

The Reading Climate Advisory Committee

Climate Change Adaptation Report



Reading, MA - 2014



To: Board of Selectmen
March 2014

Letter from the Chair

The “Reading Climate Adaptation Report – 2014” has been written to begin the conversation about how our community can anticipate and proactively plan for the inevitable impacts of climate change. It is this conversation among residents that will bring us to agreement on how to spend our limited resources to address the challenges of a more dangerous climate that Reading will face in the next decade. Our committee does not claim to be experts in the field of climate science, environmental sustainability and adaptation. In drafting this report, we have relied on information published by the Massachusetts Executive Office of Energy and Environmental Affairs, the Intergovernmental Panel on Climate Change, and the Union of Concerned Scientists. From their reports, we have attempted to glean the predictions and recommended strategies that are most relevant to Reading, Massachusetts.

Regardless of our actions to adapt to climate change, earth’s climate will continue to warm for several decades due to the physics of carbon dioxide in our atmosphere. Adaptation will be essential to reduce the harmful effects of a warming climate; however, we must continue to mitigate the degree of climate change by reducing human emissions of carbon dioxide into the atmosphere. Adaptation alone will not safeguard us from the harmful effects of “run-away climate change”.

Respectfully submitted,

Joan Boegel, Chair
Reading Climate Advisory Committee

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Much of this work has been added to their already heavy workloads and is generally not understood nor appreciated by many of our residents. Our town officials are already addressing a number of the recommendations suggested in this report; therefore, expanding the recommendations or adding others may require additional staff.

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INTRODUCTION

Reading, Massachusetts, with a population of 24,747 (2010) living in 9055 households, in an area of 9.95 square miles, has already experienced the results of global warming in terms of more serious storms, excessive precipitation and flooding, and high temperature and humidity. Due to continued emitting of greenhouse gases (GHGs) and the duration of these gases in our atmosphere, Reading, with some certainty, will face even more destructive results from extreme weather in the near and distant future.

For this reason, the Reading Climate Advisory Committee (RCAC) met with the selectmen in April 2013 and offered to write a concise climate adaptation report for the town of Reading. The selectmen agreed with this proposal, asking that the report be centered on the next five to ten years in the future rather than a more distant target.

Much of the data for this report originated in the *Massachusetts Climate Change Adaptation Report September 2011*, the Intergovernmental Panel on Climate Change (IPCC) *Summary for Policy makers, Climate Change 2007: Synthesis Report*, and the Union of Concerned Scientists (UCS) *The Changing Northeast Climate, Our choices, Our Legacy, 2007*. The RCAC attempted to localize the data from these reports that relate to a town such as Reading.

In the past, the climate committee has mainly focused its attention on the mitigation of climate change. Mitigation refers to the reduction of GHGs, predominantly carbon dioxide (CO₂), by reducing our fossil fuel energy use at home, at work, and on the road. Since the industrial revolution, the CO₂ level in the atmosphere has increased from 280 parts per million to 400 parts per million. This change has resulted in rising temperatures and, consequently, has modified our weather patterns. Increased temperatures contribute to more intense storms, sea level rise, flooding, drought, food insecurity, forest fires, heat waves and humidity, health issues, and the extinction of some species.

Since the industrial revolution, global temperature averages have increased 1.5-degrees Fahrenheit. In a high emissions scenario, the IPCC estimates that by the end of the century Massachusetts is set to experience a 5-degree to 10-degree Fahrenheit increase in ambient temperature. When we witness what 1.5-degrees has caused in our weather patterns and in sea level rise, it is hard to imagine the disruption to our climate that would result from a 5 to 10-degree average increase in temperature.

Since climate change is upon us now, we can no longer concentrate solely on mitigation; we must consider adapting to our changing climate. Adaptation is what we do to prepare ourselves for what is here and what is destined to come in the near future.

The process of adaptation has several principles worth knowing. Generally, it is more cost effective to be proactive rather than reactive in adapting to climate change. Quoting Benjamin Franklin, "An ounce of prevention is worth a pound of cure." Also, adaptation is an iterative process; it is ongoing. Since we cannot predict with complete accuracy the consequences of climate change, we must continually review our strategy and make adjustments as required.

In addition, the rate of climate change will dictate the degree of adaptation. If we can slow climate change by reducing our carbon footprint, our adaptation strategies will also be less intensive and costly. Furthermore, cumulative climate stresses, i.e. consecutive storms and power outages, could place heavy strain on manpower and finances. Lastly, we should depend on local and regional resources rather than look to the state or the federal government for assistance. In severe situations, state and national assistance will be stretched to their limits.

