



Chapter 13 - ENVIRONMENT & CLIMATE CHANGE



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Introduction

Environment and climate change are important areas of consideration for transportation planning. The Montachusett Region needs to help protect and minimize negative impacts to its many areas of environmental value and its air, water, soil and wildlife. Along with environmental protection, the Montachusett Region hopes to reduce greenhouse gas emissions which contribute to global climate change. This section will discuss the current and future activities the Montachusett Region is undertaking to protect its environment and reduce greenhouse gas emissions.

In response to building concerns on the effect of global climate change and the development of Massachusetts Green DOT initiatives, the MRPC has looked at ways climate change will impact the Montachusett Region. In particular, staff has focused on potential flooding by identifying flood prone areas and the effects that it will have on each community in relation to major transportation infrastructure. Transportation infrastructures such as roadways, bridges, rail lines etc. are essential for the economic wellbeing of our region. More than half the country's population now lives along the nation's coasts, and one third lives in the highly populated coastal areas of the Northeast. The area between Boston and Philadelphia is one of the most populous areas of the country. The Montachusett region, being a part of this larger corridor, not only has infrastructure which carries regional significance, but national as well.

"The threats that climate change poses to transportation systems—including flooding, changes in average temperatures, and extreme weather events—are clear. But MPOs and DOTs have little if any information on precisely what impacts they can expect, where, and in what time frames. As a result, agencies are largely not acting to adapt the transportation system to climate change, or are waiting for further guidance on the topic."

– FHWA *Integrating Climate Change into the Transportation Planning Process*

Regional Significance

"Global climate change affects the coastal areas with rising air temperature, increasing rainfall, rising ocean temperatures and rising sea levels, which lead to increased coastal flooding. In addition to sea level rises, much of the Northeast shoreline is gradually sinking, increasing the effects of rising ocean waters." Even though there are no coastal areas in the Montachusett region it is important to note other effects climate change may have on inland areas. "The Northeast is projected to see a steady increase in precipitation, with total increase of around 10 percent, about four inches per year, by the end of the century. It is winter precipitation that is rising fastest, with more precipitation expected to fall as rain rather than snow. Rainfall is expected to become more intense and periods of heavy rainfall are expected to become more



frequent.”ⁱ Since flooding is a major concern to transportation infrastructure in the region, it is important to identify and recognize areas which are vulnerable to such events.

The flood zone maps at the end of this section show Federal Emergency Management Agency (FEMA) 100 year flood zones in the Montachusett region. A 100 year flood is “calculated to be the level of flood water expected to be equaled or exceeded every 100 years on average. The 100-year flood is more accurately referred to as the 1% annual exceedance probability flood, since it is a flood that has a 1% chance of being equaled or exceeded in any single year.”ⁱⁱ

The map **FEMA 100 Year Flood Zones, MA DOT Bridges, and DCR Dams** shows all “High” and “Significant” hazard dams in the region and bridges that are either structurally deficient or functionally obsolete. According to the Massachusetts Highway Project Development and Design Guidebook, a *structurally deficient* bridge is defined as “a bridge structure that has a defect requiring corrective action.” *Functionally obsolete* bridges are defined as “a bridge which has no structural deficiencies but does not meet standards to adequately serve current user demands (Massachusetts).”ⁱⁱⁱ

Dams are shown by their Hazard Codes, a system that categorizes dams according to the degree of adverse incremental consequences of a failure or mis-operation of a dam. The hazard potential classification does not reflect in any way on the current condition of the dam (e.g., safety, structural integrity, flood routing capacity), rather the potential hazards downstream that would be realized by a failure. Three classification levels are *Low*, *Significant*, and *High*. According to the Massachusetts Office of Dam Safety a...

High Hazard Potential dam refers to dams located where failure will likely cause loss of life and serious damage to home(s), industrial or commercial facilities, important public utilities, main highway(s) or railroad(s).

Significant Hazard Potential dam refers to dams located where failure may cause loss of life and damage home(s), industrial or commercial facilities, secondary highway(s) or railroad(s) or cause interruption of use or service of relatively important facilities.

Low Hazard Potential dam refers to dams located where failure may cause minimal property damage to others. Loss of life is not expected.



