC, DIFW, DMR, DOT**

In 2009, the Maine Legislature directed the DEP to evaluate what options the State and its citizens have as we adapt to the impacts of climate change (124th Legislature, LD 460, "Resolve, To Evaluate Climate Change Adaptation Options for the State"). The development of *People and Nature Adapting to a Changing Climate: Charting Maine's Course 2010* (Maine's Climate Adaptation Plan) brought together a broad cross-section of Maine people representing business, trade, agriculture, forestry, health, transportation, and conservation, as well as state and municipal government. More than 70 groups participated in creating the report and working on committees. The report builds directly on the climate impact assessment by the UMaine, *Maine's Climate Future: An Initial Assessment 2009*, which offered an informative and up-to-date summary of climate change effects in Maine. The adaptation plan contains numerous strategies and more than 60 recommendations.

Link:
https://www.maine.gov/dep/sustainability/climate/adaptation-actions.html
https://climatechange.umaine.edu/climate-matters/climate-futures/

Status 2017: Ongoing implementation.

Status 2018: Ongoing implementation.

i. Natural Environment – Habitats, Species, Open Spaces, Working Landscapes, and Waterfront

Maine's 2015 State Wildlife Action Plan	**Lead Agency:**	**DIFW**
	Partner Agencies:	**DACF, DOT, DMR, DEP**

The 2015 Maine State Wildlife Action Plan revision engaged over 100 conservation partners to identify Maine's 378 Species of Greatest Conservation Need (SGCN), and actions needed to prevent further species declines. Many of these actions focus on greater understanding of and reducing impacts of climate change to SGCN and their habitats, and enhancing habitat connectivity to allow for species range shifts and movement.

Link: http://www.maine.gov/ifw/fish-wildlife/wildlife/wildlife-action-plan.html

Status 2017: Ongoing implementation. Revision completed, and now implementing the 2015 Maine Wildlife Action Plan.

Status 2018: Ongoing implementation.

III. Inventory of State Climate Activities – Adaptation

| **Keeping the Public Trust and Informing Voluntary Habitat Conservation** | **Lead Agency:** | **DIFW** |
| | **Partner Agencies:** | **DEP, DACF** |

The DIFW works with private landowners, businesses, local, state, and federal agencies, and other parties on a wide variety of land and water use proposals. The DIFW works cooperatively to help minimize the impacts of development on sensitive fish and wildlife resources, thereby helping to maintain resilient wildlife populations in the face of an uncertain climate.
Link: http://www.maine.gov/ifw/fish-wildlife/wildlife/environmental-review/index.html

Status 2017: Ongoing.

Status 2018: Ongoing.

| **Habitat Outreach** | **Lead Agency:** | **DIFW** |
| | **Partner Agencies:** | **DACF, DOT** |

Habitat Outreach is a collaborative effort of federal, state and local agencies and non-governmental organizations, to promote a nonregulatory landscape-based approach to conserving wildlife and plant habitats. The effort provides users with the best available information on rare plants and animals, important habitats, riparian areas, and undeveloped habitat blocks. The goal is to promote voluntary measures to conserve sufficient habitat to support all native plant and animal species in Maine. Habitat Outreach compiles habitat information from multiple sources, integrates it into one user-friendly package, accessible to towns, landowners, land trusts, conservation organizations and other partners.
Link: http://www.maine.gov/ifw/fish-wildlife/wildlife/wildlife-action-plan.html
Status 2017: Ongoing.
Status 2018: Ongoing.

| **Staying Connected** | **Partner Agencies:** | **DIFW, DOT** |

This project focuses on restoring and enhancing areas of continuous, undeveloped and working forest habitat across New York, Massachusetts, Connecticut, Vermont, New Hampshire, Maine, Quebec, New Brunswick, and Nova Scotia. The project's goal is to safeguard native wildlife and plants from the impacts of habitat fragmentation and the effects of climate change, such as from increasing temperatures and changes in weather patterns.
Link: http://stayingconnectedinitiative.org/

Status 2017: Ongoing.

Status 2018: Ongoing.

| **New England Governors and Eastern Canadian Premiers – Resilience** | **Lead Agency:** | **DIFW, DEP** |
| | **Partner Agencies:** | **DOT, MEMA** |

Maine has several regional initiatives underway related to resilience through work of the NEG/ECP. Each NEG/ECP jurisdiction participates in the process, but is responsible to govern its own outcomes from these regional initiatives.
Status 2017: Ongoing and initiated. 40th conference in Boston, Massachusetts on August 28-30, 2016. 41st conference in Charlottetown, Prince Edward Island on August 27-29, 2017.
Resolution 40-3: in 2016, the NEG/ECP signed a resolution "Ecological Connectivity: Adaptation to Climate Change and Biodiversity Conservation", that recognizes the importance of ecological connectivity for the adaptability and resilience of our region's ecosystems, biodiversity,

and human communities, especially in light of on-going changes to climate. Furthermore, the resolution makes clear the need and expectation for all jurisdictions within the region to work across landscapes and borders to advance efforts to restore and maintain ecological connectivity for the benefit of our fish, wildlife, ecosystems, and economies. State and provincial representatives to the Resolution Working Group began compiling an inventory of Resolution-related activities.

Resolution 41-3: in 2017, the NEG/ECP adopted a resolution "Concerning Response to Emergencies in A Changing Climate".

Status 2018: Ongoing and initiated. 42nd Conference in Stowe, Vermont on August 12-14, 2018.

Resolution 40-3: The Working Group prepared a draft progress report in preparation for the 2018 meeting.

Resolution 42-1: NEG/ECP adopted a resolution "Concerning Adaptation". State and provincial representatives to Resolution initiated preliminary conversations to form an Adaptation Working Group.

Invasive Pest Mitigation Strategy	**Lead Agency:**	**DACF**

DACF staff provides training for landowners in appropriate methods to address invasive species; and provides support for invasive pest preparedness and response efforts. Several other programs and areas of assistance are offered, including staff participation in advisory groups developing guidelines for town and land trust woodland management plans. that are "climate smart."

Links:
https://www1.maine.gov/dacf/mfs/archive/woodswise/invasive.html
http://www.maine.gov/dacf/mnap/features/invasive_plants/invasives.htm
http://www.maine.gov/dacf/mfs/forest_health/invasive_threats/index.htm
http://www.maine.gov/dacf/php/horticulture/invasiveplants.shtml

Status 2017: Ongoing.

Status 2018: Ongoing.

Soil and Water Conservation Program	**Lead Agency:**	**DACF**

DACF coordinates education and outreach on soil and water conservation practices by Maine's 16 local Soil & Water Conservation Districts. Conservation Districts provide ongoing technical assistance and education on soil health, nutrient management, erosion control, water conservation, invasive species management, sustainable agriculture and forestry, and other locally-identified natural resource management issues.

Link: http://www.maine.gov/dacf/about/commissioners/soil_water/index.shtml

Status 2017: Ongoing.

Status 2018: Ongoing.

Agricultural Water Management	**Lead Agency:**	**DACF**

DACF's Division of Agricultural Resource Development has utilized state and federal dollars to research the needs of farmers for water sources and irrigation. In the past, the Division has administered bonds to fund a water source development program to help farmers build water sources to mitigate drought. The Maine Legislature has approved four bond measures since 2001

totaling $5.5 million dollars to assist in new water source development. The Division has provided over $5.3 million to develop 179 projects for new water sources for farms. The program has protected over 11 thousand acres of farmland with crop value of over $33 million.

Link: http://www.maine.gov/dacf/ard/water_management/index.shtml

Status 2017: Ongoing. Currently, there are no grant application requests for proposals for new water source developments for agricultural entities.

Status 2018: Ongoing. Currently, there are no grant application requests for proposals for new water source developments for agricultural entities.

Nutrient Management	**Lead Agency:**	**DACF**
	Partner Agency:	**DEP**

DACF's Nutrient Management Program oversees the proper storage, management and utilization of farm nutrients through the development of Nutrient Management Plans, Livestock Operations Permits, and monitoring of Concentrated Animal Feeding Operations (CAFOs). The Program prohibits winter spreading of manure from December 1st through March 15th.

Link: http://www.maine.gov/dacf/php/nutrient_management/index.shtml

Status 2017: Ongoing.

Status 2018: Ongoing.

Sustainability Recognition Program	**Lead Agency:**	**DACF**

Program is for farmers and is currently in development, and will have a climate change component to it.

Status 2017: Ongoing.

Status 2018: Ongoing. DACF has hired an agricultural sustainability coordinator to continue research and development of this program.

Water Resources Program	**Lead Agency:**	**DACF**

Bureau of Forestry staff provides trainings and assists in remediating water crossings on forest roads to handle predicted increases in storm flow and to improve fish passage; oversees the chop and drop program, designed to improve cold-water fisheries habitat; conducts frequent workshops on Forestry Best Management Practices to protect water quality; and administers the Direct Link Loan Program, which provides reduced interest loans to loggers to purchase water quality-friendly harvesting equipment.

Link: http://www.maine.gov/dacf/mfs/policy_management/water_resources/index.html

Status 2017: Ongoing.

Status 2018: Ongoing.

Forest Climate Working Group	**Lead Agency:**	**DACF**

The Forest Climate Working Group is a consortium of various parties, whose purpose is to ensure that the full potential of U.S. forests and forest products is realized to provide climate change solutions.

III. Inventory of State Climate Activities – Adaptation

Link: https://www.forestfoundation.org/forest-climate-working-group

Status 2017: Ongoing.

Status 2018: Ongoing.

Maine Mollusk Shell Recycling Program for Coastal Acidification Remediation	**Lead Agency:**	**DMR**
	Partner Agency:	**DEP**

In 2015, Maine's Commission to Study the Effects of Coastal and Ocean Acidification issued a report, that made a number of recommendations including, "*4.3. Spread shells or other forms of calcium carbonate (CaCO₃) in bivalve areas to remediate impacts of local acidification.*" EPA is providing funding to DMR, in partnership with the Casco Bay Estuary Partnership (CBEP), local researchers, and DEP, for a demonstration shell recycling pilot program for beneficial re-use of oyster shells, and to test the effect on acidification of their use in Casco Bay tidal flats. The purpose of the project is to gain practical experience and document lessons learned to facilitate scaling up and institutionalization of a recycling program.

Status 2018: Initiated.

Adaptation Planning for Maine's Coastal State Parks	**Lead Agency:**	**DACF**

Link: https://digitalmaine.com/geo_docs/7/ (Changing Shorelines: Adaptation Planning for Maine's Coastal State Parks)

Status 2017: Complete. See Appendix A. Completed Activities.

i. *Built Environment – Infrastructure*

Transportation Adaptation Planning	**Lead Agency:**	**DOT**

Link:
https://digitalmaine.com/cgi/viewcontent.cgi?referer=https://www.google.com/&httpsredir=1&article=1057&context=mdot_docs

Status 2017: Complete.

Landscape-Based Methodology for Inland Climate Resilience of Maine's Transportation Infrastructure	**Lead Agency:**	**DOT**

This research project, co-funded by the National Academies of Science and the 2nd Strategic Highway Research Program, established the basis for the decision support matrix that estimates the risk to project delivery posed by environmental factors, including extreme weather events. One outcome of this study was DOT's shift in design guidance from sizing stream crossings for 25-year storm flows to 100-year storm flows.

Link: http://mdotweb.state.me.us/ec/documents/CulvertSizing%20May2015.pdf

Status 2017: Ongoing. Phase 1 study complete; Phase 2 study pending.

Status 2018: Ongoing. Phase 2 nearing completion.

III. Inventory of State Climate Activities – Adaptation

Coastal Maine Transportation Infrastructure Vulnerability to Projected Sea Level Rise and Storm Surge	**Lead Agency:**	**DOT**

This FHWA-funded research project overlaid GIS locations of DOT infrastructure located in coastal Maine towns with NOAA sea level rise and storm surge inundation projections for 2050 and 2100. This information will be used to inform funding, scheduling, and design decisions in future work plans, and will allow DOT to codify its consideration of changing climate-based coastal conditions.