While Reading does not directly face the dilemma of sea level rise as do nearby coastal communities, we do face challenges from the fall-out of sea level rise. As more powerful storms cause Boston to suffer economic loss, disruption to land, sea, and air transportation, and possible evacuation, Reading will not be immune to the consequences.

Locally, Reading must prepare for more severe storms resulting in:

- 1) flooding of homes and streets;
- 2) longer and more frequent power outages, especially during acute heat or cold spells;
- 3) more severe respiratory and infectious diseases;
- 4) food insecurity, if major supermarkets face the loss of power and the temporary lack of resupply;
- 5) water insecurity, if the distribution system suffers from impacts of floods and scouring or if our source becomes contaminated; and
- 6) the disruption of sewage from overflows when floods and/or inflow and infiltration overwhelm our collection system or if MWRA's Deer Island Wastewater Treatment Plant were to suffer storm damage.

Our essential recommendation is that the town should examine each situation through the lens of a changing climate and carry out proactive strategies to minimize its damaging effect on our lives.

NATURAL RESOURCES AND HABITAT

Climate change will have an impact on the biological diversity of the region. Plants are leafing and blooming earlier, and the timing of bird migration is shifting. Invasive species will move northward, and some native plants will perish. The most notable effect at present is the migration of mosquito and tick-borne vector diseases, Eastern Equine Encephalitis (Triple-E), West Nile virus, and Lyme disease.

Impacts and Vulnerability - Forest Maintenance, see appendices, Figures 2, 3, & 4.

Of the four ecosystems (forest, coastal, aquatic, wetland) present in Massachusetts, forest and wetland are most prevalent in Reading. We can expect disease to increase in cold-adaptive niche species (hardwood), and to see these species replaced slowly with more southern generalist species (fir). All of this vegetation now sequesters atmospheric carbon dioxide equivalent to about 10% of Massachusetts' annual carbon emissions. It is estimated that every acre of forest in Massachusetts provides \$1500 annually in economic value (*Massachusetts Climate Change Adaptation Report September 2011*, p34). Our trees are also effective in filtering pollutants from the air and reducing pollutant loads from storm water runoff.

The Hemlock Woolly Adelgid has already made an infestation first noted in Weston, MA, and the state authorized \$60,000 to introduce 10,000 Japanese ladybugs to eat the Adelgid. The threat of this invasive pest is continuing, and sustained vigilance will be required to maintain the existing hemlock population in Eastern Massachusetts.

Recommended Strategies – Forest Management

- In Reading, we are fortunate to have an active Conservation Commission, Town Forest Committee, Trails Committee, and Tree Warden. We have set aside a Town Forest, Bare Meadow Conservation Area, North and South Cedar Swamp, Timberneck Swamp, Kurchian Woods and several smaller protected spaces and parks. These natural green spaces need to be monitored and protected from encroachment by invasive species and pests.
- Our tree program also needs to maintain vigilance in maintaining and adding trees along our roadways. Special consideration should be given to south Main Street for its much-needed addition of trees. Tree box filters offer an additional benefit of removing some pollution and stormwater run off from impervious surfaces.
- The Reading Climate Advisory Committee recently started a tree planting donation program in which residents can make a donation to fund the planting of a memorial tree in Reading. This should continue to be promoted and advertised.

- Tree and forest maintenance needs to be a continuous effort that may need additional Fire Department involvement. As the forests face greater stress due to drought, the chance for forest fires is increased.

Impacts and Vulnerability - Wetlands, see appendix, Figure 1.

Wetlands are important to mitigate climate change effects such as coastal storm surges as well as inland flooding events. Prior to our converting to the MWRA water supply in 2007, the flood plain of the Ipswich River was important to our water source. As Reading pumped groundwater from wells near the Ipswich River, we helped to significantly drain the river during the summer months. Seasonal low flow was disastrous to the fish and other wildlife of the region. The Reading Conservation Commission enforces the state’s Wetland Protection Act, and the Ipswich River Watershed Association monitors the 35-mile river and its 155 square mile watershed. The watershed is also home to the Massachusetts Audubon Society’s largest sanctuary.

Degradation of the watershed is likely, due to more winter rains and increased run-off from impervious surfaces in addition to excess fertilizer run-off, leading to algae bloom and depletion of dissolved oxygen. More severe storms and summer droughts will also degrade the watershed and waterways. Furthermore, Massachusetts, one of the densest populations in the country, faces the loss of woodlands and watersheds due to residential and commercial development, sand and gravel operations, and the expansion of agriculture.

