Winchester Master-plan Background Document: Resilience and Sustainability

1.0: What is Resilience and Why is it Important?

Resilience is a broad term that applies to more than just ecosystem management. It has meaning for mental and physical health, economics, environment, and a whole host of other related areas.[1] For planning purposes, a serviceable definition of resilience is “the capacity of a system to respond to change or disturbance without changing its basic state.”[2] It is important to note that while a system having resilience is generally seen as a positive, the concept of resilience itself is not inherently 'good' or 'bad.' Take for example a grassland like the savannah. This is a system that has a great deal of diversity and is important to people socially, culturally, and economically, but is extremely vulnerable to environmental shocks. An extended drought, along with some over-grazing, and it is easy to turn the savannah into a desert like the Sahara, which is an extremely resilient system, albeit a difficult one for humans to live in and utilize.

In general, resilience has been an important concept for planning, because systems that are resilient tend to be more sustainable, and thus more likely to be around long term.[3] There are always unanticipated shocks in any longer-term planning process, but the increasing prevalence of climate change as a planning initiative means resilience building is more important than ever before. While there will still be unexpected shocks, climate change means that that there will be a great deal of crises that have to be planned for and dealt with, even if their individual timings are unpredictable.[4] In light of this, the emphasis in planning for climate change has shifted toward preparing towns and systems for shocks by building resilience and promoting sustainability[5]. However, there is every indication that encouraging sustainability and resilience in towns benefit them beyond protection from climatic impacts. Such measures promote local food and local culture, environmentally friendly policies, and energy-efficiency and renewable energy type measures that save money, and in some cases make it.[6] The purpose of this report is to take an in-depth look at resilience and sustainability in planning as part of background documentation for an eventual resilience and sustainability chapter to be included in Phase II of the Town of Winchester's master-plan update process. This report will begin by taking a close look at why resilience and sustainability is important, before exploring case studies on how it has

1 Tompkins and Adger 2004 (341) http://www.ecologyandsociety.org/vol9/iss2/art10/
2 Ahern 2011 http://brevard.ifas.ufl.edu/communities/pdf/SF_Fail_Safe_Reading_2011.pdf
3 Basset and Shandas 2010 http://www.tandfonline.com/doi/abs/10.1080/01944363.2010.509703
4 Tompkins and Adger 2004
5 Ahern 2011
6 Basset and Shandas 2010

been implemented elsewhere, before concluding with the best way the principles of resilience and sustainability can be incorporated into the Winchester master-plan. The first step, however, is to explore more the importance of the concepts of resilience and sustainability, followed by a discussion of the dangers posed by global climate change, and their possible impacts on Winchester and its planning processes.

1.1: What is Sustainability and Why is it Important?

The official definition of the term sustainable development comes from the 1989 document *Our Common Future*, as part of a report from the World Commission on Environment and Development. In the report, sustainable development is defined as development that "meets the needs of the present without compromising the ability of future generations to meet their own needs.[7]" The core assumption underlying discussions of sustainability is that the Earth's resources are limited, and their continued use will require careful management and rationing.[8] Scarce resources that need to be carefully managed is not a new phenomenon for small towns like Winchester, where money, time, parking, and other resources are all at a premium. Because sustainability is a broad term, there are debates in the literature over the meaning of the concept of 'sustainable development,' but in general "the sustainability literature has been able to coalesce on three major sustainable development goals: environmental protection, social and intergenerational equity, and economic development.[9]" Those three goals are reflective of the three sphere's of sustainable development, economic, social, and environmental. To be

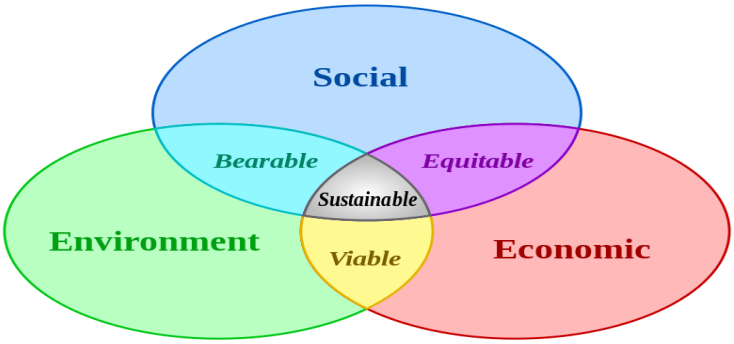

Figure 1: Venn diagram of sustainable development as a product of its three constituent parts. Note that sustainable policies are those that are bearable, equitable, and viable.

sustainable an idea has to fit within each of those spheres. This is perhaps best summed up in figure

7 Brundtland et al. 1989 (1.3.27) www.un-documents.net/ocf-ov.htm
8 Brundtland et al. 1989
9 Conroy and Berke 2004 (1381) http://www.envplan.com/abstract.cgi?id=a367

1.[10]

Although they are comprehensive documents, town-master plans traditionally look at those three areas separately, with a minimal amount of overlap. The Phase I and Phase II versions of the current master-plan update include chapters on open-space and recreation (environment), economic development in the town center (economy), and historical and cultural resources (social), among others; it is just that those areas are often separate from one another in the planning process. Sustainability is holistic, combining otherwise disparate aspects of planning processes into a synergistic whole.[11] A holistic approach to building and planning is paramount in successfully creating both sustainability and resilience within a town. Even if the parts are created separately, incorporating sustainability is an easy and efficient way to tie them together, and include ideas of multifunctionality, redundancy, and connectivity that help build resilience.[12]

1.2: Why Climate Change is Important

Recently, the focus on climate change has been changing, transitioning from the question "'is it changing?' to the more important question, 'Can society manage the unavoidable changes and avoid the unmanageable?'[13]" Both mitigation and adaptation are needed, and how society responds is crucial. Societies generally react to problems as they occur,[14] but climate change provides the opportunity for taking proactive steps to manage our climate future. There may be uncertainties about many of the aspects of climate change,[15] but what is certain is the necessity of change. The Intergovernmental Panel on Climate Change notes in its 2007 Synthesis Report that there is ''high confidence that neither adaptation nor mitigation alone can avoid all climate change impacts.[16]" This is reiterated in their 2013 Working Group report, which states that "warming of the climate system is unequivocal,[17]" and that "Each of the last three decades has been successively warmer at the Earth's surface than any preceding decade since 1850.[18]" More-over, the IPCC 2013 working group states that "it is extremely likely [defined as 95-100% certainty] that more than half of the observed increase in global average surface temperature from 1951 to 2010 was caused by the anthropogenic [human-caused] increase in greenhouse gas concentrations and other anthropogenic forcings together.[19]" Another study stated that