Link:
https://www.maine.gov/mdot/bdg/docs/BDGupdateJune2018.pdf

Status 2017: Ongoing. Next step for the project is to incorporate sea level rise and storm surge projections into the 2018-2019-2020 work plan candidate selection process, and determine influence of these considerations on project scopes, schedules and budgets. Data gathering, modeling, and mapping complete, final report submitted to DOT, final report to FHWA is pending.

Status 2018: Ongoing. New sea level rise design standard being implemented.

Risk-Based Planning and Environmental Linkages	**Lead Agency:**	**DOT**

This State Transportation Innovation Council incentive program grant from FHWA builds on previous Coastal Resiliency and landscape-based risk assessments by establishing a "risk rating" for each DOT asset.   This rating translates the complexity of the asset itself and its environmental setting into a numeric representation of risk to on-schedule and on-budget project delivery, two strategic performance measures for DOT. Risk-based asset management is required as part of federally-established MAP-21 and the FAST Act.

Links:
https://www.fhwa.dot.gov/innovation/stic/edc4_stic_factsheet.pdf
Transportation Risk Assessment for Planning and Project Delivery (TRAPPD)
http://amonline.trb.org/18-04313-1.3991062?qr=1

Status 2017: Ongoing. Project outcomes will be tested as part of work plan development beginning in June 2017.

Status 2018: Ongoing. Complete in 2019.

Use of Green Infrastructure to Enhance Coastal Highway Resiliency in Two New England States	**Lead Agency:**	**DOT**
	Partner Agencies:	**DACF, DEP**

Link: Final report pending.

Status 2017: Complete. See Appendix A. Completed Activities.

Riverine Peak Flows for Design Estimates	**Lead Agency:**	**DOT**

DOT has contracted with USGS to update the regression equations used to estimate riverine design peak flows (ex., Q25, Q50, Q100, etc). These equations are typically updated every 20 years or so; the current equations were published in 1999. DOT recognizes the importance of

updating on a regular basis, in order to capture the additional river gage data since the previous update and to reflect any changes in river hydrology. These equations, while funded by MaineDOT, FHWA and USGS, are a public resource and are widely used by other agencies and the private sector.

Link: Available upon completion.

Status 2018: Initiated contract in 2018.

Storm Modeling and Guidance Information for Project Design and Review	**Lead Agency:**	**DEP**

Incorporating the consideration of increased storm events and changes in rainfall within specific DEP programs informs project review, design guidelines, and the development of guidance information. For example, modeling results of storm events are used to inform more appropriate criteria for designs, systems and options for stormwater and erosion control measures at various types of development, including land development projects; operating facilities; road crossings; and hazardous and solid waste storage areas. DEP modeling of nutrients in land and water environments also enables better understanding of phenomena such as algae blooms in lakes, "red tide" contamination of clam beds in the coastal wetland, and growth patterns in working forests across the state. Cross-reference Section III. B. Research and Analysis "Rainfall Data for Stormwater Management".

Links:
https://www.maine.gov/dep/land/watershed/materials.html
https://www.maine.gov/dep/land/grants/stream-crossing-upgrade.html

Status 2017: Ongoing. DEP developing improved guidance for the sizing of flow-through and hybrid storage/flow-through stormwater filtration systems, to more appropriately address the distribution of rainfall intensity in recent years. Stream crossing structure guidelines include the recommendation for crossings be designed to accommodate a 100-year storm event and to be 1.2 bank full width. These resiliency measures are designed to minimize washouts and expenses to maintain and repair crossings. Cross-reference Section III. F. Grants& Loans "Stream Crossing (Culvert) Improvement Grants: Water Bond and Transportation Bond".

Status 2018: Ongoing.

Cost-effective Stormwater Management	**Lead Agency:**	**DEP**
	Partner Agency:	**DOT**

Since 2007, DEP, DOT, and the Maine Turnpike Authority (MTA) have had a Memorandum of Agreement (MOA) that streamlines the regulatory process with regard to stormwater management associated with state transportation infrastructure. Through this MOA, MaineDOT and MTA commit to meeting minimum standards for all soil disturbance associated with construction and reconstruction of transportation assets under their purviews. They also report all work falling under Chapter 500 to DEP annually, along with work anticipated in the next construction season. DOT and MTA also operate in communities that are designated Municipal Separate Storm Sewer Systems (MS4) under a General Permit with DEP. These agreements are reviewed, modified and renewed regularly.

Link: http://www.maine.gov/mdot/env/documents/2013_Transportation_MS4_GP.pdf

Status 2017: Ongoing. General Permit most recent version approved in 2017.

Status 2018: Ongoing.

III. Inventory of State Climate Activities – Adaptation

Incorporating Coastal Hazard Risk into Management of Maine's Working Waterfront Assets	**Lead Agency:**	**DMR**
	Partner Agencies:	**DACF, DOT, ME Port Authority**

In 2017, the Maine Coastal Program received NOAA funding to conduct a vulnerability assessment of working waterfront infrastructure (sea-level rise, storm surge and flooding). The goal of the project is to create guidance for use by the state in funding state and local waterfront infrastructure and to update guidance on waterfront construction techniques.

Status 2017: Initiated.

Status 2018: In progress. Penobscot Bay identified as project region. Twenty high priority sites were chosen for the analysis. RFPs for consultants released.

Shoreland Zoning Management	**Lead Agency:**	**DEP**

The DEP administers the Shoreland Zoning Management program to protect, conserve and promote environmentally wise use of sensitive areas adjacent to the state's water resources. Effective January 26, 2015, DEP's Chapter 1000: Guidelines for Municipal Shoreland Zoning Ordinances was amended to include, among other things, replacing *maximum spring tide* with *highest annual tide*. This change considers sea level rise as part of climate change by setting a standard for the setback of structures that is based on yearly estimates of the highest tides by NOAA.

Link: http://www.maine.gov/dep/land/slz/index.html

Status 2017: Ongoing.

Status 2018: Ongoing.

Brownfield Redevelopment	**Lead Agency:**	**DEP**

Sites receiving Brownfields Redevelopment funding from EPA are supposed to be evaluated for potential impacts from sea level rise in locations where it is an applicable hazard, and DEP encourages this evaluation if unevaluated. Outcomes of accounting for sea level rise can include increased setbacks from floodplains, and restored floodplains, and can be part of larger downtown economic development planning work to reduce exposure of built environment to sea level rise and related hazards.

Link: https://www.maine.gov/dep/commissioners-office/environmental_trends.html (Brownfield Sites Completed)

Status 2017: Ongoing.

Status 2018: Ongoing.

Nonpoint Source Training Center	**Lead Agency:**	**DEP**

The Office of Innovation and Assistance provides in-person and online technical assistance in response to telephone and email requests from landowners, businesses, developers, and others, including consideration of potential effects of changes in the climate. Within the Office, the Nonpoint Source Training Center works with contractors, landscapers, foresters, and code enforcement officers to bring technical assistance, certification, and new training for erosion control practices. DEP also continues to work with DOT on erosion and sedimentation control trainings and BMPs to control work site erosion. This partnering has benefited contractors statewide by delivering timely and comprehensive trainings to minimize erosion and control sediments from construction sites. Awareness at the contractor/soil interface is continually being

raised for a healthier environment.

Link: http://www.maine.gov/dep/land/training/index.html

Status 2017: Ongoing. Over 2,600 contractors have received erosion control certification.

Status 2018: Ongoing.

Low Impact Development   **Lead Agency:**   **DEP**

Low Impact Development (LID) practices are a set of site development strategies designed to mimic natural hydrologic function by reducing stormwater runoff and increasing groundwater recharge and pollutant treatment. LID practices are integrated with site infrastructure and intended to replace or replicate predevelopment hydrology using source control and relatively small-scale measures disconnecting impervious surfaces, enhancing filtration, treatment, and management of stormwater as close to its source as possible. Vegetated swales, filters, and buffers are the common LID practices permitted by DEP.

Link: http://www.maine.gov/dep/land/watershed/materials.html

Status 2017: Ongoing. Chapter 500 Stormwater Management Rules were amended (Effective August 12, 2015) to encourage redevelopment projects as an LID approach, which reduces existing pollutant load and/or runoff volume by decreasing sprawl and new developed areas. Qualifying Stormwater and Site Law redevelopment projects' treatment requirement is reduced to 0 and 50%, respectively. A stormwater credit was also made available to utilize LID strategies by allowing a reduction of up to 20% in the amount of required treatment. However, most applicants have been using the LID measures and redevelopment as their stormwater management strategy. The Non-Point Training Center also encourages LID practices and provides tools to contractors to lessen environmental impact while successfully completing projects.

Status 2018: Ongoing.

Tank Storage Siting   **Lead Agency:**   **DEP**

DEP identifies and integrates consideration of impacts to drinking water supplies when assisting with the siting of fuel storage facilities and associated services. Chapter 691, Rules for Underground Oil Storage Facilities, and Chapter 692, Siting of Oil Storage Facilities, also include standards related to potential changes in effects of climate change on surface water or sea level as considerations when assisting with the siting of fuel storage facilities and associated facilities, including above ground storage tanks and terminals (ASTs); underground storage tank (UST) facilities near surface waters; and piping to dispensers on docks (e.g. marinas).

Links:
https://www1.maine.gov/sos/cec/rules/06/096/096c691.doc (Rules for Underground Oil Storage Facilities)
https://www1.maine.gov/sos/cec/rules/06/096/096c692.doc (Siting of Oil Storage Facilities)
http://www.maine.gov/sos/cec/rules/06/096/096c693.docx (Operator Training for Underground Oil and Hazardous Substance Storage Facilities)

Status 2017: Ongoing. In 2017, DEP certified 1,004 "TankSmart" operators. Operators are predominantly from Maine.

Status 2018: Ongoing. In 2018, Chapter 691 was amended. The rule now requires that Maine Certified Tank Installers who oversee the removal of underground oil storage facilities be trained in erosion and sedimentation control practices. The rule also requires consideration of the water

quality classification of surface waters that may be impacted by a release of petroleum. In 2018, Chapter 692 was proposed for amendment. Changes have been proposed to clarify the rule to enhance consistent understanding and application of the siting requirements.

ii.   *People and Communities*

Building Resiliency Along Maine's Bluff Coast in Casco Bay	**Lead Agency:**	**DACF**
	Partner Agency:	**DMR**

Links:
http://cumberlandswcd.org/site/2017/11/building-resiliency-along-maines-bluff-coast/
http://cumberlandswcd.org/site/wp-content/uploads/2017/11/Building-Resiliency-Along-Maines-Bluff-Coastline-Technical-Manual-for-SMA-Revised-11.27.17.pdf (Report)

Status 2017: Complete.

Municipal Guidance Series	**Lead Agency:**	**DACF**
	Partner Agencies:	**DEP, DMR, DOT**

Link: http://www.maine.gov/dacf/municipalplanning/technical/climate.shtml

Status 2017: Complete.

Maine Flood Resilience Checklist	**Lead Agency:**	**DACF**

Links:
http://www.maine.gov/dacf/mgs/hazards/coastal/index.shtml
http://digitalmaine.com/mgs_publications/521
http://www.maine.gov/dacf/mgs/hazards/coastal/MaineFloodResilienceChecklistOverview.pdf

Status 2017: Complete. See Appendix A. Completed Activities.

Coastal Hazards and Resiliency Tools Project	**Lead Agency:**	**DACF**

Links:
https://www1.maine.gov/dacf/municipalplanning/technical/climate.shtml
http://www.smrpc.org/index.php/programs/land-use-plainning/slawg
https://geopub.epa.gov/RAINE/PDF/CHRT_Maine_82616.pdf (EPA RAINE Database)

Status 2017: Complete. See Appendix A. Completed Activities.

Vector-Borne Working Group	**Lead Agency:**	**DHHS-CDC**
	Partner Agencies:	**DACF**

DACF staff have worked collaboratively with the Maine Center for Disease Control and Prevention (Maine CDC) to address the northward advance of diseases carried by ticks and mosquitoes. Climate variability has allowed the deer tick to flourish through most of the southern half of the state, and Lyme disease has followed. Department staff have participated in the multi-agency Vector-Borne Working Group to develop and promote strategies to reduce the incidence of Lyme Disease. The Department has also developed a plan in collaboration with the Maine

CDC to protect the public from mosquito-borne diseases which have also been migrating northward.