In Reading, our primary “agricultural crop” could be said to be grass. This has no commercial value; we cut it too often, remove it from the premises, and then add water and too much chemical fertilizer to replenish the soil and grow more grass. The value of our grass for carbon dioxide removal and use as a biofuel is negligible.

Recommended Strategies – Wetland Maintenance

- Protect our wetlands by our zoning bylaws. Particularly, monitor areas for flood control and mitigation, and look for opportunities to add any available lands that fall under the Reading Wetlands Bylaw and/or MA Wetlands Protection Act.
- Work to eliminate as many impervious surfaces as feasible. Investigate tax incentives for residents who install pervious driveways and parking lots and methods to ensure their continued functioning.
- Educate residents in the proper use of fertilizer. Reduce the amount used and substitute organic fertilizers for those made chemically. This will reduce harmful run-off effects of nitrogen and phosphorous (educate residents about Massachusetts’ ban on phosphorus in fertilizers).
- Educate residents in the planting of trees, shrubs, flowers, vegetable and grasses that are native to Massachusetts.

- Establish community gardens in town owned land for the use of residents especially those who may not have free access to a garden.

HUMAN HEALTH AND WELFARE

Impacts and Vulnerabilities

Climate change is likely to have significant adverse impacts on human health in Reading, Massachusetts. These impacts will include direct, acute effects of extreme weather events and indirect effects such as increased risk of some diseases. Higher summer temperatures will lead to exacerbation of respiratory illnesses and cardiovascular disease. Heat stress particularly affects the elderly and the very young.

There will be more poor air quality days due to increased ozone and particulate matter in the atmosphere coupled with higher temperatures. Increased plant pollen production is expected to aggravate allergies and asthma. Vector-borne infectious diseases such as Lyme disease, Eastern Equine Encephalitis (EEE) and West Nile virus, will increase as ticks and mosquitoes thrive in warmer climate conditions. Water-borne disease outbreaks may occur during and after flooding events, and surface water quality may be degraded from sediments, pathogens, nutrients and pesticides in storm-water runoff.

Extreme weather events such as ice storms, hurricanes, and more powerful storms may affect human welfare by disrupting power and sanitary services, impairing access to safe and nutritious food, and damaging homes and property. Increased mental and physical health burdens will result from the need to cope with extreme weather, disaster response and uncertainty.

Some sectors of the population – the elderly, young children, people with chronic disease, disabled, mentally ill, and low income residents – will be particularly vulnerable to the adverse impacts of climate change on health and welfare.

Recommended Strategies – Public Health Infrastructure

At the state level, the *Massachusetts Climate Change Adaptation Report* recommends that the public health infrastructure should undergo a system-wide climate change needs assessment. Relevant to Reading, local public health officials should:

- Incorporate climate vulnerabilities into existing emergency plans (All Hazard Plan) and conduct exercises to practice plan implementation.
- Establish emergency procedures, including cooling centers and transportation, notification procedures, and *Check on your Neighbor* programs, for vulnerable populations and educate the community about these programs.

- Join regional public health programs to share resources for more efficient provision of non-emergency services aimed at prevention of disease and injury.
- Provide additional education and alerts for bad air quality days and potential for heat stress.
- Maintain and increase staffing levels of public health infrastructure.

Recommended Strategies – Vector-borne Diseases

The town of Reading participates in the East Middlesex Mosquito Control Project which provides services to survey wetlands and mosquito populations; control mosquito larvae with application of a selective biological larvicide, Bti (*Bacillus thuringiensis* var. *israelensis*), to large wetlands where mosquitoes breed; and eradicate adult mosquitoes by truck-mounted aerial spraying of the insecticide sumithrin when needed. In addition, mosquitoes are tested for West Nile Virus and Eastern Equine Encephalitis through MA Department of Public Health. Reading should:

- Continue to use the services of East Middlesex Mosquito Control Project.
- Conduct public education campaigns regarding vector-borne diseases and personal prevention practices. Specifically, target high risk groups such as outdoor workers.
- Educate all residents about mosquito breeding habitats and the need to eliminate standing water to limit their breeding opportunities.

Recommended Strategies – Ambient Air Quality

In Reading, we should implement the following measures to reduce air pollution and its resulting adverse impacts on respiratory and cardiovascular health by:

- Promote heat island effect reduction strategies – cool roofs, green roofs, green spaces – perhaps through building code revisions and/or by-laws.
- Minimize transportation-related air pollution by encouraging public transit use, walking, bicycling, carpooling and driving more fuel-efficient vehicles.
- Increase use and installation of green infrastructure including trees and vegetative cover, with preference for hypoallergenic species.