10 Adams 2006 http://cmsdata.iucn.org/downloads/iucn_future_of_sustanability.pdf
11 Ahern 2011 http://brevard.ifas.ufl.edu/communities/pdf/SF_Fail_Safe_Reading_2011.pdf
12 Ahern 2011
13 Bierbaum et al. 2013 (362) http://link.springer.com/article/10.1007/s11027-012-9423-1
14 Bierbaum et al. 2013
15 Fussel 2007 http://link.springer.com/article/10.1007/s11625-007-0032-y#page-1
16 IPCC 2007
17 IPCC 2013 (4) http://www.climatechange2013.org/images/report/WG1AR5_SPM_FINAL.pdf
18 IPCC 2013 (5)
19 IPCC 2013 (17)

it was 99.999 percent likely that not only were the 304 consecutive months of anomalously warm global temperatures to June 2010 directly attributable to the accumulation of global greenhouse gases in the atmosphere, but also that that warming was due to anthropogenic sources.[20]

By this point in time, however, climate change is unavoidable. This renders moot the argument about whether climate change is man-made,[21] and the question then becomes: "what should be done to prepare for those impacts?" While mitigation is something that best takes place at higher levels of government, climate change vulnerability management, to be effective, has to be locally contextual and take place on the local level.[22] This is where the principles of sustainability and resilience become important. "Local culture and context matters.[23]" The town that is successful in preparing for climate change will be the one that makes effective use of their local resources, but also their local culture and other things specific to their locality.

2.0: Case Studies

2.1: Building Resilience in Boston[24]

Plan Specifics

This particular document is a review of national and international programs, initiatives, and activities related to improving resilience to climate change impacts, and how that knowledge might apply to Boston. While there is discussion on over-arching municipal strategies to build resilience, most of the focus of this report is on improving resilience in buildings in particular. This includes strategies for encouraging resilience in both new and existing structures. The report comes from the Boston Society of Architects (BSA), with funding from the Barr Foundation, and aims to "provide the BSA, the Boston Green Ribbon Commission, and the City of Boston a better understanding of the strategies and specific measures that property owners can use to reduce their vulnerability to climate change, and the policies and programs that government and other public bodies can establish to spur such efforts.[25]" As such, it is not a legally binding document or integrated fully into the city's planning processes. Rather, it provides a series of recommendations and best practices for both land / home owners, architects, and city officials to draw on at need.

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20 Kokic et al. 2014 http://www.sciencedirect.com/science/article/pii/S2212096314000163
21 Ackerman and Stanton 2009 http://www.ucsusa.org/assets/documents/global_warming/climate-costs-of-inaction.pdf
22 Basset and Shandas 2010 http://www.tandfonline.com/doi/abs/10.1080/01944363.2010.509703
23 Basset and Shandas 2010 (441)
24 Newman et al. 2013 http://www.greenribboncommission.org/downloads/Building_Resilience_in_Boston_SML.pdf
25 Newman et al 2013 (1)

Plan Structure

The report is divided into five sections, 1) the scope and context of the study, 2) key resources, 3) strategies for improving the resilience of existing buildings, 4) a survey of municipal strategies for enhancing resilience, and 5) potential next steps, plus various appendices. In turn, section 3, which is one of the two sections that has actual recommendations, is focused on seven specific types, general actions, site, building structure, building enclosure, building systems, building operations, and people and building use. All of these have some measure of relevance for Winchester, but many of the recommendations are more appropriate for a denser, more urban population.. A general focus of the study, other than structural resilience, was planning for a repeat of Superstorm Sandy, and many of the recommendations revolve around managing the specific impacts from hurricanes, e.g. flooding and wind damage. This is something that is relevant to Winchester as the town regularly is at risk for storm damage, especially from flooding, even if geographically it is less exposed to the coast than Boston. Another interesting structural note is that while each recommendation is laid out in the beginning of section 3, they are followed up with a detailed breakdown of actions to take for each recommendation. Not only are the general recommendations there, but also thought was put into how to implement them on a city-wide, or just case-by-case, basis. Lastly, section 4 details municipal responses to resilience building, but instead of just listing recommendations, the report lists them by the town or city that first came up with the idea, expanding the list of potential examples from Boston and Massachusetts to all over the nation.

How it is applied:

The Building Resilience in Boston document is not an official planning document of the city itself. Rather, it is a collection of recommendations from the Boston Society of Architects and other sources that serve as guidelines to the City of Boston and other interested parties as to how to increase resilience in Buildings. This makes it an invaluable data source for Winchester in terms of how to approach specific resiliency problems, but its overall structure does not follow a master-plan style format.

Takeaways for Winchester

Building Resilience in Boston offers a great deal of information useful to Winchester. First, there are the actual recommendations from which to borrow. While there are financial and logistical reasons why Winchester cannot adopt all of the article's recommendations wholesale, the main reason is that not all of the recommendations are relevant to Winchester. For example, one of the recommendations

is to ensure resilient water during outages[26]. This is something that Winchester should be concerned with, but the Boston version is focused more on ensuring access to potable water for high-rise multi family buildings, of which Winchester has but few. Access to water during outages is an important step towards resilience, but Winchester may want to pursue a different strategy or focus for their own version of implementation. Adaptation and mitigation of climate change are often locally specific, and so the policies that benefit Boston might not translate directly to Winchester's situation.[27]

Like all resilience and climate adaptation related information, Winchester should take what they need from the report and translate into its own local context.[28] One specific structural option Winchester might adopt is the way the Boston report lays out its recommendations / action items. They lay out their approximately 30 strategies for building resilience in 7 categories, and then expand greatly upon the steps required for implementation within each category. This is an efficient way of structuring the resilience strategies, as all of the categories and sub-categories are of manageable numbers, with clear and specific steps to take for implementation. This is in contrast to something like the Winchester Climate Action Plan, which has 207 total action items and lacks clear steps toward implementation.[29]

Lastly, the section on municipal strategies for enhancing resilience is very useful to Winchester. As it is a survey, it contains a wealth of examples for each recommended strategy. Not only do each of the towns mentioned in the report have something potentially valuable to offer Winchester in terms of formulating its own strategies, but the way the survey is laid out allows Winchester to pick and choose the towns and cities closet to its geographic / political / demographic situation first, before moving on to look at other, possibly useful situations.

2.2: Building Resiliency Task Force (NYC)[30]

Plan Specifics

This report is the result of the time and effort of more than 200 dedicated volunteer experts in their respective fields, including real estate owners, property managers, architects, engineers, contractors, utility representatives, subject matter specialists, city officials, code consultants, cost estimators, attorneys and others. The goal of the report was to find ways to improve resiliency in New York City

26 Newman 2013 (72) http://www.greenribboncommission.org/downloads/Building_Resilience_in_Boston_SML.pdf
27 Bassett and Shandas 2010 http://www.tandfonline.com/doi/abs/10.1080/01944363.2010.509703
28 Bassett and Shandas 2010
29 Winchester Climate Action Plan. 2011 http://www.winchester.us/documentcenter/view/573
30 Urban Green Council 2013 http://urbangreencouncil.org/sites/default/files/2013_brtf_summaryreport_0.pdf

(NYC), ideally without expensive retrofits to existing buildings.[31] Instead, the report focuses on removing barriers to resiliency improvements, sharing information, and giving owners options on how to improve their properties themselves. However, there are additional zoning and construction codes recommended for new buildings and extensive renovations.