Link: http://www.maine.gov/dhhs/mecdc/infectious-disease/epi/vector-borne/lyme/lyme-resource-educators.shtml

Status 2017: Ongoing.

Status 2018: Ongoing.

Developing a School-Based Curriculum Intervention to Reduce Lyme Rates in Children	**Lead Agency:**	**DHHS-CDC**

Until 2016, children 5-15 years of age had the highest rates of Lyme disease in the state, and children under age 15 were also thought to be at higher risk of acquiring mosquito-borne diseases. Maine CDC therefore developed a school-based curriculum for third through fifth graders that teaches students the biology and ecology of ticks and mosquitoes, the diseases they can carry, and methods for preventing these diseases. The curriculum aligns with Maine's state educational standards.

Link: http://www.maine.gov/dhhs/mecdc/infectious-disease/epi/school-curriculum/index.shtml

Status 2017: Ongoing. In 2016, after several years of educational interventions with this age group, the rate of increase of Lyme disease among children 5-15 was somewhat lower than in other groups, and adults 65 and older surpassed children 5-15 as the most at-risk age group. The curriculum has recently been extended to middle-school grades. The curriculum has been piloted or presented 21 times over three years, in 14 elementary and three middle schools, with some elementary schools using the curriculum in multiple years.

Status 2018: Ongoing. Curricula were again presented in elementary and middle schools this year.

Developing a Vector-Borne Disease Prevention Intervention for Older Adults (Tick-Free ME Challenge)	**Lead Agency:**	**DHHS-CDC**

Through 2016, adults over the age of 65 years had the second highest rate of Lyme disease among all age groups, along with relatively high rates of anaplasmosis and babesiosis. Through focus groups, it was determined that prevention efforts should be focused on education and behavior change. Using findings from the focus groups, Maine CDC developed the Tick-Free ME challenge. The challenge is a collaboration with local libraries and other community-based organizations, providing education on ticks and tick-borne diseases, and then challenging participants to document their tick prevention behaviors during the month of July.

Status 2017: Completed. Maine CDC piloted the challenge during July 2015, and expanded it during the months of July 2016 and July 2017. The Tick-Free ME challenge has been piloted or presented in 33 libraries and 15 other community-based organizations.

Status 2018: Ongoing. Effects of this intervention on participants' knowledge of vector-borne diseases and prevention strategies were found to be negligible, and the intervention was discontinued. In its place, Maine CDC developed a social media campaign targeted at older adults, including a series of short videos on tick removal and disease prevention strategies.

III. Inventory of State Climate Activities – Adaptation

Train-the-Trainer on Tick and Mosquito Topics	**Lead Agency:**	**DHHS-CDC**

Maine created 10 brief YouTube videos on tick and mosquito topics. Using these videos, Maine is currently piloting a train-the-trainer model to train individuals as local experts so they can and go out and teach others within their communities.

Link: http://www.maine.gov/dhhs/mecdc/infectious-disease/epi/vector-borne/train-trainer/index.shtml

Status 2017: Ongoing. Train-the-trainer events were pilot-tested at five events in 2016, and presented at four events in 2017.

Status 2018: Ongoing. Six train-the-trainer presentations were held in 2018.

State Heat Response Planning	**Lead Agency:**	**DHHS-CDC**

Maine CDC created a heat response plan for inclusion in Maine CDC's all-hazards response plan.

Link:
http://www.maine.gov/dhhs/mecdc/public-health-systems/phep/documents/mainecdcallhazheat.doc

Status 2017: Complete.

Status 2018: Ongoing. The plan will be reviewed again in 2019.

Community Heat Response Planning	**Lead Agency:**	**DHHS-CDC**

Maine CDC supported and facilitated the development of a heat response plan for the Cumberland Public Health District, the first such community-level effort in Maine. This heat response plan is included in the heat portion of Maine's Climate and Health Adaption Plan, and will serve as the template for other local heat response plans.

Link:
http://www.maine.gov/dhhs/mecdc/environmental-health/heat/documents/cumberlandplan_2015.pdf

Status 2017: Ongoing. Completed Cumberland Public Health District Plan.

Status 2018: Ongoing. In late 2018 stakeholders will meet again to discuss implementation of Heat Response Plans in other Districts. This implementation is expected to begin in early 2019.

Modify Heat Advisory Thresholds for the Northeast Forecast Region	**Lead Agency:**	**DHHS-CDC**

Results of a study to estimate the heat-health relationship in the northeast were shared with the NWS regional and local offices to encourage modifications to their heat advisory product.

Link: http://www.nws.noaa.gov/os/notification/pns17-18heat_new_england.htm

Status 2017: Ongoing. The NWS has modified their heat advisory threshold for the northeast region effective the summer of 2017.

Status 2018: Ongoing. The NWS again modified their heat advisory threshold for the northeast region, shortening the duration of extreme heat required to issue and advisory. Maine CDC continues to collaborate with NWS field offices to evaluate the appropriateness of heat advisory thresholds and issuances of those advisories.

III. Inventory of State Climate Activities – Preparedness

D. Preparedness

GUIDING QUESTIONS: WHAT IS BEING DONE TO BUILD RESILIENCE TO CLIMATE IMPACTS? HOW CAN VULNERABILITIES BE REDUCED AND BENEFICIAL OPPORTUNITIES BE INCREASED?

State Energy Assurance and Emergency Management Plan	**Lead Agency:**	**GEO**
	Partner Agency:	**DVEM-MEMA**

The GEO identifies potential vulnerabilities in energy infrastructure due to several factors, including damage due to climatic events. The Plan documents all the agencies responsible for responding to energy emergencies, and explains each agency's role in addressing fuel supply disruptions and damage to critical infrastructure.

Link: http://www.maine.gov/energy/pdf/Maine_Energy_Assurance_Plan_6_1_11[1].pdf

Status 2017: On hold. No update planned at present.

Status 2018: In progress. GEO and MEMA signed an MOU to execute an update to the 2012 Energy Assurance and Emergency Management Plan. Update scheduled for completion in 2019.

State Hazard Mitigation Plan	**Lead Agency:**	**DVEM-MEMA**
	Partner Agencies:	**DACF, DEP, DHHS, DIFW**

The State of Maine Hazard Mitigation Plan (SHMP) identifies risks and vulnerabilities associated with natural disasters to develop strategies to reduce the long-term effects of natural hazards. The risk assessment is the basis for the strategy, which provides the State's blueprint for reducing the potential losses identified in the risk assessment. State Hazard Mitigation Plans must be updated every five years.

Link: https://www.maine.gov/mema/maine-prepares/plans-trainings-exercises/planning
(Volume I: Preparedness Strategy)

Status 2017: Ongoing. Collaboration with the scientific community in updating the plan.

Status 2018: Ongoing. The 2018 SHMP has been approved and updated on the MEMA website. The 2018 SHMP profiled the following natural hazards in the risk assessment: wildfire, flooding, severe summer weather, severe winter weather, hurricane, drought, earthquake, erosion, and mass wasting (landslides). Major changes from the last plan included the incorporation of extreme heat under "severe summer weather" and drought as a unique hazard type. The 2018 update describes the potential impacts of climate change on these hazards, which will likely increase the extent of natural hazard events. MEMA will continue to corroborate data with the scientific community in hopes of preparing a more climate change focused plan in 2023.

Natural Hazards Incident Annexes	**Lead Agency:**	**DVEM-MEMA**
	Partner Agencies:	**Numerous state agencies and partners**

By statute, MEMA is required to develop and maintain the State of Maine Emergency Operations Plan (EOP). The purpose of the EOP is to establish an overall framework for integration and coordination of the emergency response activities of all levels of government, volunteer organizations, and the private sector in the state of Maine. It is designed to provide a flexible

III. Inventory of State Climate Activities – Preparedness

framework under which the state of Maine may respond to emergencies. Incident annexes contain information needed to address specific emergencies that require a specialized application of the EOP. These natural hazards incident annexes include hurricane and drought.

Link: https://www.maine.gov/mema/maine-prepares/plans-trainings-exercises/planning
(Volume II: Emergency Operations Plan)

Status 2017: Ongoing. MEMA updated the Drought Annex over the course of the 2016 drought and formalized it in 2017.

Status 2018: Ongoing. MEMA is partnered with CDM Smith to prepare a hurricane evacuation study to provide state and local planners with an evacuation decision timeline. MEMA is also working to complete the update of the Hurricane Annex. Cross-reference Section III. D. Preparedness, "Hurricane Evacuation Study".

River Flow Advisory Commission	**Lead Agency:**	**DVEM-MEMA**
	Partner Agencies:	**DACF, DEP, DHHS**

The River Flow Advisory Commission (RFAC) meets each March to facilitate communication of river flow data between dam operators, river basin managers, state agencies, the USGS and the NWS during floods and droughts. The RFAC leverages snowpack reports from the Maine Cooperative Snow Survey (see "Snow Survey" for more), ground and surface water reports from USGS, and meteorological outlooks from NWS to assess flood risk across Maine. The RFAC convenes each March at a minimum and continues to meet throughout the spring as necessary until flood risk returns to normal levels.

Link:
http://www.maine.gov/rfac/
https://www.maine.gov/mema/hazards/river-flow-advisory-commission

Status 2017: Ongoing. The RFAC met with no major events to report. No significant flood impact forecast from snowmelt.

Status 2018: Ongoing. The River Flow Advisory Commission met once in March 2018 with presentations from NWS, USGS, National Flood Insurance Program and NOAA. MEMA provided a letter of support to the USGS efforts to create an ice jam tracker. MEMA, USGS, and USCG met in December 2018 to begin discussions on comprehensive, long-term ice jam monitoring in high risk areas across the state.

Drought Task Force	**Lead Agency:**	**DVEM-MEMA**
	Partner Agencies:	**DACF, DEP, DHHS**

The Drought Task Force is comprised of the same core members as the RFAC. The Task Force convenes in response to drought conditions to share information about surface and groundwater levels, to discuss observed drought impacts, and to determine available resources. While the Task Force is not regularly scheduled to convene, the RFAC co-chairs include drought outlook in their spring discussions of hydrological conditions if necessary.

Link:
http://www.maine.gov/rfac/
https://www.maine.gov/mema/hazards/natural-hazards/drought

III. Inventory of State Climate Activities – Preparedness

Status 2017: Ongoing. The Task Force met in 2016 for the first time since 2002, and met again in 2017. October 2017 Drought Warning issued. Approximately 52% of state population was in moderate drought area.

Status 2018: Ongoing. July 2018 about 15% of Maine was in a moderate drought area. October 2018 approximately 2.4% of Maine was in a moderate drought area with 52% under abnormally dry conditions. While the task force was not convened through the summer or fall months, MEMA, NWS, NOAA, and USGS stayed in active communication and actively monitored conditions.

Hurricane Evacuation Study	**Lead Agency:**	**DVEM-MEMA**
	Partner Agencies:	**DOT, DACF**

Hurricane Evacuation Studies (HES) address hurricane planning and impact assessment for coastal regions. In the Transportation Analysis, the Army Corps of Engineers coordinates with DOT to model the capacity of the evacuation network. These two analyses contribute to the key output of an HES, the evacuation clearance times matrix, which estimates the number of hours it takes to move the vulnerable population to safety under various circumstances.

Link: http://www.nae.usace.army.mil/Missions/Projects-Topics/Maine-Hurricane-Studies/

Status 2017: Ongoing. The HES used MGS's Sea, Lake, and Overland Surges from Hurricanes (SLOSH) modeling to complete the Hazard Assessment to support the study's Vulnerability Assessment, which mapped populations susceptible to storm surge to guide evacuation planning (see "Coastal Hazards" for more). MEMA coordinated with 138 local jurisdictions in 10 counties over 18 months to create evacuation zones for areas vulnerable to storm surge to determine evacuating populations in the Vulnerability Analysis. MEMA completed the last HES in 2007 and began work on the updated HES in 2016.

Status 2018: Ongoing. MEMA is partnered with FEMA, USACE, American Red Cross, Maine DPS-Maine State Police and Maine Fire Marshall, USCG, CDM Smith, and Maine's coastal and riverine communities to prepare the Hurricane evacuation study. The updated HES is expected to be complete by the start of the 2019 hurricane season.