Recommended Strategies – Indoor Air Quality

Higher temperatures, increased precipitation and extreme weather events can damage the building envelope of homes, offices, schools and commercial buildings. Such damage allows moisture and pest penetration, mold growth, and off-gassing

from building materials, all of which negatively impact respiratory health. In Reading we can:

- Educate property owners about existing and future floodplains and encourage implementation of methods to reduce damage.
- Encourage or mandate use of reflective paints and materials, and white roofs to decrease heat stress on buildings.
- Promote installation of drainage improvements, insulation and vapor barriers and provide instruction on appropriate drying and salvage efforts.
- Compile a database of areas expected to experience localized flooding throughout the town and share with the public. See appendix Figure 3.
- Consider enhancing construction standards for buildings to be resilient to climatic impacts including from floods and hurricanes.
- Improve drainage around buildings and consider capture of rainwater for storage and later use during droughts.
- Expand use of porous pavement to improve drainage on roadways and prevent run-off into buildings.
- Educate homeowners and businesses to identify and trim or remove hazardous trees – those that are likely to fall and cause damage to homes and buildings – during storms, and replace with trees placed appropriately to shade homes without being too close.

Recommended Strategies – Water Quality

Reading's drinking water originates from the Quabbin Reservoir in central Massachusetts and is supplied by the MWRA. However, the town maintains groundwater wells that could be used in an emergency. To protect the capacity and quality of the aquifer, Reading should:

- Educate public about ecologically sound landscaping practices to recharge the aquifer and to reduce chemical fertilizers.
- Improve storm water management.
- Maintain and practice contingency plans to respond to water supply impact by climate change. See page 16 on Water Supply and Disposal.

Agriculture and Food Systems

Reading residents rely on local supermarkets for access to a wide variety of fresh produce, dairy products, meat, fish, grains and processed foods that are produced throughout the country and the world. Our community is therefore vulnerable to food shortages and food contamination that might result from drought, heat waves or other adverse weather conditions (in the areas where we get most of our produce, e.g., the Midwest, California, Central or South America, etc.), pest infestations, pesticide contamination, and interruption in the transportation network due to severe storms.

Recommended Strategies – Agriculture and Food Systems

Reading could improve food security for its citizens by:

- Promoting more sustainable, local food production by home gardeners, establishing a community garden, and promoting the availability of locally grown organic produce for sale to Reading residents through farmer’s markets and local retail stores.
- Encouraging residents to keep an emergency supply of non-perishable nutritious foods to feed their household for several days in the event of a severe storm that disrupts food supply. See Flood Emergency Management Agency (FEMA) recommendations in the appendix.

LOCAL ECONOMY AND GOVERNMENT

We can expect severe weather including hotter and longer heat waves, drought, forest fires, extreme precipitation, flooding, ice storms, and super storms including hurricanes and tornadoes.

Impacts and Vulnerability

Although Reading does not enjoy a coast line and the associated concern for sea level rise, many Reading residents work in Boston as well as in other coastal cities and towns for which sea level rise is a concern. As a result, damage from flooding and higher storm surges due to sea level rise will indirectly affect Reading through its workforce. Jobs could be lost for a time, or forever, due to storm surge damage to nearby coastal communities, resulting in economic stress for local families and possible loss of tax revenue for local communities.

More severe heat waves and power blackouts will particularly stress senior citizens and very young children. As the temperature rises, the need for air conditioning increases, adding to electrical load. Because nighttime temperatures now also remain high, power equipment such as transformers are not allowed to cool off and are therefore more likely to fail.

Without electricity, air conditioning turns off, as do fans and refrigerators. In addition, ATM machines, gasoline pumps, credit card devices, cell phone and computer battery rechargers, and cash registers will no longer function. Long-term blackouts will particularly cause much stress to our older and very young residents and to those people suffering from respiratory diseases as well as severely burden our first responders.

Severe winter storms and power outages will present their own set of challenges. Without electricity, most homes will lose their heating units. It doesn't take long for residents to experience frigid temperatures that can be very uncomfortable and dangerous.

The loss of power may also affect food security. With many of our residents dependent on one or two area supermarkets for food, the loss of power for refrigeration and lighting and/or the disruption of transportation to resupply stores would soon prove problematic. If the 40 or so supermarkets in our surrounding area were not resupplied for a number of days, serious food shortages would occur.