Plan Structure

There are 33 different proposals in this report, covering resiliency in a variety of building types, including commercial, multi-family residences, hospitals, and 1-3 family homes. There are five types of proposals, but one proposal can apply to multiple areas (multi-family and commercial, etc.). The proposal types are:

- Required Upgrade. This for those few crucial cases where the task force has recommended retroactive requirements for existing buildings, for example, providing water supply in residential buildings during blackouts. The same requirements apply to new construction and renovations.
- New Code. These proposals are applicable to new construction or renovations, but are not retroactively required for already existing structures. Building types not affected by new code should still consider these proposals as strong recommendations.
- Remove Barrier. These proposals focus on improving resiliency by removing obstacles and giving owners more options for improvements, instead of adding requirements like the first two proposal types. Proposals of this type are not considered required.
- Recommended. Theses are proposals that are add-ons to the normal legal minimum standards for construction. As such, they are voluntary, but should be seriously considered.
- Further Action. These proposals still required continued effort in developing their core recommendations, and will received additional consideration by either the city or the Task Force under an extended mandate.

The proposals are also divided into three chapters, Stronger Buildings, Backup Power, and Essential Safety, with a fourth chapter devoted to better planning practices. Each proposal states the issue at hand, and a recommendation for resolving said issue. This is an effective way to present the information, making it clear what the problem is and how the report purports to solve it. Unlike the

31 Urban Green Council 2013

Boston report, which draws heavily from this one[32], this summary NYC report does not have action steps for each of their proposals, making the recommendations much more general. However, more detailed implementation processes can be found in the technical read out of the report.[33]

How it is applied

The NYC report is on behalf of the Urban Green Council, and is addressed to Mayor Michael R. Bloomberg & Speaker Christine C. Quinn.[34] This dates the report, as Bloomberg is no longer Mayor. As the recommendations in the report do not have the force of law without the support of the Mayor and the City Council, this jeopardizes the effectiveness of the report. Fortunately, the new Mayor Bill de Blasio has shown every indication that he is strongly supportive of resilience and sustainability efforts, forming a new Office of Recovery & Resiliency to push for major climate related resiliency efforts.[35] Moreover, the reports recommendations have been incorporated into the overall PlaNYC movement, ensuring that they will have an impact upon the City's recovery and resilience building processes.[36] PlaNYC runs concurrent to NYC's overall planning processes, and has been overseen by the office of Long-term Planning and Sustainability since its inception in 2007.

Takeaways for Winchester

There are enormous geographical, financial, and demographic differences between NYC and the Town of Winchester. For one, the experts who developed the NYC report compiled 5000 man hours in its creation, a feat that would be difficult for Winchester to match. However, Winchester does not have to, as there is much in this report from which Winchester can draw on when it creates its own set of recommendations. First of all, it is important to note that the Boston resiliency report draws heavily from the NYC report, to the extent that many of the recommendations and proposals are repeated, and some adapted to be more Boston specific. By comparing between the two reports Winchester can gain insight into how to adapt proposals for its own purposes.

2.3: Sustainable Lowell 2025[37]

Plan Specifics

32 Newman et al. 2013 http://www.greenribboncommission.org/downloads/Building_Resilience_in_Boston_SML.pdf
33 Urban Green Council 2013 http://issuu.com/urbangreen/docs/brtf_full_report
34 Urban Green Council 2013 http://urbangreencouncil.org/sites/default/files/2013_brtf_summaryreport_0.pdf
35 NYC Press office 2014 http://www1.nyc.gov/office-of-the-mayor/news/167-14/de-blasio-administration-releases-planyc-progress-report-highlighting-major-accomplishments-on
36 PlaNYC 2014 http://www.nyc.gov/html/planyc/html/home/home.shtml
37 Lowell 2013 http://www.lowellma.gov/dpd/community/Documents/Sustainable%20Lowell%202025.pdf

This plan is a sustainability update to the City of Lowell's Master-plan. Like most Master-plans, Lowell hopes to use the plan to guide development and maintenance of transportation, economic, and housing systems in the city, as well as preserving and improving the physical environment and other community resources. The plan update had a robust public participation component, including a telephone survey of over 800 residents and 5 separate visioning sessions. Overall, the update targets 8 specific goals and / or action areas, sustainable neighborhoods, housing choice, mobility & access, vibrant & unique urban hub, healthy & sustainable local economy, environmental resilience, effective operations, infrastructure & technology, and sustained public engagement. /these action areas correspond with four aims from the vision process, which seeks to improve Lowell's livability, its sense of place, its longevity, and the public sense of responsibility for building a sustainable environment.

Plan Structure

The plan is structured simply, but holds a great deal of information and contains a large amount of action items. Each of the eight goals / action areas has their own list of objectives, and then each of those objectives has their own set of action items. For example, the Sustainable Neighborhoods action area has nine specific objectives:

1. Preserving the unique quality and character of each of Lowell's neighborhoods
2. Promoting safe and welcoming neighborhoods
3. Prioritizing land-use policies that promote walkable, well-networked neighborhoods.
4. Supporting vibrant neighborhood business districts that are easily accessible to all residents
5. Cultivating schools as models for community cohesion and self-sufficiency
6. Fostering neighborhood-level camaraderie, advocacy, and resource sharing
7. Ensuring the integration of nature, green space, and high quality recreational resources into the urban landscape.
8. Celebrating, improve, and activate waterfront resources
9. Developing policies and programs that facilitate the production, distribution, and consumption of locally grown food in the greater Lowell region

In turn, objective 1 has thirteen separate objectives, including “work with community stakeholders to identify neighborhood characteristics to be protected, preserved, and enhanced[38]”, “Routinely update, implement and develop new neighborhood plans in collaboration with the local community[39]”, as well as other related action items. As each action area has between seven to ten objectives, and each

38 Lowell 2013 (4) http://www.lowellma.gov/dpd/community/Documents/Sustainable%20Lowell%202025.pdf
39 Lowell 2013 (5)

objective has anywhere between six and fourteen action items, there are well over 300 action items in the plan update as it stands. While the structure of the update allows Lowell to present all of the action items in a relatively simple fashion, the number of action items makes the implementation of individual action items difficult.