Critical Facilities Mapping	**Lead Agency:**	**DVEM-MEMA**
	Partner Agencies:	**DACF, MEGIS, DOT**

The Critical Infrastructure Program at MEMA maps critical infrastructure on top of hazard risk maps such as flood risk and potential storm surge inundation maps, to assess the vulnerability of critical infrastructure to various natural hazards. Critical infrastructure, from an emergency management perspective, is defined as "sectors that compose the assets, systems, and networks, whether physical or virtual, so vital to the United States that their incapacitation or destruction would have a debilitating effect on security, national economic security, national public health or safety, or any combination thereof." Critical infrastructure mapping is a continuous process of updating the datasets of critical infrastructure assets as their locations change and overlaying them on risk maps that also change with technological advancements.

Status 2017: Ongoing. MEMA continually built new partnerships throughout 2017 as a means to corroborate data and layers within GIS.

Status 2018: Ongoing. MEMA is collaborating with parties involved in the Maine Hurricane Evacuation Study to map CI layers over surge maps.

III. Inventory of State Climate Activities – Preparedness

Anticipatory Spill Response Preparedness   **Lead Agency:**   **DEP**

With the changing climate, the DEP is anticipating and preparing for an increase in the number of emergency response requests related to hazardous material releases, including smaller-scale incidents such as spring blizzard damage to residential aboveground storage tanks, and larger-scale incidents involving material storage and transportation, either related to vessels in transit, or at terminal facilities.

Additionally, DEP works with NOAA to evaluate and utilize Environmental Sensitivity Index (ESI) maps. These maps are a tool used by first responders for use in prioritizing and targeting protection strategies by identifying priority areas. The maps show biological, geological and human resources along the coast of Maine most at risk from oil spilled into the marine or estuarine environment. The maps have been produced for over 35 years, are updated periodically (for Maine in 1985, 2007, and 2016), and content of the ESI data has evolved significantly over this time.

Links:
http://www.maine.gov/dep/spills/emergspillresp/evi/index.html,
https://response.restoration.noaa.gov/maps-and-spatial-data/environmental-sensitivity-index-esi-maps.html
https://www.maine.gov/dep/commissioners-office/environmental_trends.html (Petroleum Contaminated Sites Closed)

Status 2017: Ongoing. In calendar year 2016, DEP responded to 2,855 spills, mostly from overturned delivery trucks and in coastal areas, and over 800 from Above Ground Storage Tanks, with just under 200 from Underground Storage Tanks. In 2017, DEP responded to a total of 3,346 spills with 862 from ASTs and 182 from USTs. Also in 2017, DEP closed 117 long-term oil spill sites. DEP evaluated a new set of coastal maps for the coast that NOAA has prepared as of published in September of 2016, using money from Hurricane Sandy response. The newest version of these maps incorporates coastal storm hazard and potential inundation data to better respond to climate change concerns.

Status 2018: Ongoing. From 1 January to 15 October 2018, DEP responded to 2,032 spills. Most spills were petroleum based with 584 from ASTs and 124 from USTs.

Source Water Emergency Spill Response Exercises   **Lead Agency:**   **DEP, DHHS-CDC**

Maine CDC Drinking Water Program staff are reviewing Source Water Risk Analysis Reports to identify potential sources of contamination to water supplies that have direct intakes in rivers or sand/gravel wells near rivers, and are working with communities to simulate emergency spill response exercises. These exercises challenge utilities to respond to mock impacts to their water supplies, under stressed conditions such as flooding or drought, with the goal of increasing resiliency of Maine's drinking water supplies.

Status 2017: Ongoing. Tabletop exercises held in Berwick, Brunswick/Topsham, Farmington, Jackman, Dover-Foxcroft, Old Town/Orono/Veazie, and Castine.

Status 2018: Ongoing. Tabletop exercises held in Southwest Harbor (Summer 2018), and a full-scale tabletop was held in Berwick.

III. Inventory of State Climate Activities – Preparedness

Disaster Debris Management Planning	**Lead Agency:**	**DVEM-MEMA**
	Partner Agency:	**FEMA**

The state Debris Management Plan establishes the necessary framework to prepare for and support debris removal operations in response to state and local disaster events which generate disaster debris. The Plan defines the responsibilities of state agencies and discusses the roles of county and municipal government in debris management operations. MEMA wrote the Debris Management Plan in 2009 and revised it in 2014. MEMAs Training and Exercise Program hosts several FEMA Debris Management courses each year.

Link: http://www.maine.gov/mema/planning/debris_mgmt_plan.pdf

Status 2017: Ongoing. No trainings were held or attended in 2017 for debris management.

Status 2018: Ongoing. MEMA staff attended FEMA Debris Management Training in December of 2018. MEMA is currently updating the 2014 State Debris Management Plan based on lessons learned from the October 2017 Wind Storm. MEMA is also coordinating with both local and federal partners to develop a more streamlined debris management plan adoption process.

Municipal Guidance for Debris Management Siting	**Lead Agency:**	**DEP**
	Partner Agency:	**DVEM-MEMA**

DEP coordinated with MEMA to create municipal guidance for siting temporary debris management locations. Selecting appropriate site(s) for temporary management of disaster debris and having a plan in place before disaster strikes helps manage large quantities of debris more safely, more efficiently, and in a more environmentally sound manner, and may help with cost reimbursement following a declared disaster if FEMA funding assistance is available. DEP can provide pre-authorization of sites that meet standards to avoid impacts to public health or the environment. This guidance builds on lessons learned from natural disasters already experienced in Maine and our region.

Status 2017: Ongoing. DEP has presented its guidance to transfer station operators and municipal officials at Maine Resource Recovery Association (MRRA) conferences and at transfer station training sessions, and has coordinated with Regional Planning Organizations as they worked with municipalities to select sites for approval. DEP received siting guidance for York and Sagadahoc Counties tailored for municipalities in those areas, and was contacted about several possible sites in Androscoggin County as well. DEP reached out to interested parties to review their efforts.

Status 2018: Ongoing. DEP is assisting five communities to complete plans currently, and will be doing additional outreach in 2019 to engage with other municipal representatives through more focused sessions. MEMA will work closely in 2019 with DEP and communities to ensure both state and federal siting regulations are being met as a means to ensure eligibility for federal reimbursement after a disaster

Health Messaging During Heat Waves	**Lead Agency:**	**DHHS-CDC**

Maine CDC developed and continues to refine basic health messaging for health care providers and the public about heat-related illnesses, both for general use and for use during heat events. This messaging focuses on preventing, recognizing, and treating heat-related illnesses.

Link: http://www.maine.gov/dhhs/mecdc/environmental-health/heat/

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Status 2017: Ongoing.

Status 2018: Ongoing. The summer of 2018 was unusually hot, and Maine CDC issued a variety of messaging during 5 distinct events between May and August. Significant health effects, in the form of emergency department visits and Emergency Medical Service 'runs,' were identified during those events, most especially during a ~7-day event around the July 4 holiday.

Animal Health   **Lead Agency:**   **DACF**

The DACF Animal Health Program aims to prevent the introduction and spread of contagious diseases among poultry and livestock; to promote public health and food safety as it relates to zoonotic disease; to enhance the quality and health of livestock; and to maintain fair practices in the buying and selling of poultry and livestock. The Program would be involved in any incidents of excessive heat stress in cattle.

Link: http://www.maine.gov/dacf/ahw/animal_health/index.shtml

Status 2017: Ongoing.

Status 2018: Ongoing. No reported problems during the hot summer of 2018.

III. Inventory of State Climate Activities – Raising Awareness

E. Raising Awareness

Maine Climate Clearinghouse & Maine Adaptation Toolkit	**Lead Agency:** DEP **Partner Agencies:** DACF, DVEM-MEMA, DHHS-CDC, DIFW, DMR, DOT, GEO

In recognition of work at state agencies, and by active organizations in Maine and our region, state webpages have been created to provide a centralized Maine-focused directory of available climate resources. DEP's Climate Program houses the clearinghouse of information on climate change mitigation and adaptation pertinent to Maine communities. Resources are managed in coordination with MICA work group member agencies. Version 1 was added to the DEP website in 2012.

The clearinghouse is intended to be a resource for the public to learn about information, services and capacities available through various providers, and to aid in determining solutions to problems related to climate change. The webpages provide relevant information, and provide links to sites with more specific content and contact information. Content on the climate webpages is designed for entry- and technical-level users. Information is available about what climate change is, what changes are occurring, and what is impacted by these changes. Risk and vulnerability assessment tools and resources, case studies, topic-specific toolkits, and contact information for engaged practitioners is also available. Collectively, this information can enable and enhance consideration of climate-related factors that affect communities, homes, and businesses, and it can be integrated into decision-making for short- and long-term projects and plans.

Links:
https://www.maine.gov/dep/sustainability/climate/index.html (Clearinghouse homepage)
https://www.maine.gov/dep/sustainability/climate/adaptation-toolkit.html (Adaptation Toolkit)
https://www.maine.gov/dep/sustainability/climate/mica.html (Agency Partners)

Status 2017: Ongoing. The Maine Adaptation Toolkit was added in 2015. Version 2 was updated throughout 2017, incorporating input gathered beginning in 2015.

Status 2018: Ongoing. Version 2 was completed and added to the DEPs website in April 2018.

Climate Work Group	**Lead Agency:** DEP

DEP's Climate Program is coordinating an intra-agency cross-bureau workgroup that aims to create regular connectivity across DEP on climate activities by providing information sharing opportunities that support staff in key topic areas that affect their work.

Status 2017: Initiated.

Status 2018: Ongoing.

III. Inventory of State Climate Activities – Grants and Loans

F. Grants and Loans

Coastal Community Grant	**Lead Agency:**	**DACF**
	Partner Agencies:	**DMR, DEP**

Coastal Community Grants are provided annually on a competitive basis to municipalities and regional planning commissions for a variety of coastal priority issues, including vulnerability assessments, adaptation planning, community education, and strategy development. The grants are for municipal and regional projects in Maine's Coastal Zone. Examples of past projects are Damariscotta's downtown vulnerability analysis, Boothbay Harbor's wastewater treatment plant study, Vinalhaven's downtown study, and Chebeague's waterfront facilities study.

Funding for these technical assistance grants comes from Maine Coastal Program's annual grant from NOAA. Subject to available funding.

Links:
https://www.maine.gov/dacf/municipalplanning/financial_assistance.shtml
https://www.maine.gov/dacf/municipalplanning/casestudies/ccg-case-studies.shtml (Case Studies)

Status 2017: Ongoing. Subject to available funding.

Status 2018: Ongoing. 2018 grant program is focused on improved water quality in priority coastal watersheds, or to increase resiliency/adaptation to erosion and flooding, while preserving coastal natural resources.

Shore and Harbor Grant	**Lead Agency:**	**DMR**
	Partner Agencies:	**DACF, DEP, DOT**

DMR's Shore and Harbor Grant program provides competitive awards to coastal municipalities to conduct waterfront planning; vulnerability assessments are eligible.

Link: https://www.maine.gov/dmr/mcp/grants/shore-and-harbor-planning-grants.html

Status 2017: Ongoing.

Status 2018: Ongoing.

Clean Water State Revolving Loan Fund (Wastewater and Stormwater Adaptation Planning and Implementation)	**Lead Agency:**	**DEP**

The Clean Water State Revolving Fund (CWSRF) is a loan program for wastewater infrastructure and some non-point source abatement activities. DEP jointly administers this program with the Maine Municipal Bond Bank. Since this program began, 398 loans have been awarded, totaling $811 million, for numerous projects serving 134 municipal wastewater treatment facilities and collection systems. Funding supports pollution abatement projects that safeguard our water, enhances energy efficiency and capacity, and helps keep rates low for Mainers. In addition, to facilitating this funding, the DEP also provides extensive technical assistance to support these projects from idea to operation. The CWSRF's currently-funded coastal projects include wastewater treatment facility upgrades, sewer force main replacement, and CSO abatement

III. Inventory of State Climate Activities – Grants and Loans

projects. CSO discharges are weather dependent and go up and down from year to year. The overall goal is a general downward trend in overflows.