HIGH HAZARD DAMS IN THE MONTACHUSETT REGION

Dam Name	City/Town	Ownership	Regulating Authority	ID Code
Lower Naukeag Lake Dam	Ashburnham	Municipality	Office of Dam Safety	MA00002
Upper Naukeag Lake Dam	Ashburnham	Municipality	Office of Dam Safety	MA00003
Winnekeag Lake Dam	Ashburnham	Private	Office of Dam Safety	MA00007
Lake Wampanoag Dam	Ashburnham	Private	Office of Dam Safety	MA00010
Ashby Reservoir Dam	Ashby	Municipality	Office of Dam Safety	MA00334
Whites Mill Pond Dam	Winchendon	Private	Office of Dam Safety	MA00630
Lake Monomonac Dam	Winchendon	Municipality	Office of Dam Safety	MA00631
Whitney Pond Dam	Winchendon	Municipality	Office of Dam Safety	MA00633
Crocker Pond Dam	Westminster	Private	Office of Dam Safety	MA00638
Westminster Reservoir Dam	Westminster	Private	Office of Dam Safety	MA00639
Wyman Pond Compensating Reservoir Dam	Westminster	Municipality	Office of Dam Safety	MA00641
Hickory Hills Lake Dam	Lunenburg	Private	Office of Dam Safety	MA00851
Fall Brook Reservoir Dam and Dike	Leominster	Municipality	Office of Dam Safety	MA00869
Notown Reservoir Dam	Leominster	Municipality	Office of Dam Safety	MA00870
Scott Reservoir Dam	Fitchburg	Municipality	Office of Dam Safety	MA00871
Lovell Reservoir Dam	Fitchburg	Municipality	Office of Dam Safety	MA00872
Wrights Reservoir Dam	Gardner	Municipality	Office of Dam Safety	MA00117
Cowee Pond Dam	Gardner	Municipality	Office of Dam Safety	MA00118
Perley Brook Reservoir Dam	Gardner	Municipality	Office of Dam Safety	MA00119
Lake Shirley Dam	Lunenburg	Municipality	Office of Dam Safety	MA00455
Lost Lake Dam	Groton	Municipality	Office of Dam Safety	MA00808
Greenes Pond Dam	Fitchburg	Municipality	Office of Dam Safety	MA00875
Overlook Reservoir Dam	Fitchburg	Municipality	Office of Dam Safety	MA00876
Snows Mill Pond Dam	Fitchburg	Private	Office of Dam Safety	MA00878
McTaggarts Pond Dam	Fitchburg	Municipality	Office of Dam Safety	MA00879
Rockwell Pond Dam	Leominster	Municipality	Office of Dam Safety	MA00882
Pierce Pond Dam	Leominster	Private	Office of Dam Safety	MA00883
Wachusett Reservoir Dam	Clinton	State	Office of Dam Safety	MA00886
Cresticon Upper Dam	Athol	Private	FERC Jurisdiction	MA00932
Crescent Street Dam	Athol	Private	Office of Dam Safety	MA00934
Birch Hill Dam	Royalston	Federal Agency	Army Corps of Engineers	MA00963
Tully Lake Dam	Royalston	Federal Agency	Army Corps of Engineers	MA00970
Bickford Pond Dike	Hubbardston	Municipality	Office of Dam Safety	MA01022
Wachusett Reservoir North Dike	Clinton	State	Office of Dam Safety	MA01294
Lovell Reservoir Dike	Fitchburg	Municipality	Office of Dam Safety	MA01334
Lake Samoset Dam	Leominster	Private	Office of Dam Safety	MA00866
Notown Reservoir Dike	Leominster	Municipality	Office of Dam Safety	MA01240
Overlook Reservoir Dike	Fitchburg	Municipality	Office of Dam Safety	MA01236
Falulah Reservoir Dam	Fitchburg	Municipality	Office of Dam Safety	MA02312
Red Dam	Winchendon	Municipality	Office of Dam Safety	MA02345
Damon Pond Dam	Ashby	State	Office of Dam Safety	MA02518



Environmental Impacts of Transportation

The environmental impact of transportation is significant because it is a major user of energy, and burns most of the world's petroleum. This creates air pollution, including nitrous oxides and particulates, and is a significant contributor to global warming through emission of carbon dioxide.^{iv} One of the most well documented human contributors to climate change is emissions from automobiles. According to the Environmental Protection Agency (EPA) around 13% of all global greenhouse gas emissions are from the transportation sector and almost all (95%) of the world's transportation energy comes from petroleum-based fuels, largely gasoline and diesel. A significant contributor to overall transportation emissions is congestion on our roadways, causing cars to idle and produce more byproduct from burning fuel.

Transportation generates 30 percent of America's total global warming emissions, including more than one-third of all U.S. carbon dioxide emissions.