How it is Applied

There is an entiresection of the Lowell plan that covers plan implementation, but while there are brief descriptions of recommended next steps for different groups of stakeholders, there is a dearth of specific steps. For example, elected officials are exhorted to "Provide leadership and policy direction to support the shared vision of Lowell as a sustainable city by listening actively to stakeholder concerns, taking a lead in civic education, increasing presence at community meets and events...[40]", while artists, entrepreneurs & small businesses should "support and partake in the local culture of entrepreneurship and innovation, striving to meet identified community needs through direct service delivery and to fill market niches whenever possible.[41]" Altogether there are nineteen different groups addressed, ranging from elected officials and the city manager to regional agencies, city boards & commissions, schools, local businesses and even individual residents. This is a comprehensive and potentially impact-ful way of including stakeholders in the implementation process, but the lack of specific implementation steps risks hindering coordination.

Takeaways for Winchester

The overall format of the Lowell plan is valuable for Winchester, as is the wealth of different action items. Ultimately, the Lowell plan prizes building resilience because of the broad array of actions it recommends to build sustainability in the City. Therefore, there are many different takeaways for Winchester when it comes to building its own resilient and sustainable community. Especially of value to Winchester are the recommended actions for each group of stakeholders relevant to the town. It helps keep the plan grounded in the different groups, and provides an easy way for people to see how they contribute.

However, another takeaway for Winchester is what not to do when it comes to building resilience. The Lowell plan is broad, perhaps too broad. It has even more action items than the 207 in the Winchester

40 Lowell 2013 (153) http://www.lowellma.gov/dpd/community/Documents/Sustainable%20Lowell%202025.pdf
41 Lowell 2013 (158)

Climate Action Plan[42], and while Winchester has completed almost 50% of those actions in the three years since that plan's publication, many of the remaining actions are so broad as to be meaningless. Action items without clear, attainable objectives are difficult to achieve, and while Lowell attempts to set up its plan in such a way as to have action items that make up an objective, and then objectives that make up a goal, nowhere in the plan are there specific implementation steps laid out, unlike the NYC and Boston resiliency reports. While this may be because of the differing nature of the reports, as semi-independent documents, the Boston and NYC reports have theoretically more leeway in making recommendations, since Lowell's document is an amendment to their town-master plan, it should be specific. Thus, the main takeaway for Winchester should be to have a smaller number of attainable action items, with clear steps on how to achieve the various objectives laid out in the plan. Planning is an important part of building resilience, but if the plan is difficult to understand, or has too many moving parts to implement correctly, then it has a chance of damaging resilience instead.[43]

3.0: Recommendations

Both resilience and sustainability are broad concepts, and so incorporating them into a comprehensive master-plan can be done in a number of different ways. The list of recommendations that follow are intended as a conceptual framework for the master-planning process to build on when it comes to incorporating the ideals of resilience and sustainability into the town master-plan. Opportunities for resilience building include:

3.1 Community Engagement

An essential component of building resilience and sustainability is a robust public participation / community engagement process. For example, “although urban planning and land-use zoning generally take place within local government structures, the enforcement and effectiveness of planning and zoning are dependent on the inclusionary and consensual nature of the process.[44]” Thus, an essential component of building resilience and sustainability is a robust public participation / community engagement process.[45] The benefit to resilience is two-fold. Not only is engaging the public an effective method for discovering vulnerabilities that might have been overlooked, but also

42 Winchester CAP 2011 http://www.winchester.us/DocumentCenter/View/573
43 Basset and Shandas 2010 http://www.tandfonline.com/doi/abs/10.1080/01944363.2010.509703
44 Tompkins and Adger 2004 (3) http://www.ecologyandsociety.org/vol9/iss2/art10/
45 Tompkins and Adger 2004 http://www.ecologyandsociety.org/vol9/iss2/art10/

increasing social capital through community engagement is a powerful tool for increasing resilience.[46] "Participation in the planning process is argued to be a critical part of a paradigm shift toward planning for sustainable development."[47] Increasing social capital through participation strengthens a community, making it more like to respond to potential shocks, climatic or otherwise, and thus makign it more resilient.[48] There are several actions which could be taken to increase participation in Winchester's planning processes, or otherwise build resilience in the community.

First, any new planning process (such as the Master-plan), must include some type of public meeting, whether a charrette or otherwise. To have an impact, the public must have input into projects discussed, beyond merely approving already designed projects.[49] While Winchester is probably small enough that most vulnerabilities will not be overlooked, the possibility is still there, and proper public participation ensures that more people are included in the process and more needs are met.

In a similar vein, efforts should be made to solicit public views to identify areas and institutions that people perceive of as vulnerable, either to climate change or other shocks. It is also possible that people will have effective ideas as to how those vulnerabilities should be addressed. Winchester already relies heavily on public involvement in its governmental processes, especially when it comes to issues like climate change, for which there is not a clear federal or state directive.[50] Committees like the Winchester Climate Action Advisory Committee[51] (CAAC) or Sustainable Winchester[52] have done yeoman work in promoting sustainability and resiliency in the town. Their services are necessary to continued progress in the area of sustainable development, and the creation of similar committees to look after hazard mitigation and disaster planning for Winchester could go a long way towards building resilience, both through actual work done and by acting as a force multiplier on the town government's actions.

The last recommendation is more specific to the planning department, and involves the continued inclusion of social and environmental justice issues when it comes to planning. Climate change often impacts more heavily on otherwise vulnerable populations, and mitigating those vulnerabilities is

46 Conroy and Berke 2004 http://www.envplan.com/abstract.cgi?id=a367
47 Conroy and Berke 2004 (1383)
48 Conroy and Berke 2004
49 Bassett and Shandas 2010 http://www.tandfonline.com/doi/abs/10.1080/01944363.2010.509703
50 Smith et al. 2010 http://www.cakex.org/sites/default/files/adaptation-federal-leadership.pdf
51 http://www.winchester.us/267/Climate-Action-Advisory-Committee
52 http://www.sustainablewinchester.org/

essential in making a town more resilient.[53] By including and taking proper account of social justice issues, Winchester's planning processes can go a long way towards removing or otherwise neutralizing vulnerability issues before they become more dangerous problems.

3.2: Vulnerability Assessment

The next section of the plan involves proper vulnerability assessment for the town of Winchester. Climate change is unpredictable[54], and so planning for climate change involves eliminating as many variables as possible so that there will be less unpredicted shocks and impacts.[55] One way to do this is through performing an assessment to see where and to what degree there are vulnerabilities to climate related impacts.[56] This is important to resilience building, because if vulnerabilities can be mitigated or eliminated, then the town or system in question is better able to respond to shocks.