Since 2015, DEP has promoted operational resiliency at wastewater treatment systems. Climate Adaptation Plans (CAPs) for wastewater systems in Maine communities have been supported by the United States Congress through the State's Clean Water State Revolving Fund (CWSRF) for Maine communities. Maine DEP has made available up to $20,000 per project available in loan principal forgiveness for wastewater utilities to assess their systems and develop CAPs for them. With this funding, communities can identify hazards associated with climate change, evaluate their critical assets, identify adaptation practices, and develop recommendations that build resiliency into their systems. Additionally, through loan principal forgiveness, up to $50,000 per project is available for wastewater utilities to create Fiscal Sustainability Plans (FSP).

Funding administered on annual cycles as SRF is approved and allotted to states at the federal level.

Link:
http://www.maine.gov/dep/water/grants/srfparag.html
https://www.maine.gov/dep/commissioners-office/environmental_trends.html (Combined Sewer Outflows)

Status 2017: Ongoing. CAPs completed in 2016 for Brownville, and in 2017 for Norway and for Lincoln.

Status 2018: Ongoing. A total of $200,000 in funding has been allotted to 10 communities for development of wastewater system CAPs.

Drinking Water State Revolving Fund Loans and Capacity Development Grants   **Lead Agency: DHHS-CDC**

The Drinking Water Program provides low interest capital improvement loans and capacity development grants for public water system projects that, among other objectives, seek to bolster resilience to drought and flooding through infrastructure upgrades.

Grants are administered on annual cycles as SRF is approved and allotted to states at the federal level.

Links:
http://www.maine.gov/dhhs/mecdc/environmental-health/dwp/pws/srf.shtml
http://www.maine.gov/dhhs/mecdc/environmental-health/dwp/partners/capacityDevelopment.shtml

Status 2017: Ongoing.

Status 2018: Ongoing. In 2018, the DWP incorporated consideration of resiliency into its ranking of loan and grant applications.

Hazard Mitigation Grant Program   **Lead Agency: DDVEM-MEMA**

MEMA administers the Hazard Mitigation Grant Program (HMGP) to fund projects identified in local hazard mitigation plans that are sustained actions taken to reduce or eliminate the long-term risk from natural hazards. By mitigating the impacts of natural hazard events, HMGP projects increase resilience to future events that may be exacerbated by climate change.

III. Inventory of State Climate Activities – Grants and Loans

HMGP funds are post-disaster and are thus only available following a federally-declared disaster.
Link: https://www.maine.gov/MEMA/mitigation/mema_mit_grants.shtml

Status 2017: Ongoing. Maine received approximately $1,500,000 in grant funding through the HMGP for the first time since 2005 when FEMA announced the allocation of funds associated with the October 2017 Wind Storm disaster. Applications for grant funding are being processed between December 2018 and February 2019.

Status 2018: Ongoing. Maine received approximately $207,894 in grant funding through the HMGP from the February 2018 Coastal Storm. MEMA has developed a relationship with the Nature Conservancy to provide potential "living coastline" options to community mitigation projects. Applications for grant funding are being processed between December 2018 and February 2019.

Stream Crossing (Culvert) Improvement Grants: Water Bond and Transportation Bond	**Lead Agency:**	**DEP**

2014 Water Bond: The Maine Legislature passed a law (PL 2013, Ch. 589) authorizing a general fund bond to ensure clean water and safe communities. The law required that a referendum be passed by Maine voters. On November 4, 2014, voters passed Question 6, identified as the "Clean Water for Maine" bond.
2017 Transportation Bond: On November 7, 2017, voters passed Question 3, identified as the "Transportation" bond. The bond provides $5 million for a competitive grant program that matches local funding for the upgrade of municipal culverts at stream crossings to improve fish and wildlife habitats, reduce risk of failure and overtopping, and increase community safety.
2018 Transportation Bond: On November 5, 2018, voters passed Question 3, identified as the "Transportation" bond. The bond provides $5 million for a competitive grant program to make upgrades to municipal culverts at stream crossings that improve safety and improve fish and wildlife habitats.

Link:
http://www.maine.gov/dep/land/water_bond_rfp.html
https://www.maine.gov/dep/land/grants/stream-crossing-upgrade.html

Status 2017: In progress.
2014 Water Bond: Using a Request for Proposal (RFP) process to disburse the funds for two portions of the bond, DEP awarded $5.4 million toward vital public improvement projects including stream crossing or culvert upgrades, and $400,000 to restore state wetlands. 72 towns, water districts, road associations and other entities in all 16 counties of Maine completed projects for stream crossing infrastructure improvements. Climate resiliency consistent with the Stream Smart design criteria was included in the RFP criteria, and many projects replaced culverts with structures that offer greater hydraulic, ecological, and long-term economic benefits than traditional, hydraulically designed culverts. All funded projects had a strong emphasis on improving climate resiliency, greatly increasing the resilience of the state's water crossing infrastructure. Many projects also made use of decision support tools developed through previous efforts such as Stream Smart designs, Stream Stats, and the Stream Habitat Viewer. In all rounds, projects that were awarded funding scored higher on average for designing for climate resiliency than those that did not. These results suggest that culvert improvements made through water bond funding, in general, increased the climate resiliency of water crossing infrastructure. In a report to DEP, one award recipient

III. Inventory of State Climate Activities – Grants and Loans

noted that their town completed the costly improvement from a culvert to a span, which successfully passed a large rain event immediately upon completion. Further, it was noted that a similar sized rain event would have washed out the original culvert previously. In 2016, 8 projects were completed. In 2017, 14 projects were completed.

Status 2018: In Progress.

<u>2014 Water Bond</u>: In 2018, 21 projects will be completed, and in 2019, 28 projects will be completed.

<u>2017 Transportation Bond</u>: Once monies are in place to administer the program, using an RFP process to disburse the funds, DEP anticipates three rounds of funding are anticipated beginning in early 2019. Eligible project sponsors include local governments, municipal conservation commissions, soil and water conservation districts and private nonprofit organizations.

<u>2018 Transportation Bond</u>: Eligible project sponsors include local governments, municipal conservation commissions, soil and water conservation districts and private nonprofit organizations

Wastewater Infrastructure Projects:	**Lead Agency:**	**DEP**

Wastewater Infrastructure Bond

<u>2018 Wastewater Infrastructure Bond</u>: The bond provides: $27,650,000 wastewater treatment facility planning, construction grants and hydrographic modeling in coastal watersheds, prioritizing areas with high-value shellfish resources; $2,000,000 grants to towns to help replace malfunctioning septic systems that are polluting coastal watersheds or causing a public nuisance; and, $350,000 assist homeowners whose homes are served by substandard or malfunctioning wastewater treatment systems, including straight pipe discharges, individual overboard discharge systems, subsurface wastewater disposal systems, septic tanks, leach fields and cesspools, which result in direct discharges of domestic pollutants to coastal watersheds.

Status 2018: In Progress. On November 5, 2018, voters passed Question 2, identified as the "Wastewater Infrastructure Bond".

Historic Preservation Fund Grants	**Lead Agency:**	**MHPC**

Historic Preservation Fund Grants are available for planning, evaluation, adaptation or mitigation activities for properties, archaeological sites or historic districts listed in the National Register of Historic Places threatened by changing climatic conditions. Eligible recipients are limited to non-profit organizations, municipalities, including Certified Local Governments, counties or state agencies. Grants are generally announced annually in the winter or spring.

Link: https://www.maine.gov/mhpc/grants/index.html

Status 2017: In progress. Grants were made to projects with a focus on historic properties statewide and in Gardiner.

Status 2018: In progress. Grants were made to projects in Portland and South Portland.

IV.   Future Work Group Activities

In addition to maintaining a list of activities underway, MICA revisits a list of actionable items to continually improve and update previous work group recommendations that create a guide for future MICA activities. The 2019 list is developed from the 2014 *Maine Prepares* report and *Maine Prepares 2018 Update*. A list of the acronyms used in the Future Work Group Activities section can be found on page 2.

Future activities are grouped under two headings:

<u>Part A. Interagency Coordination</u> activities are primarily focused on work to be completed on behalf of the MICA work group.

<u>Part B. Agency Level Activities</u> are primarily completed by individual agencies or subsets of the full MICA work group member agencies. These are grouped into five headings that include:

- Monitoring, Mapping, and Modeling;
- Other (research and analysis; implementation of adaptation and preparedness options);
- Funding;
- Standards and regulatory considerations; and
- Cross-promotional activities that further linkages between climate mitigation, adaptation and preparedness.

A. Interagency Coordination

1) To continue to strengthen interdepartmental cooperation, the Maine Interagency Climate Adaptation work group should continue to meet as outlined in this report and in these future activity areas:

   a. MICA could consider expanding membership to additional state agencies.
      ➢ MHPC joined MICA in 2018, expanding membership to a total of nine agencies.

   b. MICA should maintain an ongoing commitment by the participating agencies, meeting periodically, and group membership should be periodically reviewed. Subgroups or subcommittees focused on specific topics, actions or practices may be established as needed and may include additional agency staff to provide expertise on issues.
      ➢ MICA 2018 meetings in January, September, and October. MICA will continue to hold quarterly work group meetings going forward.
      ➢ Several topics have been identified for potential subgroup work, including near-term opportunities in Future Activities parts A2-A5 below.

Lead Agency	Partner Agencies
DEP	DVEM, DACF, DHHS, DIFW,

IV. Future Work Group Activities – Agency Level Activities

DMR, DOT, GEO, MHPC

2) Develop a way to share data on existing assistance efforts that individual agencies are providing to the same entity. This should bridge the gap to the municipal level and create more effective and efficient adaptation responses, including opportunities for lessons to be transferable from one locality to another.
  ➢ No specific mechanism created for this to date. Continues to be of interest to MICA.

Lead Agency(ies)	Partner Agencies
	All MICA Agencies

3) MICA should create basic, informative criteria to evaluate adaptation responses and measures that could be tailored to user needs and available upon request with accompanying assistance.
  ➢ Near-term focus for MICA could be to develop a draft framework, criteria questions, and guides via a more complete list of mechanisms and strategies for use by entities when pursuing resilience work to consider at decision-making points. DEP Climate Program began initial research with an intern from UMaine's Climate Change Institute in 2017, and continued this effort in 2018. Several existing materials have been gathered and could be updated and leveraged into a more cohesive effort.   For example, through DOTs TRAPPD tool (Cross-reference Section III. C. Adaptation "Risk-Based Planning and Environmental Linkages".)

Lead Agency	Partner Agencies
DEP	All MICA Agencies

4) The work group will continue to maintain an inventory of climate-specific and related state activities. The inventory includes ongoing state projects, programs, initiatives, and groups including resources with a list of those involved and links to content.
  ➢ *ME Prepares 2018 Update* completed 1/2018, and *ME Prepares 2019 Update* completed 1/2019. The report has been updated with an appendix that will be used to maintain a list of completed activities identified though the MICA 'Maine Prepares' reporting process.

Lead Agencies	Partner Agencies
All MICA Agencies	All MICA Agencies

5) DEP should continue to coordinate the state's climate activities through efforts of the interagency adaptation group, and continue to maintain the webpages to reflect ongoing work.

  a. The state's web-based climate resources, including the Climate Clearinghouse and Maine Adaptation Toolkit, should be maintained and further developed by MICA member agencies.
    ➢ A major revision to DEPs climate webpages and Adaptation Toolkit was completed in April 2018 through interagency coordination with MICA member agencies.
    ➢ Additional outcomes of interest that may be achieved through continued dialog: understanding resilience needs; identifying barriers to implementing practices; and

investigating programs, policies, and initiatives to increase resiliency of Maine communities.

➤ Initial work started to create an 'Adaptation Tracking Tool' aligning info from several state level climate-related planning documents.

b. Efforts should be made to conduct outreach and provide assistance to municipalities in planning for resiliency using these online resources.
➤ In 2018, created a fact sheet created for Climate Webpages, and created a basic presentation MICA work group and related activities created.
➤ Coordinated assistance pilot project with UMaine for Town of Belfast began in 2018. A goal is to make use of available resources through MICA, UMaine, and those contributed to the Climate Clearinghouse and Adaptation Toolkit.