Recommended Strategies – Impacts and Vulnerability

- Reading residents can ready their households for serious storms by embracing *emergency preparedness*. Residents who plan ahead for exigencies can greatly increase the resilience of Reading by reducing the load of first responders. Both FEMA and MEMA have excellent guidelines for citizen preparedness, which should be studied and adopted by all residents. Water, food, prescription drugs, extra cash, all should be kept on hand to enable residents to maintain their lives for three to four days without access to commercial businesses. (See Appendix, FEMA information, for more information.)
- Regional and local officials, health leaders, and business leaders should closely collaborate, knowing that the federal and state providers will concentrate on major state medical, energy, and infrastructure issues. *Regional cooperation* is already happening and should be encouraged and expanded. Our fire chief is an active member of the Fireside Metropolitan Fire District and our police chief participates in the North Eastern Massachusetts Law Enforcement Council comprised of 54 communities.
- Town government initiatives:
 - a. *Implement all pertinent guidelines* from the Massachusetts Emergency Management Agency (MEMA) and other state assistance programs to help municipalities with planning adaptation measures to lessen the impact of our more severe weather patterns.
 - b. *Initiate public discussions and deliberations* to develop criteria, set priorities, and establish or modify policies for emergency actions during

severe weather or other emergencies. Incorporate adaptation strategies into the Reading Master Plan. Most importantly, provide continual public education on the need for emergency preparedness as well as knowledge of emergency plans and procedures.

- c. Continue to train Reading's *firemen and police on the latest information* to properly respond to emergency situations. Also, staff and train our Local Emergency Planning Committee and maintain close relations with our Regional Emergency Planning Committee. Lastly, be sure to provide our Emergency Management Director, presently Fire Chief Burns, with the staff and equipment to properly fulfill his responsibilities.
- d. Publicize Reading's favorable business climate to attract companies providing energy efficiency and renewable energy equipment. *The Massachusetts Clean Energy and Climate Plan for 2020* will help create 36,000 jobs in the state, 23,000 to improve efficiency of energy use in buildings. According to the *Massachusetts Climate Change Adaptation Report, 2011*, "the estimate for employment from in-state demand for renewable energy in Massachusetts in 2020 is 6,000 to 12,000 full-time jobs".
- e. Some suggestions for further consideration; some are already underway:
 - *Plan for an emergency medical facility.*
 - Plans to *relocate our most vulnerable residents to safer locations* include our high school and middle schools. We should also consider our larger stores, such as Jordan's Furniture, Home Goods, and Home Depot as potential safe areas during extreme emergencies.
 - Appoint voluntary *health and safety watch leaders* in each neighborhood. Town meeting members may be willing to assume some of this responsibility for their precinct.
 - Discuss *food security* with the major food purveyors to better understand the reality of our food supply and to determine strategies to maintain continuity of supply.
 - Be aware that due to our changing climate, many *100-year flood plains have been reduced to 20-year flood plains* and 500-year flood plains reduced to 100-year plains.
 - Fresh water security can be enhanced with greater use of rain barrels, emergency town wells, and the use of grey water to flush toilets.

- Consider *altering work hours to cooler times* of the day and providing additional breaks for outdoor workers during times of high heat index.
- *Incentivize conversion to local renewable energy sources* to alleviate dependence on the grid and to protect from power disruptions. Additional renewable energy sources could provide electricity to emergency control centers and relief centers.
- *Increase the town's emergency fund* – “Damage to private property due to climate extremes may result in a reduction of the municipal tax base, while at the same time call for an increase in services for vulnerable populations, emergency response, and public infrastructure maintenance upgrades or replacement.”
- Extreme weather events could damage *vulnerable historic buildings*. The Parker Tavern would be within this category and should be evaluated for such an event and decisions made as to what can be done to preserve it.

KEY INFRASTRUCTURE

Our present living conditions depend on energy sources, telecommunications, transportation, clean water supply, health and safety services, including disposal of waste water, solid waste and hazardous materials. We also depend on the present infrastructure of buildings, roads, bridges, and rail service. With increased temperature and more severe storms and droughts, all of these services and infrastructure will be stressed.

Although Reading is not likely to be directly affected by a storm surge or rising sea levels, damage to our infrastructure and our low-lying neighbors' habitat will ultimately affect us. Our source of drinking water (MWRA), wastewater treatment (Deer Island), solid waste management (Covanta-Haverhill, etc.), electrical generating capacity (New England Power Pool facilities), and gas and oil supply lines can be disrupted by storm damage outside of our town boundaries.