Thus, Winchester should undertake a vulnerability assessment to see which areas in the town are most vulnerable to climate change (specifically flooding) as well as other disasters. Part of building resilience and vulnerability is knowing where the vulnerabilities in a town are, and how they can be accounted for or otherwise addressed. Properly assessing climate change vulnerability is a four-fold process that looks at exposure, sensitivity, capacity, and available resources. Any assessment must measure first "how a system is *exposed* to existing and future climatic stress...how *sensitive* the system is to the changes...the *capacity* of the system to adapt to these stresses...[57]" and finally, what resources are available to address the vulnerabilities identified in the first three parts. Essentially, this means identifying areas of vulnerability, assessing the severity of the vulnerability, determining the resilience of area impacted, and then evaluating the resources available to address the original vulnerability[58]. For Winchester, this might look something like:

- Step 1: Identify which areas are most likely to be flooded
- Step 2: Identify the severity of the flooding for each area
- Step 3: Identify the people and items most likely to be impacted by flooding and how severely
- Step 4: Look for ways and means to either prevent the flooding from happening, or to lessen its overall impact. This could mean moving houses, building dykes, culverts, or other drainage systems, or even just distributing sandbags before major storms.

53 Tompkins and Adger 2004 http://www.ecologyandsociety.org/vol9/iss2/art10/
54 Preston et al. 2013 http://link.springer.com/article/10.1007/s11027-013-9503-x
55 Ibid.
56 Berrang-Ford et al. 2011 http://www.sciencedirect.com/science/article/pii/S0959378010000968
57 Hjerpe and Glaas 2012 (475) http://link.springer.com/article/10.1007/s11027-011-9337-3
58 Ibid

This is similar to the BOA process for creating a vulnerability assessment. Their steps are: 1) Collect and analyze data on hazards and exposure. 2) Create scenarios of potential outcomes 3) Develop inventory of buildings vulnerable to each risk and 4) Develop checklist for vulnerability assessment.[59] Whatever steps Winchester decides to take, the important part is acting on them to prevent or mitigate future climatic impacts.

Thus, in conjunction with these steps, Winchester should create a comprehensive disaster plan for the town government and residents to follow in a time of crisis. Specifically, the town should look at the MA state hazard mitigation plan[60] and consider creating and using an equivalent document for Winchester to properly assess vulnerability and risk. Including:

- Creating places of refuge for use during disasters
- Having emergency communication plans for emergency services and residents to use in times of disaster
- Educating Households on the importance of having their own personal disaster plan

An example of what a hazard map might look like comes from the Massachusetts State Hazard Mitigation plan:

Primary Hazards	Structural Damage	Utility Outage	Chemical Release/ Spill	Commodity Shortages	Emergency Comm. Failure	Erosion	Structural Fire	Mold	Carbon Monoxide Poisoning	Disease	Flooding	Landslide	Dam Failure	Storm Surge	Tornado	Wildfire	Hail	Tsunami
Coastal Erosion	x										x	x						
Coastal Flooding	x		x			x		x		x		x						
Inland Flooding	x	x	x			x		x		x		x	x					
Hurricane/ T.S.	x	x	x	x	x	x		x	x	x	x			x	x			
Tornado/ Downburst	x	x	x					x										
Major Thunderstorm/ lightning		x					x								x	x	x	
Earthquake	x	x	x	x	x		x		x			x	x					x
Winter Storms/nor'easters	x	x		x		x	x		x		x			x				
Ice Storms	x	x		x	x		x		x									
Ice Jam	x										x		x					
Landslide	x					x												
Wildfires	x						x											
Tsunami	x	x	x	x		x		x		x	x							
Major Urban Fire	x	x	x															
Drought				x												x		
Epidemic / Pandemic Disease				x														

Illustration 1: Secondary Hazard Effects Matrix for Boston (From MA Hazard Mitigation Plan (2010) Pg 117 Table 14

3.3 Building Resilience

59 Newman 2013 http://www.greenribboncommission.org/downloads/Building_Resilience_in_Boston_SML.pdf

60 MA State Hazard Mitigation Plan 2014 http://www.mass.gov/eopss/docs/mema/mitigation/state-hazard-mitigation-plan/massachusetts-state-hazard-mitigation-plan.pdf

From a structural and planning viewpoint, one of the most important areas in which to increase resilience is by increasing resilience in buildings.[61] Drawing on the hazard plan developed from section 3.2, Winchester should prepare their buildings for the most common types of climate vulnerability in those buildings area. For example, because one of the main weather-related concerns in Winchester is flooding,[62] one proposal for Winchester is to improve regulations for flood resiliency of new and substantially improved buildings in the 100 year-flood-plain. This can be accomplished through actions such as changing building / construction codes to include language from FEMA's home and commercial retrofitting guides.[63] These documents have a number of guidelines for reducing the risks and impacts of flooding, including instructions on wet-proofing buildings, dry-proofing buildings, how to elevate structures in flood plains, and many others.

Zoning codes can also be changed to discourage new construction in high-risk areas, or to encourage retrofits to bring existing buildings more into line with established thinking on resiliency. On a similar note, Winchester could also amend the building code to address other issues of weather-related resilience as appropriate. For Winchester, this would include things like wind resiliency, flood resiliency, and others. For example, NYC report recommends strengthening windows and doors to raise the wind speed required to lift the roof off of a house, as well as requiring new door and window installation measures to strengthen envelope assemblies.[64]

Another code requirement that Winchester could adopt is an amendment to construction codes to protect against utility service interruption. This is to make sure buildings, especially public buildings, emergency shelters, and hospitals have some form of back-up power system in the event of a systemic outage. While residents and land-owners should be encouraged to purchase generators and other back-ups, especially for large multi-family homes, having reliable back-ups for public services is paramount. One example is to "prioritize which electrical equipment will run on backup power so buildings can remain habitable during extended blackouts. Because co-generation and solar power systems are always in use, they can be more reliable than generators that are only turned on during emergencies.[65]" Co-generation is using natural gas to generate electricity while harnessing the excess / expelled energy to heat the building. While electricity lines can be downed by a storm, underground natural gas lines

61 Newman et al. 2013 http://www.greenribboncommission.org/downloads/Building_Resilience_in_Boston_SML.pdf
62 Winchester CAP 2011
63 FEMA 2014 http://www.fema.gov/media-library/assets/documents/480?id=1420
64 Urban Green Council 2013 http://issuu.com/urbangreen/docs/brtf_full_report
65 Newman et al. 2013 (67) http://www.greenribboncommission.org/downloads/Building_Resilience_in_Boston_SML.pdf

are much more durable, allowing buildings using co-generation to continue to function even during a blackout[66]. Still, a back-up that has not been tested is a backup that cannot be relied on, and so requiring proper maintenance and testing is essential. Lastly, there should be a requirement in construction codes to place building services such as electrical service panels, various IT services, tankless water heaters, and others, above expected flood levels.[67] In addition, buildings that serve an essential purpose, such as certain municipal buildings or buildings like hospitals, should be required to have durable back-up energy, heating, cooling, and ventilation systems, as well as water systems that work during outages.[68] The less immediate danger outages pose to essential infrastructure, the easier it is to recover and respond to shocks.