Lead Agencies	Partner Agencies
DEP	All MICA Agencies

c. The clearinghouse should include a section specifically to provide guidance for municipalities, companies and individuals that helps them select the most appropriate GIS application or another tool for their situation. It should be in the form of a directory, or as a 'climate viewer', and include current GIS information to help local level adaptation efforts be informed about climate-related changes in their area.
➤ Several GIS layers available through links on the Climate Clearinghouse and Adaptation Toolkit that are provided by state agencies and other adaptation providers in Maine and the region. No consolidated 'climate viewer' available at this time.

Lead Agencies	Partner Agencies
DEP, MEGIS	All MICA Agencies

d. As part of the clearinghouse, DEP, DACF, and DMR should create or provide information on a "planning toolkit" for municipal planners and developers to use in project design, plan and ordinance development. The toolkit should enable and enhance consideration of climate-related factors that may affect developments now and in the future. This should include tools to evaluate a range of potential climate-related scenarios such as, but not limited to, temperatures, water quality, water quantity, flood-related water levels, and changes occurring in the natural environment as it relates to organisms and habitats. The evaluation tools should allow design characteristics to be adjusted based on regional or local goals. A list of topics to include 'tools' for should be consolidated by MICA members.
➤ DACF and DMR completed development of Municipal Guidance Series, Flood Resilience Checklist, and creation of Coastal Community Grant Case Studies. DEP has added these resources to the Adaptation Toolkit's section for 'Community Planning'. Cross-reference Section III. F. Grants and Loans "Coastal Community Grants" and Appendix A. Completed Activities.

Lead Agencies	Partner Agencies
DEP, DACF, DMR	All MICA Agencies

IV. Future Work Group Activities – Agency Level Activities

    e.   Resources to support interested entities on climate messaging should be provided as part of the adaptation toolkit.

        ➢ Some state specific materials are being developed by other entities in Maine, and may be helpful to incorporate into the Climate Clearinghouse and Adaptation Toolkit.

Lead Agency	**Partner Agencies**
DEP	All MICA Agencies

B. Agency Level Activities

6)   Continue all current monitoring, mapping, modeling, mitigation, and messaging, along with all other activities related to climate change adaptation as time and resources allow.

    ➢ Cross-reference Section IV. A4 and A5. Resources documenting state of current activities over time included in *Maine Prepares* reports, state climate webpages, and Adaptation Tracking Tool.

Lead Agencies	**Partner Agencies**
All MICA Agencies	All MICA Agencies

i. *Monitoring, Mapping, and Modeling*

7)   State agencies support the state geologists and USGS in identifying any existing gaps in stream and groundwater level monitoring gauge datasets, and add to the gauge network as necessary.

    ➢ Work in progress. Current activities include verifying location and physical characteristics of the wells. Cross-reference Section III. B. Research and Analysis "Groundwater Monitoring Networks".

Lead Agency	**Partner Agency**
DACF	DEP

8)   Tools for modeling climate-related changes in water resources should be used or developed, specifically so that any impacts to surface, ground, and storm waters can be considered and used to inform any necessary adaptive responses.

    ➢ State agencies are taking several regularly occurring actions to reduce impacts to water resources. However, no comprehensive approach has been developed and adopted for integrating climate-related changes into existing tools and assistance efforts across agencies. A few examples include:

        • DACF; cross-reference Section III. B. Research and Analysis "Soil Water-Balance Project", "Groundwater Monitoring Networks", "Snow Survey", "Water Resource Investigations", and "Improving Water Use Information"

        • DEP: cross-reference Section III. B. Research and Analysis "Rainfall Data for Stormwater Management", "Nutrient Modeling in Land and Water Environments & Regional Monitoring Network", and Section III. C. Adaptation "Low Impact

IV. Future Work Group Activities – Agency Level Activities

Development", "Storm Modeling and Guidance Information for Project Design and Review", and Section III. D. Preparedness "Tank Siting".

- DIFW: cross-reference Section III. C. Adaptation "Keeping the Public Trust and Informing Voluntary Habitat Conservation".

Lead Agencies	**Partner Agency(ies)**
DACF, DEP	

9) Sea-level and other coastal hazards analyses should be accessible through web-based mapping tools, and should be continually researched and updated to help municipalities, land managers, landowners, conservation planners, government agencies, and others in Maine better understand and integrate this information into their decision making.

- ➢ MGS added latest sea level rise scenarios from NOAA to the Maine coastal hazard viewers. Cross-reference Section III. A. Research and Analysis "Coastal Hazards including Sea, Lake, and Overland Surge from Hurricanes Modeling".

Lead Agency(ies)	**Partner Agency(ies)**
DACF	

10) State agencies support the expansion and continued updating of LiDAR mapping as conditions dictate and resources allow. An inventory of LiDAR data already in existence from work by NOAA and U.S. Army Corps of Engineers should be part of this effort since it is likely that several smaller surveys have been completed along the Maine coastline in the recent past and could be incorporated.

- ➢ As of 2018, DOT in the middle of a 5-year, $100,000 per year, commitment to the state-wide LiDAR effort.

Lead Agency	**Partner Agencies**
MEGIS	All MICA Agencies

11) An interagency GIS group effort should identify any gaps in information to reveal anomalous or changing circumstances regarding climate-related effects and impacts on specific resources or infrastructure in Maine.

a. Existing data layers from state, federal, or other sources reflecting those changes should be evaluated, or new data developed where changes are identified. Related data layers are recommended to be available individually or as a collective web-based mapping tool, possibly through the Maine Library of Geographic Information (Geolibrary).

- ➢ Agencies could begin to identify near term opportunities and coordinate with GIS staff on any priority areas. Effort could incorporate Future Activity part A5c 'climate viewer'.

Lead Agency	**Partner Agencies**
MEGIS	All MICA Agencies

IV. Future Work Group Activities – Agency Level Activities

b. A summary of available climate-related data should be developed, as well as a summary of data that needs to be developed, along with a time frame and resources needed to fill any identified data gaps.
   ➢ Created Climate Trends and Data page on DEPs website in 2018. This living list of resources could be circulated to statewide, federal, and regional partners to complete. Additional work could also be pursued with MEGIS to make data available as GIS layers and in online viewers. Cross-reference in Section III. E. Raising Awareness "Maine Climate Clearinghouse & Maine Adaptation Toolkit".

c. Current layers should be reviewed for accuracy, up-to-date data, and consistency of the software being used.
   ➢ No specific climate actions taking at this time. Continues to be of interest.

d. Older 'historical' data that is often of high value should be kept available for use in trend analysis.
   ➢ No specific climate actions taking at this time. Continues to be of interest.

e. Online mapping programs should have a process for updates, to monitor usage, as well as for decommissioning them when they are no longer financially supported and scientifically updated.
   ➢ No specific climate actions taking at this time. Continues to be of interest.

Lead Agencies	Partner Agencies
MEGIS, DEP	All MICA Agencies

ii. Other Activities

12) DEP, DIFW, DACF and DVEM-MEMA should continue to support the development of local Debris Management Plans, focusing on provisions in existing rules and statutes that may currently impede emergency clean-up activities after damaging storm events, such as the federal requirement for town-by-town siting as opposed to regional siting between or among more than one locality.
   ➢ Coordination between MEMA, DEP, and FEMA occurred in 2018. If towns have adopted a debris management plan before the date of the declared incident period, then they can qualify for a one-time incentive of a two (2) percent cost share adjustment applied only to debris removal work completed within 90 days (during the pilot only). This can be accomplished through creating their own unique plan or by adopting the State's Debris Management Plan. Additionally, individual municipalities will need to identify the specific locations for their temporary debris management sites. Those sites need to be identified and approved in coordination with FEMA, MEMA, and DEP prior to a storm event to be eligible for reimbursement should that become available after a disaster declaration. It is also possible for municipalities to share a site. In some cases, this may be more realistic than having one debris removal site for every municipality. A clear methodology, such as through development of a mutual aid agreement, to track debris handling costs will likely be needed if not required, as funding reimbursement will be based on this documentation, specifically for accounting how much debris came from

IV. Future Work Group Activities – Agency Level Activities

which municipality. Cross-reference Section III. D. Preparedness "Disaster Debris Management Planning" and "Municipal Guidance for Debris Management Siting".

a. Modeling efforts for major storm events should also be used to inform planning, and site identification, for temporary 'holding sites' for disaster debris management, and to co-establish avenues for reuse and recycling of those materials.
   ➤ DEP Disaster Debris Management Guidance includes general site and operational design considerations for flooding and erosion that prohibit sites to be located within any V or A zones as shown on a town's Flood Insurance Rate Map (FIRM), on slopes less than 5%, and a provision that stormwater run on and run off be controlled to avoid adverse impacts to water bodies or supplies. Cross-reference Section III. D. Preparedness "Municipal Guidance for Debris Management Siting".

Lead Agencies	Partner Agencies
MEMA, DEP	DACF, DIFW, DOT

13) DOT, DVEM-MEMA, DIFW, and DEP should continue to identify critical points of vulnerability along supply and evacuation routes, where increases in runoff or changes in sea level may increase the risk of infrastructure failure, and initiate efforts to minimize those risks. Characteristics of the environment adjacent to applicable vulnerable routes should also be considered as part of this effort, such as fresh and tidal waters or other protected habitats since they may contribute to the degree of vulnerability.
   ➤ 2016 ESI Maps for Maine being evaluated and version incorporates coastal storm hazard and potential inundation data to better respond to climate change concerns. Cross-reference Section III. D. Preparedness "Anticipatory Spill Response Preparedness".
   ➤ The 2016-2019 HES used MGS's Sea, Lake, and Overland Surges from Hurricanes (SLOSH) modeling to complete the Hazard Assessment to support the study's Vulnerability Assessment. Cross-reference Section III. D. Preparedness "Hurricane Evacuation Study".

Lead Agencies	Partner Agency
DOT, DVEM-MEMA, DEP	DIFW

14) State-owned water crossing transportation infrastructure vulnerable to climate-related effects should continue to be identified so that adaptation can be part of planned and future rehab and replacement projects.
   ➤ DOT has several concurrent efforts underway. Cross-reference Section III. C. Adaptation "Landscape-Based Methodology for Inland Climate Resilience of Maine's Transportation Infrastructure", "Coastal Maine Transportation Infrastructure Vulnerability to Projected Sea Level Rise and Storm Surge", and "Risk-Based Planning and Environmental Linkages"
a. DOT should also identify key infrastructure elements for improvement such as those identified as critical to evacuation and supply routes.
   ➤ Cross-reference DOT and MEMA work in Section III. D. Preparedness "Hurricane Evacuation Study".

Lead Agencies	Partner Agency
DOT, DDVEM-MEMA	DEP

IV. Future Work Group Activities – Agency Level Activities

15) DACF should explore opportunities for incorporating techniques into working forest management plans to help maximize carbon uptake, and to consider current and future habitat quality and health including co-benefits to other resources such as to drinking water, and to maintain migration corridors.
   ➢ DACF Bureau of Forestry conducts frequent workshops on Forestry Best Management Practices to protect water quality. Cross-reference Section III. C. Adaptation "Water Resources Program".

Lead Agency	Partner Agency
DACF	DIFW

16) State agencies should take a watershed-scale flood prevention planning approach as opposed to local site-by-site planning, to support more effective regulation and management of stormwater for development, re-development, and retrofits, and to better evaluate the adequacy of existing public infrastructure to properly manage stormwater, including determining best practices to address any inadequacies.
   ➢ No specific actions taking at this time.

Lead Agency	Partner Agencies
DEP	All MICA Agencies

17) DACF and DEP should create opportunities for better data collection of agricultural water needs, soil moisture conditions, and reported stresses or damages from inadequate water supplies.
   ➢ Agricultural water use study complete. Cross-reference Section III. B. Research and Analysis "Improving Water Use Information".
   ➢ State agencies participated in development of Northeast Drought Early Warning System as part of the development of the National Integrated Drought Information System. Cross-reference Section III. D. Preparedness "Drought Task Force".

Lead Agency	Partner Agency
DACF	DEP

18) DACF and DEP should increase focus of agricultural water management through promotion of more intensive use of soil health practices, improved irrigation efficiency, and water source development.
   ➢ DACF has revised and updated its agricultural water resource webpages to provide more relevant information and links for drought resiliency and mitigation.