More than 60 percent of U.S. transportation emissions come from cars and light trucks.

Source: EPA

Regional Initiatives

Environment and climate change are important areas of consideration in transportation planning. It is important to account for the most vulnerable infrastructure when considering improvements and planning future developments. Efforts to prepare and mitigate the effects of climate change have been made and are currently underway in the region which MRPC has been both directly and indirectly involved in. The following are brief descriptions of such efforts.

Montachusett Regional Stormwater Development Program

The objective of the Stormwater Data Development Program is to complete an inventory and assessment of roadway drainage systems in environmentally sensitive areas located along local jurisdiction federal aid eligible roadways in the region. This information will be shared with municipalities who in turn are required to maintain it due to the Environmental Protection Agency's (EPA) Phase II Stormwater Regulations. This effort will also add to the data MRPC references along the federal aid system of roadways and could potentially act as a pilot program to assist MRPC communities in this new EPA requirement.

After consultation with member communities interested in assistance the focus of the 2016 program will be to work with communities to create a mobile application which would assist in data collection and organization. Currently the Phase II guidelines have not been fully developed by the EPA, however, MRPC will seek to assist communities as necessary.



Central Massachusetts Evacuation Plan Mapping

This effort coordinates with the Central Massachusetts Planning Commission (CMRPC) and the Central Massachusetts Homeland Security Council to develop a data assessment/SWOT Analysis (strategic planning method to evaluate the Strengths, Weaknesses, Opportunities and Threats) of existing conditions, to be used for the ultimate development of a county-wide evacuation plan. This plan is partially funded through the Homeland Security Council and will focus mainly on the development of evacuation zones, critical infrastructure, demographic data and the designation of evacuation routes.

Multi-Modal Corridors

To lessen the reliance on driving and burning fossil fuels, which contributed to global climate change, the region is initiating programs that make it easier and safer to have more transportation mode choices. Within the Montachusett region, this includes the development and promotion of bicycle and pedestrian trails and lanes and the establishment of Safe Routes to School and Complete Streets programs in member communities.

Over the last few years, the MRPC has utilized GIS mapping to document where various pedestrian, bicycle and mixed use trails are in the region. All 22 MRPC communities have been surveyed and mapped. An inventory is available for the public that shows trails which are available for use. Using trail inventories in these ways can encourage the use of bike and pedestrian modes of travel and might be a first step in planning for future trail construction.

The MRPC also works to assist communities with walkability and complete streets. In 2012, Walkability studies were conducted in the towns of Groton and Westminster. These planning documents were requested to study the downtown areas of each town and how walkable or accessible they are for residents and visitors. These reports showed detailed information for traffic counts, sidewalk inventory and condition, points of interest locations, etc. The MRPC is also in the process of completing a Complete Streets study for the town of Lancaster. This study will analyze the entire community and assist with prioritizing the areas where complete streets would be most suited in the town. The hope is to create more community or TIP funded projects from these studies.

Trail Inventory

This project was driven by the Montachusett Regional Trail Coalition (MRTC). The MRTC is focused on trail connectivity by establishing new trails as well as maintaining the existing trail network. This group was formed in March 2012 and is made up of state and local officials and other interested parties who are passionate about trails in the region. These individuals made a request to MRPC for assistance with developing a regional trail map that can be used to boost trail interest, awareness and tourism for the region. The Montachusett Region Trail Guide was published in 2014 and was distributed to various locations across the region including all public libraries, town halls and visitors centers.



Renewable Energy

The Montachusett Region is working on increasing the use of renewable energy sources. Some of the Montachusett Region communities have Wind-Energy Bylaws and Wind-Energy Turbines. The Montachusett Regional Planning Commission (MRPC) is also working on a Regional Energy Plan and the Montachusett Regional Transit Authority has attained many renewable energy systems and vehicles in the last few years.

Montachusett Regional Energy Plan

The MRPC has completed the development of a Regional Energy Plan. In the fall of 2011 MRPC was awarded \$66,000 from the federal Department of Commerce's Economic Development Administration (EDA) to put together the plan. The goal of the plan is to make recommendations to the Montachusett Region's 22 communities to promote the reduction of electricity used, energy used for transportation, an non-electric energy used for heating; replacement of fossil fuels with renewable resources and the reduction of global climate change emissions. The scope of work for this project included a renewable energy regional inventory (mentioned above), design and construction of energy educational exhibits, and series of community workshops. An assessment and analysis of the Montachusett Region Current Energy Needs/Demands (by end-user) was also undertaken. Based upon this information, Worcester Polytechnic Institute students worked to build a system dynamics simulation model of future energy demands and needs within the Montachusett Region. The model can be used to simulate a variety of path-altering scenarios. The study and its recommendations can be found on the MRPC.org website in the Comprehensive Planning section under "Energy Planning".