There are several additional ways building resilience can be strengthened in preparation for climate change. On a structural level, Winchester should encourage building plans and construction codes that enhance structural elements for extreme loads, enhance building insulation, manage heat gain, and extend emergency lighting and services.[69] As with having back-up systems, the purpose of these types of resilience building measures is to ensure that vulnerabilities are addressed or mitigated. By adopting stricter design and construction codes, Winchester can ensure the reduction of any immediate climatic impacts, whether wind or rain, heat or chill.[70] However, it is important to note changes to building, construction, or zoning codes should be looked at and re-evaluated in the future. Part of the danger posed by climate change is that predictions of its effects continue to worsen.[71] Buildings now that are prepared for the coming twenty years of climate change, may not be prepared for the coming forty years. The degree of resilience building necessary will continue to be a moving target, and thus plans need to be flexible, adaptive, and most of all, evaluative of their strengths and weaknesses moving forward.[72]

3.4: Education and Outreach

Despite widespread agreement among scientists as to the causes of climate change and the necessity of preparation,[73] in the US climate change is still seen as a matter of debate. To manage such debate, the framing of the plan is important, as leading with climate change or other environmental reasons for

66 Newman et al. 2013
67 FEMA 2013 http://www.fema.gov/library/viewRecord.do?id=6938
68 Newman et al. 2013 http://www.greenribboncommission.org/downloads/Building_Resilience_in_Boston_SML.pdf
69 Newman et al. 2013
70 Urban Green Council 2013 http://issuu.com/urbangreen/docs/brtf_full_report
71 Preston et al. 2013 http://link.springer.com/article/10.1007/s11027-013-9503-x
72 Conroy and Berke 2004 http://www.envplan.com/abstract.cgi?id=a367
73 IPCC 2013 http://www.climatechange2013.org/images/report/WG1AR5_SPM_FINAL.pdf

change can derail discussion and make public participation much more difficult. For example, plans in conservative regions should “emphasize economics and cost savings, since, if climate change action plan were approached as an environmental issue, no one except “the same two sierra club members would show up.”[74] Proper framing can help plans avoid extraneous debate, but care should be taken that the framing does not misrepresent the plan's purpose to sidestep a robust public participation process.

With that in mind, one powerful tool for encouraging resilience is the ability to educate the stakeholders of the plan. Education and outreach can be useful in a variety of situations. For citizens reluctant to pursue resilience building or climate change mitigation as a strategy, convincing people of the necessity of a plan is an important step in the planning process. As discussed in the community engagement section, public participation is an important social justice component of a planning process, and including more diverse views helps to make plans more resilient and more effective.[75]

In addition to ensuring that a plan addresses stakeholder needs and vulnerabilities, education and outreach can also have a multiplicative impact on the effectiveness of a plan. Any town-wide hazard plan should also include a segment dedicated to educating households on the importance of having their own, individualized disaster plan.[76] Ideally, one that draws on and follows Winchester's own town disaster plan. One of the indirect dangers of disaster-type scenarios is people panicking and causing more damage. If more people know the town disaster plan, and have their own, individual plan to follow, it becomes much less likely that there will be incidents of wide-spread panic.[77] Being able to respond effectively to shocks is an important part of being resilient, and Winchester should make a point of encouraging households to plan their own disaster responses. Instructions and resources for household disaster planning can be found here at this FEMA sponsored website: http://www.ready.gov/. Many states, and some cities, have their own ready.gov pages, including NYC[78]. This is a good way of allowing people easy access to locally specific information, and can be accompanied with mailings, leaflets, and other outreach methods for maximum effect.[79] Unfortunately, neither Massachusetts nor Boston has a similar site, and so opportunities for learning from other, local work are limited. Still, there is much to be learned from both the FEMA site and the locally specific sites.

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74 Bassett and Shandas 2010 (441) http://www.tandfonline.com/doi/abs/10.1080/01944363.2010.509703
75 Preston et al. 2011 http://link.springer.com/article/10.1007/s11027-010-9270-x
76 FEMA 2013 http://www.fema.gov/library/viewRecord.do?id=6938
77 FEMA 2013
78 ReadyNYC 2014 http://www.nyc.gov/html/oem/html/get_prepared/ready.shtml
79 FEMA 2014 http://www.ready.gov/localized-ready-programs

3.5: Sustainability related measures

Most of the recommendations discussed previously are focused on resilience building as preparation for disasters, but that is a narrow, albeit important, section of resilience building. One thing the Lowell plan does well in building resilience is focusing on becoming more sustainable as part of the city's planning process.[80] When it comes to planning, resilience and sustainability are linked. If something is sustainable, it is able to be used for a long time, without being used up and without using up other resources,[81] while to be resilient is have the ability to bounce back, to respond to stresses without changing its basic state.[82] Sustainability and resiliency are both concerned with longevity, and thus the most resilient systems are often the ones that are most sustainable.[83] Our reliance on fossil fuels is a powerful example of a system that is inherently unsustainable. Not only is the fuel running out, but because we are reliant on fuels that emit an overabundance of GHGs, we are having difficulty mitigating the threat of climate change.[84] Part of building resilience in Winchester therefore revolves around making Winchester more sustainable.

One of the basic methods of building sustainability along with resiliency is to promote energy-efficiency on all levels of Winchester, from the municipal government to commercial businesses, to local residents. Energy efficiency measures both building resilience and save money, which can be its own form of resilience building. For example, making sure a building is better insulated makes it take less energy to heat / cool, but also reduces danger posed by outside elements in case of an outage or other disaster.[85] Winchester is fortunate in that there is much work already being done to promote energy-efficiency on the local level. Increased energy-efficiency and reduced greenhouse-gas emissions are some of the main goals of the Winchester Climate Action Plan,[86] and so incorporating some of the action items of the CAP into the Master-plan is an effective way to promote energy-efficiency. In particular, the Master-plan should find someway to support the efforts of Sustainable Winchester's Cool Winchester program.[87] This can be through changing building / construction codes, finding a way to support tax breaks for energy-efficiency improvements, or other methods.