Fortunately there are about 170 electric generating facilities throughout the state. As a result, sharing power is straightforward and will be enhanced by anticipated development of a smart grid. However, the fuel, natural gas, for most of these generators comes principally from pipelines and tanker ships at three import terminals (one on land and two offshore). Gas is delivered through many miles of underground transmission lines and local distribution pipes.

There are ever fewer old, inefficient, coal power stations still in operation. For Reading, other power sources, such as, nuclear, hydropower, and alternative sources will not be able to generate more than “emergency” power. In addition, 90 % of our petroleum,

critical for transportation and heat, is imported by ship or barge. Thus, we are very dependent on the infrastructure around Boston Harbor.

Reading residents should be prepared to become energy self-sufficient in the short term in order to power critical equipment. This includes generating power for sump pumps, fuel oil pumps, and water pumps for hot water, oil heat. Businesses should have emergency power for such uses as pumping gasoline from service stations and operating refrigeration in supermarkets. At home, appropriate storage of oil and gas should be considered with the understanding that residential gas and oil heating systems usually require electricity to function. Even the popular wood pellet stoves require electrical power, although some stoves have emergency battery power that will temporarily operate the stove.

Preparedness should also include extra batteries and rechargers that use solar panels or hand power to recharge batteries for radios, wireless telephones and computers. Also, consider alternative measures for water security such as water storage in rain barrels and cisterns, grey water to flush toilets and hand pumps for water wells. Finally, homeowners should consider composting all organic waste and storing solid waste outside in a closed container.

Impacts and Vulnerability - Water Supply and Disposal

We now depend on the Massachusetts Water Resources Authority (MWRA) for our water, which starts in the distant Quabbin Reservoir. This supply could be disrupted for a number of reasons from a major line break, water pollution, and terrorist activities. To use water from our wells within the Ipswich River watershed in case of emergency would require some treatment. The maintenance of the wells and pumping capacity is important in terms of the pumping, chlorinating, and distributing of water in an emergency, but plans should be in place to treat the water. The addition of a second access (36 inch line) to the MWRA water supply is planned and would mitigate the impacts of a line break.

Reading sends its domestic sewer wastewater to the MWRA for treatment at Deer Island. Much of this water flows by gravity, although the Town does maintain 12 pumping stations for low-lying buildings/areas. If a problem arises, emergency pumping could be required; back up generators should be maintained.

Reading sends its storm water to three separate watersheds. Both the Town and the State have joint responsibility to maintain the watersheds and riverbanks (e.g., Ipswich, Saugus and Aberjona Rivers).

Recommended Strategies – Water Supply and Disposal

- Provide for Water Security
 - a. Maintain well access to the Ipswich River for emergency use.
 - b. Encourage MWRA to provide a second 36” water supply line into Reading in the event of a water line break to the main pipeline.

- c. Educate residents in the reuse of grey water (water from the shower and tub) that can be used to flush toilets in the event of an emergency.
 - d. Strongly encourage the employment of rain barrels and cisterns whose water could be chlorinated or boiled for potable use. Boiling with electric stoves requires electricity; however, if electrical power is down, sodium hypochlorite (Clorox®) is usually available. Generally 10 drops of 1% chlorine in one quart of clear water will provide drinkable water.
 - e. Underground brooks could also be tapped for water in emergency conditions. The water in Memorial Park is filled by gravity from a spigot located behind the fire station. Perhaps, residents in a water crisis could use this water.
 - f. Residents should be encouraged to store sufficient bottled water for at least three days duration - one gallon daily for each resident. With sufficient warning, residents should fill their bathtubs with water for consumption and flushing toilets.
 - g. Supplement our strong program to encourage residents to adopt water conservation measures.
- In the event of a malfunction to our sewerage system to Deer Island, the availability of community Porto-Potties should be considered for evacuation centers (the need for which was seen in recent U.S. disaster situations).
 - In regards to storm water, we need to define low-lying problem areas, and protect the roadbed and other structures as best we can. Zoning laws can prevent some problems of building in marsh and riverbed areas while we work to keep our storm drains clear.

Impacts and Vulnerability - Fossil Fuels

If a gas line breaks, emergency personnel from the utility companies and the Town fire department will respond. In the case of a major catastrophe, gas supply will be turned off to isolate the problem. As a result, many residents who use natural gas will find themselves without heat for warmth, cooking and possibly refrigeration. In case of a major conflagration, the fire department may use emergency measures (e.g., fire lines) that may also close off gas flow. The Town management needs to understand and support these decisions. As a result, evacuation centers may be required for people that heat with gas in the winter.