Renewable Energy Systems

Throughout the Montachusett Region, there are various renewable energy systems including wind turbines, solar photovoltaic, geothermal, landfill gas, hydro, and biomass. Over the last few years, there has been an increase in these types of systems throughout the region. The increase in renewable energy systems is helping relieve the demand on burning fossil fuels which lowers CO₂ emissions and greenhouse gases. The map *Renewable Energy Assets* at the end of this section is an inventory of these systems throughout the region done as part of MRPC's Montachusett Regional Energy Plan (2011)

Montachusett Energy Advisory Committee

Montachusett Energy Advisory Committee is a group of various representatives from private and public sectors with an interest in energy issues and was appointed by the Montachusett Region Comprehensive Economic Development Strategy Committee (MRCEDS). The Energy Advisory Committee was formed the end of 2009 as part of a grant awarded by EDA to develop an Emergency Back-Up Power Sources Mitigation Plan. The committee provided oversight and policy guidance to the MRPC staff during its implementation. The committee continues to operate and provides the same oversight over the current Regional Energy Plan.



Siting of Renewable Energy Facilities

The Montachusett Regional Planning Commission (MRPC) and the Northern Middlesex Council of Governments (NMCOG) were awarded \$188,512 in grant funds in fall 2012 from the federal Department of Commerce's Economic Development Administration (EDA) to develop a plan for the Siting of Renewable Energy Facilities for the Montachusett Region and the Northern Middlesex Region. The Montachusett Energy Advisory Committee, formed in January 2010, provided oversight of the project within the Montachusett Region. Partners in the project include Middlesex Community College, Mount Wachusett Community College, Worcester Polytechnic Institute, and the Greater Lowell Workforce Investment Board.

The goal of this project was to create a Regional Renewable Energy Facility Siting Plan encompassing the MRPC and NMCOG communities containing recommendations for siting and promoting renewable energy facilities. Adequately siting and promoting renewable energy facilities in appropriate locations will decrease reliance on fossil fuels and petroleum products. Currently, there are insufficient siting standards for renewables; therefore developers of renewable energy often do not know what criteria they need to meet in order to develop wind, solar, geothermal, hydropower and other facilities. This project was completed in 2014.

Wind-Energy Bylaws/Ordinances

Wind-Energy Bylaws/Ordinances detail specific height and setbacks requirements for wind-energy systems and provide identified areas in which people are allowed to put up wind-energy turbines either by right or through a special permit. This provides an easier, quicker and less costly method than obtaining a zoning variance. In communities that do not have wind-energy bylaws/ordinances, a person might need to get a zoning variance to build their wind-energy turbine. The following is a list of communities within the Montachusett Region that have Wind-Energy Bylaws/Ordinances: Ashburnham, Ashby, Athol, Clinton, Fitchburg, Gardner, Groton, Lunenburg and Winchendon.

Pre-Disaster Mitigation Plans

In 2008, MRPC wrote Natural Hazard Pre-Disaster Mitigation Plans for all 22 communities in the Montachusett Region and in the winter of 2012, MRPC initiated the updating of these same plans with funding provided by the Federal Emergency Management Agency through the Massachusetts Emergency Management Agency and the Massachusetts Department of Conservation and Recreation. These plans identified hazards and assessed their risk of occurring. These hazards included climate change as well as flooding, wind, winter storm and fire related hazards. Flooding, droughts and severe winter storms can be caused by climate change's increase in temperature and storm frequency. These plans also included mitigation strategies for these types of hazards ranging from increased drainage management to increased communication between community boards and departments.



Montachusett Regional Transit Authority (MART) Initiatives

Along with environmental protection, the Montachusett Region hopes to reduce greenhouse gases emissions which contribute to global climate change. As a Regional Transit Agency, MART provides public transportation to area residents and visitors. Environmentally friendly initiatives include the outfitting of maintenance facilities in Gardner and Fitchburg with solar power and the inclusion of Hybrid powered buses and cars to their fleet of vehicles. MART continuously looks to upgrade the efficiency of their fleet and currently operates 30 city buses, of which 5 are Hybrids.