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80 Lowell 2013 http://www.lowellma.gov/dpd/community/Documents/Sustainable%20Lowell%202025.pdf
81 http://www.merriam-webster.com/dictionary/sustainability
82 Duit et al. 2010 10.1016/j.gloenvcha.2009.01.004
83 Ahern 2011 10.1016/j.landurbplan.2011.02.021.
84 IPCC 2013http://www.climatechange2013.org/images/report/WG1AR5_SPM_FINAL.pdf
85 Newman 2013 http://www.greenribboncommission.org/downloads/Building_Resilience_in_Boston_SML.pdf
86 Winchester CAP 2011 http://www.winchester.us/DocumentCenter/View/573
87 Cool Winchester 2014 http://www.coolwinchester.org/Home.html

Along with energy-efficiency, another sustainability emphasis for the plan must be on renewable energy-generation. It is not enough to reduce fossil fuel use, to be more resilient the town must find a method of moving away from fossil fuels as a primary fuel source. The Winchester CAP has several action items involving renewable energy, solar and wind specifically,[88] which would be valuable to the Master-plan. The town should continue to look at purchasing renewable energy for municipal building use, as well as finding ways to encourage local creation of renewable energy generators, either through tax breaks for new construction, or through changes in building and / or zoning codes. The Lowell plan puts this as "Identify the impediments to implementation of renewable energy systems on private homes and commercial properties, and seek to address them through education, permit streamlining, and ordinances which properly balance incentives with regulation of potentially harmful impacts.[89]"

Along with regular renewable energy generation, Winchester should consider removing any barriers to co-generation.[90] A co-generation system, otherwise known as a combined heat and power system, powers a building and then uses the left-over heat to heat or chill the building. During Hurricane Sandy, buildings with a CHP (Combined Heat and Power) system were some of the few to retain power and heat. Congeneration thus increases "resiliency, since natural gas-fueled cogeneration can operate as long as gas pipelines are working, even during electricity blackouts.[91]" Lastly, in addition to Wind and Solar, Mill Pond and Aberjona River also offer Winchester the opportunity for hydroelectric energy generation in the center of town.

Besides energy, proper waste management / recycling is an important part of sustainability and resilience.[92] Thanks to the Winchester CAP and members of the Winchester Climate Action Advisory Committee, among others, Winchester recently developed and implemented a single-stream recycling program.[93] However, there is still much that can be done to promote waste management in the town. The town should consider updating "solid waste and recycling [bylaws] so as to expand access to and participation in recycling by all residential and commercial properties in the city,[94]" as well as working with commercial businesses to compost food waste.[95]

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88 Winchester CAP 2011 http://www.winchester.us/DocumentCenter/View/573
89 Lowell 2013 (118) http://www.lowellma.gov/dpd/community/Documents/Sustainable%20Lowell%202025.pdf
90 Newman 2013
91 Urban Green Council 2013(20) http://urbangreencouncil.org/sites/default/files/2013_brtf_summaryreport_0.pdf
92 Bassett and Shandas 2010 http://www.tandfonline.com/doi/abs/10.1080/01944363.2010.509703
93 Winchester CAP 2011 http://www.winchester.us/DocumentCenter/View/573
94 Lowell 2013 (113) http://www.lowellma.gov/dpd/community/Documents/Sustainable%20Lowell%202025.pdf
95 Winchester CAP 2011

3.6: Other Resiliency Related Measures:

Resiliency is a very broad concept, covering a wide array of systems and circumstances. There are resilience-building measures that the town should take that are not explicitly in one of the categories discussed above.

One such action item is planning and building for more rainfall. Part of what climate change will bring to the Northeast is a warmer and wetter climate,[96] and so building resilience in that particular case means preparing for more rainfall, both per storm and over the course of the entire year. Preparations can include infrastructure to reduce flooding, such as levees or flood-walls,[97] or softer hazard resilient landscape designs like sloped tree pits that act as water traps, absorbing rainwater.[98] On a similar note, Winchester should consider sidewalk protection from floods, or exterior flood protection around buildings.[99] Where and how such flood protection should be applied is part of any vulnerability assessment performed by the town.

The last few recommendations both involve facilitating actions on a post-disaster basis. Both the Boston and NYC reports recommend pre-approving emergency inspectors, streamlining the recovery process by having a larger pool of people to provide "post-disaster building assessments,[100]" i.e. making sure buildings are able to be open and used without danger to their occupants. On a similar note, the town government can encourage more volunteers to help during disaster scenarios by passing or otherwise supporting good Samaritan legislation that protects emergency workers and other volunteers from liability.[101] Lastly, an important part of recovering from disaster is the support from members in the surrounding community. Winchester should pre-negotiate emergency recovery agreements with both service providers and surrounding towns and cities to smooth recovery and limit the economic and human impact of the emergency.[102] By communicating and coordinating with surrounding towns especially, the amount of human and financial capital available to address emergency preparedness issues multiplies. Crises such as hurricanes impact multiple regions, not just one town, and so coordinating resources is an essential apart of planning for climate change and

96 EPA 2014 http://www.epa.gov/climatechange/impacts-adaptation/northeast.html
97 Newman et al. 2013 http://www.greenribboncommission.org/downloads/Building_Resilience_in_Boston_SML.pdf
98 Urban Green Council 2013 http://issuu.com/urbangreen/docs/brtf_full_report
99 Newman et al. 2013
100 Urban Green Council 2013 (31) http://urbangreencouncil.org/sites/default/files/2013_brtf_summaryreport_0.pdf
101 Newman et al. 2013 http://www.greenribboncommission.org/downloads/Building_Resilience_in_Boston_SML.pdf
102 Urban Green Council 2013

building resilience.[103]

4.0: Conclusion / Moving Forward

While the concept of resilience touches on a wide array of activities, ideas, and other systems, the successful incorporation of resilience into a planning process involves intimate knowledge of the plan or town in question. "Building resilience capacity through landscape and urban planning requires that planners and designers identify the stochastic processes and disturbances that a particular landscape or city is likely to face, the frequency and intensity of these events and how cities can build the adaptive capacity to respond to these disturbances while remaining in a functional state of resilience.[104]" Thus in terms of climate change, the first step of building resilience must be a vulnerability assessment. In an era of sparse resources, it is important to prioritize projects , and what the effect might be if a project does not get fundedn.

However, resilience is about more than planning for climate change. While climate change is perhaps one of the most severe long-term threats to towns like Winchester, the fact remains that climate change, however variable its effects, is a known threat. True resilience, true sustainability, both involve surviving and maintaining Winchester's way of life moving forward into an uncertain future. The most important principles of resilience therefore are redundancy, modularization and adaptation.[105] Redundancy and modularization are achieved when multiple elements or components provide the same, similar, or backup functions, spreading risks across time, across geographical areas, and across multiple systems.[106] When a major urban function or service is provided by a centralized entity or infrastructure, it is more vulnerable to failure, but when the same function is provided by a distributed or decentralized system, it is more resilient to disturbance. Flexible and adaptable systems help to provide redundancy, as different systems can change in response to other systems failing.