In case of emergency, gasoline will be a critical source of energy for motor vehicle evacuation and for emergency generator usage. Local fuel oil and coal supplies should be less of a problem since they could be stockpiled. The use of wood and

propane (with outside tanks) may be considered in some households – battery operated carbon monoxide sensors are a must in such homes.

Recommended Strategies – Fossil Fuels

- Reading already has designated the high school and Coolidge Middle School as evacuation centers in the event of fuel emergency. We could also consider our larger stores such as Jordan’s Furniture, Home Goods, and Home Depot as emergency centers if needed. Jordan’s comes with mattresses.
- For immediate supply, service stations must be able to pump gasoline without electrical service from the grid (gasoline generators). Similarly, the emergency resupply of service stations should be pre-arranged from out-of-area suppliers.
- Major food providers (supermarkets) should ensure on-site power generation for the refrigeration of perishable foods.
- On-site power generation in residential homes could provide heat in winter and air conditioning in summer for residents and their neighbors.
- On-site power generation should be considered for vital businesses such as pharmacies and doctors’ offices, which require refrigeration for some of their drugs as well as electricity to operate their test equipment (X-ray machines) and to sterilize surgical implements.
- Residents should consider wood stoves and propane heat with the propane tank situated safely outside the home. Keep in mind that wood pellet stoves require electricity to operate and require battery operated CO2 sensors for safety.

Impacts and Vulnerability - Electricity

Electricity is a major requirement for modern living. Sump pumps, oil burner oil pumps and hot water distribution pumps, and many snow blower starters depend on electricity, as well as lights, refrigerators, electric stoves, and microwave ovens. Residents should be encouraged to provide their own temporary, emergency power generation; without such power, emergency shelters would be needed in extreme cold or hot conditions. The Town has a municipal power department (RMLD) and can influence emergency management decisions (RMLD and CAB boards). It should be noted that the RMLD has an excellent record in terms of the number and length of power outages, compared with other utilities.

Furthermore, the RMLD gives a no-cost, home energy inspection with air-sealing, CFL light bulbs, and insulation rebates. With Next Step Living, the RMLD literature indicates that 15% of Massachusetts’s homes can pay a lower monthly electric bill with solar power.

Between 1980 and 2011, average residential usage per capita in Massachusetts increased from 2125 kWh to 3099 kWh according to the U.S. Energy Information Administration. In the last decade, this usage has decreased slightly partly due to the cool economy as well as to greater efficiency. Although we have made great strides in efficiency in the areas of lighting, batteries, flat screen TVs, air conditioners, appliances, tablets and smartphones, stricter building codes, etc., we have not made the expected reductions in per capita energy use. This is due to more devices being used in larger homes with central air conditioning versus a few window units. Thus, efficiency savings are lost by the increased number and use of these electrical devices. To reduce our carbon footprint, we must look to energy conservation along with alternative, non-fossil fuel, electricity.

Planning for Special Needs Residents and Services

Reading has a large elderly population and an undetermined indigent population, which may need special assistance in an emergency. These populations need to be identified before an emergency occurs, so that electricity and heating fuel can be supplied if needed. Within their precincts, Town Meeting members may be able to assist in this project.

For the remaining residents, planning is important. Generators, gasoline, fuel oil, water, and batteries need to be available and maintained. Now may be the time to promote greater use of rain barrels, and composting organic materials, as part of an emergency plan.

Recommended Strategies – Electricity

- Local power generation and storage should become a priority for emergency management.
- Alternative power such as solar, wind, and geothermal, should be encouraged along with a bank of batteries maintained by the RMLD. The batteries could provide temporary emergency power and as well as help meet peak load demand.
- Consider incentives to residents who possess emergency power generators. This power could be used in emergency situations or to offset peak loads.
- The Town should have a list of all the buildings in Reading that have off-grid power for possible use in emergency situations.
- As electric powered cars become more common, electric power from car batteries may be used to power the grid during peak load times. With smart grids, power can move both ways: to the customer as well as from the customer.
- Reading needs to encourage the use of solar thermal power to provide hot water as well as solar voltaics to generate electricity. Although the RMLD does offer a comparable solar rebate program, it should increase its financial

incentives from net-metering and feed-in-tariffs to further encourage solar energy. For example, solar electricity generated during peak time could be paid peak rates to encourage its development. In the last several years 20 residential customers from the four RMLD towns installed solar electric power. This is a good start, but we need to do much more. Moreover, the RMLD payment for alternative electricity generated by third party providers does not encourage the installation of solar energy.