Green Communities

There are 136 communities in the Commonwealth that are ranked as clean energy leaders and are eligible for municipal renewable power and energy efficiency grants which Massachusetts Department of Energy Resources (DOER) denotes them as a Green Community. These are communities that have met five criteria, one of which is providing as-of-right siting in designated locations for renewable/alternative energy generation, research & development, or manufacturing facilities. For communities with by-right Wind-Energy bylaws/ordinances, they already meet this criterion. The other four are: adopt an expedited application and permit process for as-of-right energy facilities, establish benchmark for energy use and developed a plan to reduce baseline by 20 percent within 5 years, purchase only fuel-efficient vehicles, set requirements to minimize life-cycle energy costs for new construction. These criteria all deal with decreasing energy usage or increasing renewable energy usage, which will help lower CO₂ emissions. There are twelve Green Communities in the Montachusett Region. They are Ashburnham, Athol, Ayer, Gardner, Harvard, Lancaster, Leominster, Lunenburg, Petersham, Shirley, Townsend and Westminster.

Statewide Initiatives

GreenDOT

On June 2, 2010, the Massachusetts Department of Transportation (MassDOT) launched the GreenDOT Policy Directive, a comprehensive environmental responsibility and sustainability initiative that will make MassDOT a national leader in “greening” the state transportation planning. MassDOT’s GreenDOT Vision is as follows-

“The Massachusetts Department of Transportation will be a national leader in promoting sustainability in the transportation sector. Through the full range of our activities, from strategic planning to construction and system operations, MassDOT will promote sustainable economic development, protect the natural environment, and enhance the quality of life for all of the Commonwealth’s residents and visitors. This will enable MassDOT to use resources in a manner that serves its existing customers while preserving our resources for future generations.”



The following three mutually-reinforcing goals form the foundation of GreenDOT, which form the basis for “Applicable Regional Objectives/Strategies”

- Reduce greenhouse gas (GHG) emissions
- Promote the healthy transportation modes of walking, bicycling, and public transit
- Support smart growth development

The following are the State targeted GHG reductions from GreenDOT policy:

GreenDOT Policy Goals	Principal Actions	GHG Reduction
Reduce Greenhouse Gas Emissions	Construction Fleet TDM Eco-Driving	1.53 MMTCO ₂ e (5.3%)
Promote Healthy Transportation	Transportation investments that enable increased use of these modes	0.20 MMTCO ₂ e (0.7%)
Support Smart Growth Development	Change in travel behavior due to smart growth development patterns	0.38 MMTCO ₂ e (1.3%)
Total		2.11 MMTCO ₂ e (7.3%)

Challenges

- How can we reduce Greenhouse gases emitted via the transportation system?
- How can we encourage sustainable practices in transportation improvements?
- How can we ensure transportation infrastructure does not have adverse effects on the environment?
- How can we prepare for the effects of Climate Change?

Moving Forward – Addressing Challenges

- Encourage the development of more projects which qualify for Congestion Mitigation and Air Quality (CMAQ) funds.



- Assist and encourage communities to buy into GreenDOT policies and incentivized programs.
- Maintain the prevalence of environmental factors when reviewing and prioritizing transportation projects.
- Continue to monitor and assess vulnerable infrastructures.

The importance of the environment in the Montachusett region goes beyond just the moral responsibility to protect our planet. Natural resources and attractions which exist in the region could also have economic benefits as well. Both the protection of our environment and the efficient connectivity of people to these assets should play a prominent role in transportation decision making now and in the future. Environmental Performance Measures set in this plan will help ensure progress continues to be made.

Action Items

Action	Next Steps	Outcome
Program and implement 100% of Congestion Mitigation Air Quality (CMAQ) projects within the regional Transportation Improvement Program (TIP).	Work with communities to develop projects that would be eligible for these funds.	Maximizing the funding programs which improve the environment.
Increase percentage of alternative fuel vehicles within the overall transit fleet by 2020.	Seek new funding; maximize existing programs which attain such vehicles.	Decreasing the carbon footprint of the transit fleet.



ⁱ “Confronting Climate Change in the U.S. Northeast: Science, Impacts and Solutions,” a report of the Northeast Climate Impacts Assessment © 2007 Union of Concerned Scientists.