With a focus on redundancy and adaptation, building resilience becomes about minimizing failure points and making sure that if systems have to fail, then they do so in a way that minimizes their impact and allows other systems to take their place.[107] Many of the above recommendations follow a similar

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103 Conroy and Berke 2004 http://www.envplan.com/abstract.cgi?id=a367
104 Ahern 2011 (342) 10.1016/j.landurbplan.2011.02.021.
105 Ahern 2011
106 Ahern 2011 10.1016/j.landurbplan.2011.02.021.
107 Ahen 2011

strategy, e.g. insulating buildings more fully makes energy costs cheaper[108], but it also makes buildings habitable for longer during outages and disastrous climatic conditions. In towns with limited resources, this sort of benefit stacking is extremely valuable. Projects should be evaluated carefully to determine what their effects might be, and how these effects might be complimentary to one another. Doing more with less is an essential aspect of resilience planning.[109]

In terms of incorporating resiliency into a Master-planning process, the first step must be the type of vulnerability assessment discussed in section 3.2. While there are many general actions to increase resilience, including tweaking building and zoning codes to encourage resilient construction, any specific efforts to address something like climate change should not be done on an ad hoc basis. It can be difficult to accurately predict the impacts certain actions will have, or even if the issue they are addressing is something that Winchester needs to be concerned with. This plays into the local nature of climate change, climatic vulnerabilities, and resilience building. There are broadly applicable actions, better insulation, more energy-efficient buildings, a switch to renewable energy, less waste and more recycling, all are actions that increase sustainability and resilience no matter where those actions are taken. However, a town like Winchester is unlikely to need to prepare their buildings for disasters like Earthquakes or Hurricanes, and so not all resilience building strategies will be effective for Winchester. Even Boston, geographically close to Winchester it may be, has strategies in its resilience report that are not applicable for Winchester. As a smaller town, Winchester has a much smaller building footprint, and does not have to worry about skyscrapers or other tall buildings, or the large and diverse population of Boston. Resilience is a local issue, even if it exists as part of larger regional and national frameworks[110], and so figuring out where building resilience would be most useful is an important first step.

108 Newman 2013 http://www.greenribboncommission.org/downloads/Building_Resilience_in_Boston_SML.pdf
109 Ahern 2011
110 Corfee-Morlot et al. 2009 http://www.oecd.org/governance/regional-policy/44232263.pdf

Appendix A: Recommendations

Building Resilience in Winchester: Recommendations	
Field	**Recommendation**
Community Engagement	Public charrettes to involve local stakeholders in the planning process
	Solicit public views to identify institutions and areas that are perceived to be vulnerable
	Consider social / environmental justice issues when changing zoning codes, building codes, and in other planning processes
Vulnerability Assessment	Undertake a vulnerability assessment to see which areas are most vulnerable to climate change.

	Create a comprehensive disaster plan to address or mitigate those vulnerabilities
	Create places of refuge for use during disasters
	Have Emergency Communication plans
	Educate households on the importance of having their own disaster preparedness Plans
Building Resilience	Improve regulations for flood resiliency for new and substantially improved buildings in the 100 year flood plain
	Study and implement zoning changes to encourage retrofits of existing buildings and construction of new resilient buildings in the 100 year flood plain
	Amend any construction codes and develop best practices to protect against utility service interruptions
	Encourage building plans and construction codes that increase building resilience in terms of weather, temperature change, and other shocks.
	Extend emergency lighting and services
	Relocate & Protect building systems
Education & Outreach	Educate households about what to do in case of disaster
	Partner with local community organizations to enhance resilience at a household level
	Locate vulnerable (in an environmental and / or social sense) populations in town and plan to address their needs
Other Resilience Measures	Plan and build for more rainfall
	Consider sidewalk or exterior flood protection
	Consider levees or floodwalls, if applicable
	Encourage hazard resilient landscape design
	Pre-approve emergency inspectors
	Support Good Samaritan Legislation
	Pre-negotiate emergency recover agreements
Sustainability related measures	Remove barriers to co-generation as well as solar energy (if applicable)
	Promote energy-efficiency
	Emphasize renewable energy generation
	Continue town encouragement of waste management and recycling procedures

Appendix B: Resources

- Massachusetts State Hazard Plan: http://www.mass.gov/eopss/docs/mema/mitigation/state-hazard-mitigation-plan/massachusetts-state-hazard-mitigation-plan.pdf
    - This is the most recent version of the MA state hazard plan, detailing recommendations and instructions on how to plan for disasters, both climate change related and otherwise. This includes ideas for specific actions, as well as how to structure one's own plan.
- Household Disaster Planning: www.ready.gov
    - Contains instructions, tools, and resources for households looking to create their own disaster plans.
- Federal Emergency Management Association: www.fema.gov

- FEMA has a wide variety of useful resources for anything disaster or climate change related, and are an important guide to anyone hoping to build resilience. Some of their documents that are relevant to Winchester include:
- The Homeowners Guide to Retrofitting (2014): http://www.fema.gov/media-library/assets/documents/480?id=1420
  - The Federal Emergency Management Agency (FEMA) has prepared this guide specifically for homeowners who want to know how to protect their homes from flooding.
- Mitigation Ideas: a Resource for Reducing Risk to Natural Hazards (2013): http://www.fema.gov/media-library/assets/documents/480?id=1420
  - The purpose of this document is to provide a resource that communities can use to identify and evaluate a range of potential mitigation actions for reducing risk to natural hazards and disasters. The focus of this document is mitigation, which is action taken to reduce or eliminate long-term risk to hazards.

- Building Resiliency Task Force: http://urbangreencouncil.org/buildingresiliency
  - A report from a massive NYC task force headed by the Urban Green Council. It provides 33 actionable proposals for making New York buildings and residents better prepared for the next extreme weather event, and is a valuable source of information for resilience building. The full technical report also has lists of tasks for each actionable proposal, as well as implementation instructions. The full task force report can be found here: http://issuu.com/urbangreen/docs/brtf_full_report
- Building Resilience in Boston: http://www.greenribboncommission.org/downloads/Building_Resilience_in_Boston_SML.pdf
  - A report from the Boston Society of Architects and others with recommendations and tips on how to increase resilience. The report cribs heavily from the NYC building resilience report, and focuses mainly on resilience for buildings.
- Stockholm Resilience Centre: http://www.stockholmresilience.org/
  - Advances research on the governance of social-ecological systems with a special emphasis on resilience – the ability to deal with change and continue to develop.
- Institute for Sustainable Communities: http://www.iscvt.org/
  - Helps communities around the world better address environmental, economic, and social

challenges. A great source for resources, tips, and tools.

- Oak Ridge National Laboratory, Energy-efficiency and Renewable Energy Page: http://web.ornl.gov/sci/eere/
    - Contains a great deal of research and publications related to energy-efficiency and renewable energy, both for buildings and communities. Has Department of Energy recommendations for reducing energy use, installing more building insulation, and other energy-efficiency related measures.
- The Environmental Protection Agency: http://www.epa.gov/climatechange/impacts-adaptation/northeast.html
    - Contains information on the projected climatic impacts for the Northeastern United States, and has the possibility of government grants designed to address such issues.