- The RMLD should maintain its rebates for high efficiency appliances, and the pricing incentives based on off-peak “time-of-use” of electricity.
- The RMLD should strongly consider the adoption of the community shared solar program as outlined in the *RMLD Four-Town Local Energy Action Plan*. This program gives residents ownership of a renewable energy source – solar panels -- and credits for the energy generated.
- The town should consider the use of distributed power by the use of natural gas with combined heat and power systems (CHP). By this method, we could generate electricity on site as well as heat and cool our buildings.

Conclusion

The Reading Climate Advisory Committee hopes that this report will begin a community discussion on how to adapt to climate change. Since our challenges will be somewhat unpredictable, and new solutions will emerge, we must continually review and refine our adaptation strategies to meet these difficulties. Moreover, we need to look to ourselves for local needs rather than to federal and state authorities who will be stressed meeting national and state-wide challenges.

In addition, we know that along with adaptation, we must mitigate our greenhouse gas emissions from fossil fuels and from agricultural and animal husbandry processes if we wish to protect our Earth from run-away climate change. The International Governmental Panel on Climate Change (IPCC), *Synthesis Report, Summary for Policymakers, 2007*, p. 19, states, “Unmitigated climate change would, in the long term, be likely to exceed the capacity of natural, managed and human systems to adapt.”

The report continues, “There is high confidence that neither adaptation nor mitigation alone can avoid all climate change impacts; however, they can complement each other and together can significantly reduce the risks of climate change.”

It is with this hope to significantly reduce the risks of climate change that the Reading Climate Advisory Committee has written this report.

Respectfully,

Reading Climate Advisory Committee
Joan Boegel, David Williams, Ron D’Addario

Appendices

1. Federal Emergency Management Agency – FEMA Emergency Preparedness Kit

FAMILY SUPPLY LIST (SEE [HTTP://WWW.READY.GOV/DOCUMENT/FAMILY-SUPPLY-LIST](http://www.ready.gov/document/family-supply-list))

Ready Kids & The Federal Emergency Management Agency present:

Family Supply List

Emergency Supplies:

Water, food, and clean air are important things to have if an emergency happens. Each family or individual's kit should be customized to meet specific needs, such as medications and infant formula. It should also be customized to include important family documents.

Recommended Supplies to Include in a Basic Kit:

- Water, one gallon of water per person per day, for drinking and sanitation
- Food, at least a three-day supply of non-perishable food
- Battery-powered radio and a NOAA Weather Radio with tone alert, and extra batteries for both
- Flashlight and extra batteries
- First Aid kit
- Whistle to signal for help
- Infant formula and diapers, if you have an infant
- Moist towelettes, garbage bags and plastic ties for personal sanitation
- Dust mask or cotton t-shirt, to help filter the air
- Plastic sheeting and duct tape to shelter-in-place
- Wrench or pliers to turn off utilities
- Can opener for food (if kit contains canned food)

Clothing and Bedding:

If you live in a cold weather climate, you must think about warmth. It is possible that the power will be out and you will not have heat. Rethink your clothing and bedding supplies to account for growing children and other family changes. One complete change of warm clothing and shoes per person, including:

- A jacket or coat
- Long pants
- A long sleeve shirt
- Sturdy shoes
- A hat and gloves
- A sleeping bag or warm blanket for each person

1. FEMA – Emergency Preparedness Kit (continued)

Family Supply List (continued)

Below are some other items for your family to consider adding to its supply kit. Some of these items, especially those marked with a * can be dangerous, so please have an adult collect these supplies.

- Emergency reference materials such as a first aid book or a print out of the information on www.ready.gov
- Rain gear
- Mess kits, paper cups, plates and plastic utensils
- Cash or traveler's checks, change
- Paper towels
- Fire Extinguisher
- Tent
- Compass
- Matches in a waterproof container*
- Signal flare*
- Paper, pencil
- Personal hygiene items including feminine supplies
- Disinfectant*
- Household chlorine bleach* - You can use bleach as a disinfectant (diluted nine parts water to one part bleach), or in an emergency you can also use it to treat water. Use 16 drops of regular household liquid bleach per gallon of water. Do not use scented, color safe or bleaches with added cleaners.
- Medicine dropper
- Important Family Documents such as copies of insurance policies, identification and bank account records in a waterproof, portable container

Figure 1, Wetland Map (clearer version available at the town's website)