Lead Agency	Partner Agency
DACF	DEP

19) DACF and DIFW should conduct more intensive monitoring and management of those invasive species that compete more effectively in warmer climates.
   ➢ Several efforts underway to monitor and manage invasive species, though additional resources needed.

IV. Future Work Group Activities – Agency Level Activities

- DACF and DEP: cross-reference Section III. B. Research and Analysis "Invasive Freshwater, Wetland and Terrestrial Plants".
- DACF: cross-reference Section III. B. Research and Analysis "Forestry Inventory Program", "Agriculture, Integrated Pest Management & Cooperative Agricultural Pest Survey (CAPS)", Section III. C. Adaptation "Invasive Pest Mitigation Strategy" and "Soil and Water Conservation Program".
- DEP: cross-reference Section III. B. Research and Analysis "Nutrient Modeling in Land and Water Environments & Regional Monitoring Network".

Lead Agency	**Partner Agency**
DACF	DIFW

20) DACF should identify new opportunities for potential shifts in crop selection and production techniques to reflect changes in growing seasons, soil temperatures, and precipitation patterns.
  ➢ DACF coordinates education and outreach on soil and water conservation practices including on soil health, nutrient management, erosion control, water conservation, invasive species management, sustainable agriculture and forestry, and other locally-identified natural resource management issues. Cross-reference Section III. C. Adaptation "Soil and Water Conservation Program".
  ➢ DACF is currently developing a sustainability recognition program for farmers and will have a climate change component to it. Cross-reference Section III. C. Adaptation "Sustainability Recognition Program".

Lead Agency	**Partner Agency(ies)**
DACF	

21) DIFW should explore opportunities to incorporate climate-vulnerable species' needs and research into species planning and Wildlife Management Area management and conservation.
  ➢ In 2017, DIFW partnered with UMaine to develop template strategies for incorporating climate considerations into coastal and inland Wildlife Management Areas.

Lead Agency	**Partner Agency(ies)**
DIFW	

22) State agencies should coordinate with partner agencies to investigate potential effects of changing weather on nature-based tourism and recreation.
  ➢ In 2017, DIFW partnered with UMaine, the National Park Service, and other partners on a successful interdisciplinary proposal titled 'Maine's Changing Winter: focus on natural resources, ecology, and the economy. Partners met to identify research and coordination needs for next steps.

Lead Agency	**Partner Agency(ies)**
DIFW	To be determined

IV. Future Work Group Activities – Agency Level Activities

iii. Funding

23) DEP, DMR and DHHS will continue to develop proposals and obtain funding for Wastewater, Septic, Overboard Discharge and Drinking Water infrastructure resiliency projects.
   ➢ LD 1510, "An Act to Authorize a General Fund Bond Issue to Fund Wastewater Infrastructure Projects", signed June 27, 2018. Voters approved ballot question November 9, 2018 authorizing $30,000,000 to be administered by DEP for wastewater systems (facilities, septic, overboard discharge) discharging to coastal watersheds. Cross-reference Section III. F. Grants and Loans "Wastewater Infrastructure Projects: Wastewater Infrastructure Bond".

Lead Agency(ies)	Partner Agencies
	DEP, DMR, DHHS

24) As part of Section 1 of LD 1254, "Resolve, To Further Study the Implementation and Funding of an Integrated Beach Management Program", DEP and DACF were directed to convene a working group to review and update the 2006 report titled "Protecting Maine's Beaches for the Future: A Proposal to Create an Integrated Beach Management Program". In the 2017 update, a Beach Nourishment Program including a proposed RFP process was outlined. Pending any further actions, the work group recommends the program outlined in the report be revisited. Additionally, as part of any further efforts on a Beach Nourishment Program, MICA recommends that DECD and DIFW be included.
   ➢ No source is currently available to fund a Beach Nourishment Program to use RFP criteria for.
   ➢ Nourishment Survey of near-shore sources (2018 MGS NOAA Project of Special Merit).
   ➢ Chapter 418 Beneficial Re-Use major substantive rulemaking complete, finally with changes effective July 8, 2018. The revised rule contains a reduced procedure for use of de-watered dredge material as beach nourishment fill. It also utilizes the most up-to-date science for screening with the conversion from Remedial Action Guideline screening numbers to EPA's Regional Screening Levels.

Lead Agencies	Partner Agencies
DEP, DACF	DIFW, DECD

25) State agencies should continue to allocate funding to facilitate resiliency (could include adaptation and hazard mitigation) assessment, planning, and design implementation for wastewater, drinking water utilities, historic districts and properties, and for archeological sites, and to raise awareness of these opportunities.
   ➢ Since 2015, the DEP has promoted wastewater treatment facility operational resiliency by offering up to $20,000 per project in CWSRF loan principal forgiveness for communities to assess their systems and develop a Climate Adaptation Plan. Cross-reference Section III. E. Grants and Loans "Clean Water State Revolving Loan Fund".
   ➢ Starting in 2017, MHPC has provided Historic Preservation Fund Grants for planning, evaluation, adaptation or mitigation activities for properties, archaeological sites or historic districts listed in the National Register of Historic Places threatened by changing

IV. Future Work Group Activities – Agency Level Activities

climatic conditions. Cross-reference Section III. E. Grants and Loans "Historic Preservation Fund Grants".

Lead Agencies	Partner Agency(ies)
DEP, DHHS-CDC, MHPC	

26) To the extent practicable, opportunities for public-private partnerships on adaptation projects should be identified, and efforts to make cost-effective and efficient use of public resources should be pursued.
   - ➢ Began preliminary conversations to connect state university system, state agencies, and adaptation practitioners on assistance requests.

Lead Agencies	Partner Agency(ies)
All MICA Agencies	

27) The state should identify ways to coordinate funding sources across agencies to consolidate separately-funded project segments into one larger fund or 'package', or through multiple funding sources, for a single larger project that addresses the totality of a problem, rather than having to approach a situation piecemeal.
   - ➢ Initial conversations only. *2010 People and Nature Report* identifies several potential sources.

Lead Agencies	Partner Agency(ies)
All MICA Agencies	

28) The work group should identify linear processes to integrate practices that best position the state to apply for and receive funding from federal partners to implement resilience practices, such as updating planning documents so they are consistent with federal requirements.
   - ➢ No specific actions at this time.

Lead Agency(ies)	Partner Agencies
	All MICA Agencies

iv.   *Standards and Regulatory Considerations*

29) DEP should evaluate and update Department rules to be responsive to climate-related impacts on Maine's lakes and freshwater resources, and work with EPA for approval on any revisions.
   - ➢ No specific actions at this time.

Lead Agency	Partner Agency
DEP	EPA

   a. DEP should identify areas where climate-related changes impact base flow, and regulations pertaining to determination of those levels. Any updating of information that is warranted to create more resilient outcomes reflective of these climate-related changes should be integrated into the method for determining base flow under DEP's Rules, Chapter 587, In-Stream Flows and Lake and Pond Water Levels.

IV. Future Work Group Activities – Agency Level Activities

> ➤ No related changes or review to inform changes to Chapter 587 have been initiated or incorporated at this time.

Lead Agency	Partner Agency(ies)
DEP	

   b. DEP should periodically revisit the rain event standards used for the design of stormwater control projects in the Department's Rules, Chapter 500, Stormwater Management, and keep the standards to accurately account for more frequent high-volume rain events associated with climate change.

> ➤ Effective August 12, 2015, Chapter 500 Stormwater Management rules were amended. New rainfall data that becomes available can be reviewed and possibly adopted in future versions of Chapter 500.

Lead Agency	Partner Agency(ies)
DEP	

30) State agencies should seek resolution of conflicts between development standards in flood areas, including in the Shoreland zone and in federal wildlife and wetland protection areas, resulting from any changes that may have occurred since they were previously updated to current and future conditions from a changing climate.

> ➤ DEP Climate and Adaptation program began regional initial review of other New England state regulations regarding sea level rise and floodplain related standards in 2018.

Lead Agency	Partner Agencies
DEP	DACF, DIFW

   a. DEP should identify and seek consistencies in application submission requirements that are impacted by sea level rise across departmental work areas.

> ➤ Projects within Coastal Sand Dune Systems required to consider two feet of sea level rise over 100 years from project review under DEP's Chapter 355 Sand Dune Rules. Only applicable to projects in coastal sand dune systems.

Lead Agency	Partner Agencies
DEP	DACF, DIFW

31) State agencies should seek resolution of any conflicts between state and federal requirements and standards as they apply to adaptation and mitigation projects requiring state licensing.

> ➤ No specific actions at this time.

Lead Agencies	Partner Agencies
DEP, DVEM-MEMA	DOT, DIFW

   a. Existing state and federal regulations should be examined to identify any impediments to beneficial emergency and nonemergency responses to the types of impacts that have been observed or that may arise under a changing climate. This includes, where possible, efforts to streamline state and federal review processes to allow more timely and adaptive responses.

IV. Future Work Group Activities – Agency Level Activities

> ➤ Some effort has been taken for management of debris produced in a disaster event. Cross-reference Section IV. Part B. 12 and 12a.

Lead Agency	Partner Agencies
DDVEM-MEMA	All MICA Agencies

v. *Cross Promotional Activities*

32) GEO, DOT and DEP should continue to cross-promote opportunities for lower and zero emission-based transportation, and efficiency-based technology adoption. Could include a focus on freight.
> ➤ GEO, DOT, and DEP have worked together to provide strategic direction on the use of VW settlement funds for installation of EV charging stations along state highway corridors. Cross-reference Section III. A. Mitigation "Electrifying Transportation".

Lead Agencies	Partner Agency
GEO, DOT, DEP	EMT

33) Efforts should be made to preserve, and expand where possible, appropriate offset categories during RGGI program review periods.
> ➤ Efforts to preserve offset categories in RGGI review. Currently, due to relatively low CO_2 allowance prices, there has been no demand for CO_2 offset allowances for the projects currently operating in Maine. Cross-reference Section III. A. Mitigation "Emissions Offset Categories / Reducing Carbon Emissions from Licensed Sources"

Lead Agency	Partner Agency(ies)
DEP	

34) Efforts to support programs that provide more efficient energy consumption, including those that have the co-benefit of reducing particulates in the atmosphere, should be pursued, such as those available through Efficiency Maine.
> ➤ DEP continues to provide support for US EPAs SmartWay program. Cross-reference Section III. A. Mitigation "SmartWay Program".

Lead Agencies	Partner Agency
DEP	EMT, GEO

Appendix A. Completed Activities

Appendix A: Completed Activities

The Completed Activities list retains previously reported projects, program work and initiatives that have been completed as of the *Maine Prepares 2019 Update*. Several activities in the report constitute completed aspects and products of activities, but the overall status is reported to be continuing in some manner. For example, planning documents are not included in the completed activities list, because many such documents are produced in a cyclical nature and are in parts of the implementation phases between reporting cycles.

Research and Analysis

GUIDING QUESTIONS: WHAT IS IMPACTED BY CLIMATE? WHAT CHANGES ARE BEING OBSERVED?

Physical Environment – Air, Land, Water

Coastal Hazards including Sea, Lake, and Overland Surge from Hurricanes Modeling	**Lead Agency:**	**DACF**

DACF has several GIS datasets related to climate change and coastal hazards such as for sea level rise, storm surge, impacts from hurricanes (CAT 1-4, Maine has experienced CAT 1-2), and for the highest annual tide (revised annually). Applications include determining inundation areas, and can show direct observations of change as well as analyzing various scenarios for flooding in coastal areas. Tools include links to currently available data related to coastal hazards and hazardous areas in Maine, and can be used to help inform communities of potential impacts, and begin conversations of how to prepare. Portal online.

Link: http://www.maine.gov/dacf/mgs/hazards/coastal/index.shtml

Status 2017: Complete.

Habitats and Species – Saltwater, Freshwater, and Terrestrial Systems

Modeling the Effects of Sea-Level Rise on Coastal Habitats	**Lead Agency:**	**DACF**
	Partner Agencies:	**DIFW, DOT**

Maine's tidal marshes are important to commercial fishery interests and to a wide diversity of wildlife species, and are predicted to be negatively impacted by sea-level rise. Science and planning staff from DACF worked with DIFW, using funding from NOAA to develop a LiDAR-based coast-wide dataset depicting the impacts of various sea-level rise scenarios on high and low coastal marshes. The towns of Bath, Bowdoinham, Georgetown, Phippsburg, Scarborough and Topsham participated in the project.