ⁱⁱ Holmes, R.R., Jr., and Dinicola, K. (2010) *100-Year flood—it's all about chance* U.S. Geological Survey General Information Product 106

ⁱⁱⁱ Massachusetts Highway Project Development and Design Handbook. (January 2006):

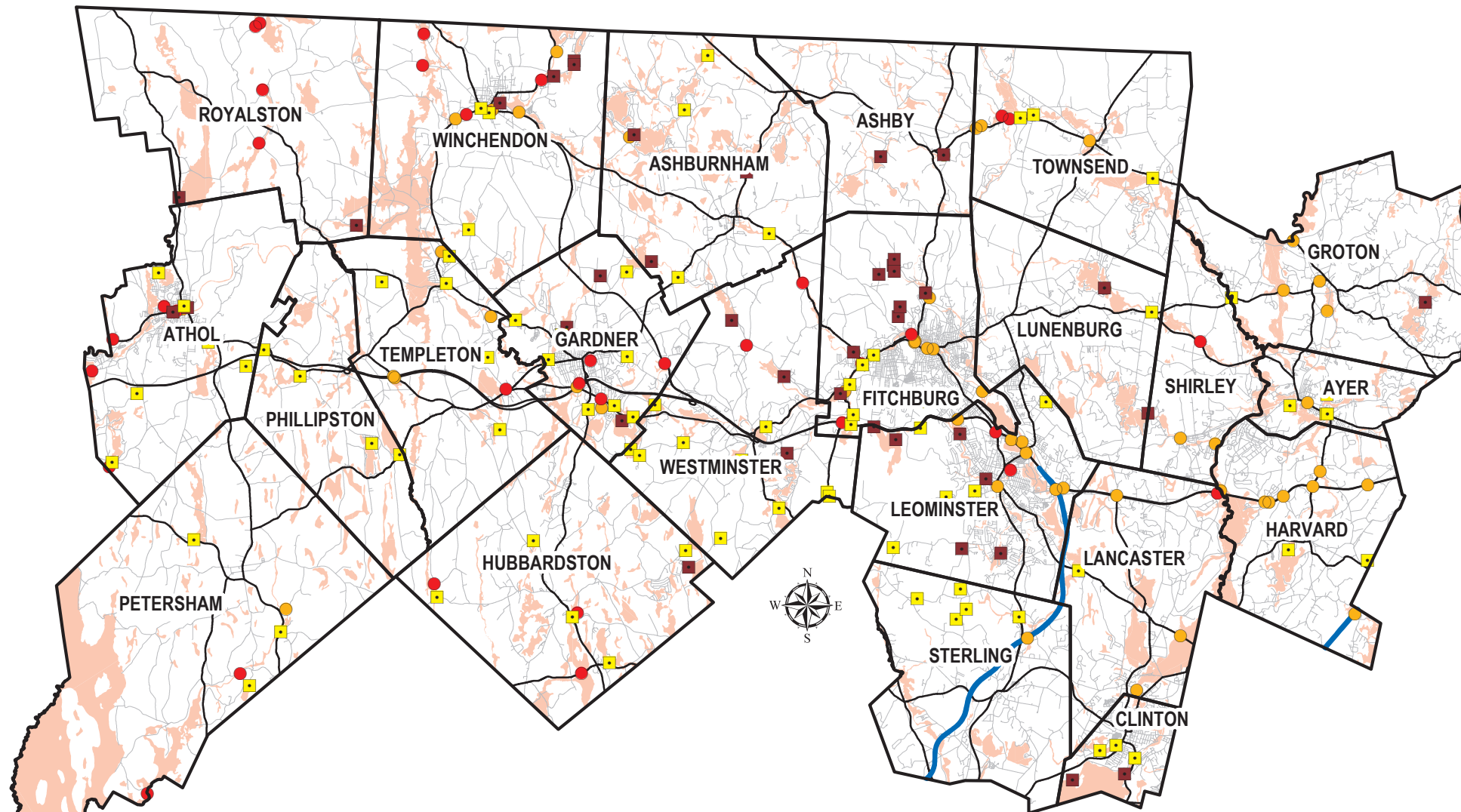
Massachusetts Highway Department; Executive Office of Transportation

^{iv} Center for International Climate and Environmental Research (2007). "Climate forcing from the transport sectors"



MRPC: RTP 2016

FEMA 100 Year Flood Zones, MA DOT Bridges and DCR Dams



Legend

- Community Boundaries
- Interstate Routes
- US & State Routes
- Other Roadways
- FEMA 100 Year Flood Zones

Dams

- High Hazard
- Significant Hazard

Bridges

- Structurally Deficient
- Functionally Obsolete



DATA SOURCES: MassGIS, MassDOT and the MRPC.

DISCLAIMER: The information depicted on this map is for planning purposes only. All data are representational and are not adequate for boundary definition, regulatory interpretation, or parcel-based analysis.

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