Link: http://www.maine.gov/dacf/mnap/assistance/coastal_resiliency.html

Status 2017: Complete. Portal online.

Appendix A. Completed Activities

Climate Change and Biodiversity in Maine: Vulnerability of Habitats and Priority Species	Lead Agency:	DIFW
	Partner Agencies:	DACF

Scientific staff from DIFW, DACF, conservation groups, land trusts, and USFWS evaluated Maine's plants, animals, and habitats for vulnerability to climate change and reported these findings in Climate Change and Biodiversity in Maine (Whitman et al 2013). Researchers looked at 442 vulnerable species in Maine and found that climate variations could significantly impact 168 species. Results of this study were incorporated into Maine's 2015 Wildlife Action Plan, helping to determine Maine's Species of Greatest Conservation Need (SGCN) most vulnerable to climate change.

Link:
https://www.manomet.org/sites/default/files/publications_and_tools/2013%20BwH%20Vulnerability%20Report%20CS5v7_0.pdf

Status 2017: Complete.

Built Environment and Critical Infrastructure (Energy, Communication, Transportation, Water Utilities, Stormwater)

Transportation Adaptation Planning	Lead Agency:	DOT

The Climate Change and Transportation in Maine report reviews observed and projected climate patterns in Maine and builds on the direct of LD 460 enacted by the 124th Legislature "Resolve, To Evaluate Climate Change Adaptation Options for the State"). Impacts to transportation systems are summarized along with short- and long-term strategies for resilience. Report completed October 2009.

Link:
https://digitalmaine.com/cgi/viewcontent.cgi?referer=https://www.google.com/&httpsredir=1&article=1057&context=mdot_docs

Status 2017: Complete.

Aquatic Resource Management Strategy	Partner Agencies:	DACF, DEP, DIFW, DMR, DOT

The Aquatic Resource Management Strategy was a joint effort between DACF, DEP, DIFW, DMR, and DOT, as well as federal agencies, conservation organizations and municipal representatives to develop a statewide aquatic conservation and restoration strategy that aimed to maintain and restore the ecological health of aquatic ecosystems. The program developed a pocket guide that contains best management practices (BMPs) and guidance for those installing new and replacement crossings where culverts are 6 feet or less in diameter; a master reference manual that incorporates the best of existing BMP documents and Stream Smart crossing principles; the identification of existing opportunities for partnerships and/or project funding sources and potential new initiatives that would better enable local actions that benefit statewide aquatic resource priorities; and the identification of further refinements and objectives for the Maine Stream Habitat Viewer, which is an on-line tool for data sharing and planning and assessing stream restoration projects that was developed by the Maine Stream Connectivity Working Group.

Appendix A. Completed Activities

Links:
https://www.maine.gov/mdot/publications/
https://www.maine.gov/mdot/publications/docs/brochures/pocket_guide_stream_smart_web.pdf (Stream Crossing Pocket Guide)
Status 2017: Complete.

People and Communities (Buildings & Homes, Community Planning, Public Health & Services, Social Vulnerability)

Water Resource Investigations	**Lead Agency:**	**DACF**
	Partner Agencies:	**DHHS-CDC**

In collaboration with the DHHS Drinking Water Program, the USGS, and the Kennebunk-Kennebunkport-Wells Water District, hydrogeologists at DACF investigated water resources in the Branch Brook watershed of southern Maine, which is a primary water supply for the Water District. The project developed a groundwater model that more realistically represents the supply of and demands on groundwater within the watershed. The model can assess the impacts of changes in water supply due to climate change or other factors, and changes in demand due to increased pumping.

Link: https://pubs.usgs.gov/sir/2014/5235/

Status 2017: Complete.

Climate Forecast Predictions for the Lyme Disease Tick Vector	**Lead Agency:**	**DHHS-CDC**

Climate forecast predictions developed through a collaboration between Maine CDC, the UMaine Climate Change Institute, and the Maine Medical Center Research Institute's Vector-Borne Disease Laboratory (MMCRI) indicate that by 2050 virtually the entire state will whave a sufficiently warm climate for the Lyme disease tick vector (*Ixodes scapularis*, or deer tick) to reproduce and complete its life cycle, and thus allow for the further expansion of tick-borne diseases.

Status 2017: Complete.

Enhancing the Tick-Borne Disease Surveillance System	**Lead Agency:**	**DHHS-CDC**

Maine CDC evaluated its tick-borne disease surveillance system, resulting in several system enhancements, as well as the identification of two high-risk groups for Lyme disease: children 5-14 years old, and adults 65 years and older.

Link: http://www.maine.gov/dhhs/mecdc/infectious-disease/epi/publications/2015-Lyme-Surveillance-Report.pdf

Status 2017: Complete.

Appendix A. Completed Activities

Building Resilience Against Extreme Heat Events   **Lead Agency:**   **DHHS-CDC**

Maine CDC has applied CDC's BRACE framework to develop adaptation plans for extreme heat events. As part of this framework, modeling conducted by UMaine Climate Change Institute with funding support by Maine CDC indicates a significant increase in the number of high heat days by 2060. This research can be used to help communities plan for the future effects of high heat events. Results are included in UMO CCI's Maine's Climate Future report.

Link: https://climatechange.umaine.edu/wp-content/uploads/sites/439/2018/08/Maines_Climate_Future_2015_UpdateFinal-1.pdf

Status 2017: Complete.

Statistical Modeling to Evaluate the Heat-Morbidity/Mortality Response Curve for Maine   **Lead Agency:**   **DHHS-CDC**

Maine CDC has performed time-series meta-analysis modeling in collaboration with colleagues from Brown University and the state health agencies in New Hampshire and Rhode Island to identify more data-driven thresholds for issuing heat-related health advisories. These modeling results demonstrated that there are increases in heat-related morbidity and mortality at heat index levels below the NWS thresholds for issuing heat advisories. Results were published in the journal Environmental Research.

Link: http://www.sciencedirect.com/science/article/pii/S0013935116312609

Status 2017: Complete. Results from this analysis were shared with the NWS's Northeast Region office, and in response to the findings, in April of 2017 the NWS Northeast Region in April 2017 lowered its threshold for issuing heat advisories to a level more consistent with the study findings.

Status 2018: No further work at CDC. In Spring 2018 NWS again modified its heat advisory issuance criteria, such that duration as well as maximum daily heat index levels are more in line with study results.

Adaptation

GUIDING QUESTIONS: WHAT IS BEING DONE TO BUILD RESILIENCE TO CLIMATE IMPACTS? HOW CAN VULNERABILITIES BE REDUCED AND BENEFICIAL OPPORTUNITIES BE INCREASED?

Natural Environment – Habitats, Species, Open Spaces, Working Landscapes, and Waterfront

Adaptation Planning for Maine's Coastal State Parks   **Lead Agency:**   **DACF**

DACF-managed Parks and Public Lands are subject to erosion, land loss, flooding from hurricanes and winter storms, and other hazards. This project is a collaboration among several DACF programs to determine the vulnerability of infrastructure and habitats of Maine's most at-risk coastal state parks and historic sites to sea level rise and storm surge. The project identified sites for improving public safety, mitigating hazards, siting future development, and making lasting investments in park improvements. The study area includes Popham Beach State Park,

Appendix A. Completed Activities

Reid State Park, Crescent Beach State Park, Kettle Cove State Park, Fort Pemaquid, Fort Popham, and Popham Colony.

Link: https://digitalmaine.com/geo_docs/7/ (Changing Shorelines: Adaptation Planning for Maine's Coastal State Parks)

Status 2017: Complete.

Built Environment - Infrastructure

Use of Green Infrastructure to Enhance Coastal Highway Resiliency in Two New England States	**Lead Agency:**	**DOT**
	Partner Agencies:	**DACF, DEP**

Maine's DOT and the New Hampshire DOT are studying the feasibility of applying green infrastructure methodology along two highly vulnerable coastal highway sections. Working with UNH, multiple state and federal agencies, and non-profits, the two transportation agencies are building on existing information regarding sensitive habitats, structural conditions, ocean dynamics, social considerations, regulatory environments, and climate-based projections to determine the benefit-cost balance for green, green-gray, and gray stabilization methods in areas of active erosion. This project was selected for funding by FHWA as one of four pilots nationwide.

Link:

Status 2017: Complete. Final report pending.

People and Communities

Building Resiliency Along Maine's Bluff Coast in Casco Bay	**Lead Agency:**	**DACF**
	Partner Agency:	**DMR**

This project is currently underway along Casco Bay. A project goal is to understand the implications of storms and shoreline change on bluffs by using existing bluff stability and landslide hazard maps, historical erosion rates, and accelerated erosion rates driven by sea-level rise. This project is a collaboration of DACF, DMR, the Casco Bay Estuary Project, and the Cumberland County Soil and Water Conservation District. Products will include a decision-tree for evaluating non-structural methods of slope stabilization, case studies of vulnerable eroding bluffs, and a planting guide for landscaping solutions.

Links:
http://cumberlandswcd.org/site/2017/11/building-resiliency-along-maines-bluff-coast/
http://cumberlandswcd.org/site/wp-content/uploads/2017/11/Building-Resiliency-Along-Maines-Bluff-Coastline-Technical-Manual-for-SMA-Revised-11.27.17.pdf (Report)

Status 2017: Complete.

Municipal Guidance Series	**Lead Agency:**	**DACF**
	Partner Agencies:	**DEP, DMR, DOT**

Many local governments in Maine are looking for practical steps to help make their communities more resilient in the face of rising sea-levels and more frequent intense storm events. To help

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address this need, the Municipal Planning Assistance Program and nine of Maine's Regional Planning Organizations, with funding from the Maine Coastal Program, have collaborated on a series of guidance documents.

The guidance documents explain how to identify threats to community resources, and how to respond to those threats by integrating climate adaptation measures into existing local policies, practices, and ordinances. Each of the ten documents in the series addresses a different area of municipal responsibility.

Link: http://www.maine.gov/dacf/municipalplanning/technical/climate.shtml

Status 2017: Complete.

Maine Flood Resilience Checklist   **Lead Agency:**   **DACF**

The Maine Flood Resilience Checklist is a simple and practical self-assessment tool designed to assist communities evaluate how well well-positioned they are to prepare for, respond to, and recover from flooding events and sea level rise. It provides an integrated framework for examining local flood risk; assessing vulnerability of the natural, built, and social environments; and identifying specific opportunities, actions, and strategies to enhance community flood resilience.

Links:
http://www.maine.gov/dacf/mgs/hazards/coastal/index.shtml
http://digitalmaine.com/mgs_publications/521
http://www.maine.gov/dacf/mgs/hazards/coastal/MaineFloodResilienceChecklistOverview.pdf

Status 2017: Complete. Pilot test of the Community Resiliency Index and associated engagement process in 1 coastal community (Summer/Fall '16). The checklist is now available.

Status 2018: Ongoing. DACF has provided funds to Regional Planning Commissions to use the flood resiliency checklist with their member towns. Several coastal communities have conducted workshops and utilized the checklist.

Coastal Hazards and Resiliency Tools Project   **Lead Agency:**   **DACF**

Science and planning staff worked with numerous regional and local partners on the Coastal Hazards and Resiliency Tools (CHRT) project with the goal of promoting coastal hazard resiliency at local and regional levels. The project focuses on developing vulnerability assessment datasets, engaging directly with interested communities through education and outreach, and aiding local partners in developing locally acceptable adaptation strategies for dealing with the potential impacts of storms and future sea-level rise. Part of these efforts included developing the GIS datasets required for assessing the potential impacts of various sea-level rise scenarios on both natural and built environments in each partner community. These sea-level rise scenarios were superimposed onto the highest annual tide and the 100-year storm water elevation to assess potential impacts.

Links:
https://www.maine.gov/dacf/municipalplanning/technical/climate.shtml
http://www.smrpc.org/index.php/programs/land-use-plainning/slawg
https://geopub.epa.gov/RAINE/PDF/CHRT_Maine_82616.pdf (US EPA RAINE Database)

Status 2017: Complete. On-going efforts to address resiliency in many coastal communities.

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