University of Massachusetts Boston

UMass Boston Hazard Mitigation Plan Annex A

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TABLE OF CONTENTS

SECTION		PAGE NO.
Executive Summary		**ES-1**
1.	**INTRODUCTION**	**1-1**
1.1	UMass Boston Overview	1-1
1.1.1	Campus History	1-2
1.1.2	City of Boston	1-3
1.1.3	Campus Location & Environment	1-4
1.1.4	Future Campus Development – 25 Year Master Plan	1-6
1.1.5	Community Involvement	1-12
2.	**PLANNING PROCESS**	**2-1**
2.1	Planning Team	2-1
2.2	Existing Data and Reports Utilized for the Plan	2-8
2.3	Stakeholder Engagement	2-8
2.3.1	Campus Kick-Off Meeting	2-8
2.3.2	Stakeholder Interviews	2-9
2.3.3	Hazard Identification and Risk Assessment Meeting	2-12
2.3.4	Hazard Mitigation Goals, Hazard Profiles, Loss Estimates, and Projects Meeting	2-13
2.3.5	Campus Mitigation Projects Focus Groups	2-14
2.3.6	Public Meeting No. 1	2-15
2.3.7	Presentation of Draft Hazard Mitigation Plan Facilitated Review Meeting	2-19
2.3.8	Public Meeting No. 2	2-19
3.	**HAZARD PROFILES & RISK ASSESSMENT**	**3-1**
3.1	Natural Hazards Impacting Campus	3-1
3.1.1	Coastal Erosion	3-4
3.1.2	Coastal Storm/Nor'Easter	3-6
3.1.3	Flood	3-9
3.1.4	Drought Hazard	3-17
3.1.5	Earthquake	3-19
3.1.6	Extreme Heat	3-27
3.1.7	Hailstorm	3-30
3.1.8	Extreme Wind Events	3-32
3.1.9	Severe Winter Storm	3-40
3.1.10	Thunderstorm & Lightning	3-44
3.1.11	Tsunami	3-48
3.1.12	Urban Fire	3-49
3.1.13	Wind Storm	3-52
3.2	Human hazards	3-54
3.2.1	Vulnerability to Weapons of Mass Destruction	3-55
3.2.2	Civil Disturbance	3-56
3.2.3	SCADA Failure	3-57
3.2.4	Hazardous Materials Incident	3-57
3.2.5	Bomb Threat	3-59
3.2.6	Vandalism	3-60

3.2.7 Methane Emissions 3-61
3.2.8 Proximity to Flight Path 3-61
3.2.9 Violent Criminal Incident 3-62
3.2.10 Robbery/Burglary 3-63
3.2.11 Pandemic Health Issue 3-64
3.2.12 Explosion 3-64
3.2.13 Cyberattacks/Cyberterrorism 3-65
3.2.14 Proximity to Gas Tank at Commercial Point 3-66
3.2.15 Active Shooter 3-66
3.2.16 Industrial Accident 3-67
3.2.17 Critical Infrastructure Failure 3-68
3.2.18 Failure of Building Materials 3-69
3.2.19 Arson 3-70

4. VULNERABILITY & IMPACT ASSESSMENT 4-1

4.1 Asset Inventory 4-1
4.1.1 Loss of Function 4-1
4.1.2 Building Vulnerability Assessment 4-3

5. GOALS & OBJECTIVES 5-1

6. MITIGATION ACTIVITIES & ACTION PLAN 6-1

6.1 Mitigation Activities & Action Plan 6-1
6.2 Mitigation Project Prioritization 6-3
6.3 Potential funding sources 6-10
6.4 Capabilities Assessment 6-10
6.4.1 Administrative Capability 6-10
6.4.2 Plan & Program Capability 6-15
6.4.3 Fiscal Capability 6-17
6.4.4 Regulatory Environment 6-19

7. PLAN IMPLEMENTATION, MAINTENANCE & ADOPTION 7-1

7.1 Plan Maintenance & Revision 7-1
7.2 Revising the Plan 7-2
7.3 Integration into Other Planning Mechanisms 7-3
7.4 Adoption 7-3
7.5 Approval 7-3

LIST OF TABLES

TABLE **PAGE NO.**

Table 1-1: Climate Data for Boston 1981 - 2010 1-4
Table 1-2: UMass Boston Campus Building Information 1-5
Table 1-3: UMass Boston 25 Year Master Plan – Future Campus Development 1-7
Table 2-1: UMass Boston Hazard Mitigation Planning Team 2-1
Table 2-2: Stakeholders Engaged in UMass Boston Hazard Mitigation Plan 2-3
Table 2-3: Topics Reviewed During Campus Kick-Off Meeting 2-9
Table 2-4: UMass Boston Stakeholder Interview Matrix 2-10
Table 2-5: UMass Boston Interview Topics & Themes 2-11
Table 2-6: Topics Reviewed During Hazard Identification and Risk Assessment Meeting 2-12
Table 2-7: Topics Reviewed During Hazard Mitigation Goals, Hazard Profiles, Loss Estimates and Projects Meeting 2-13
Table 2-8: High Priority Projects Discussed by Focus Group 2-14
Table 2-9: Topics Reviewed During Facilitated Review Meeting of the Draft Hazard Mitigation Plan 2-19
Table 3-1: Quantitative/Qualitative UMass Boston Natural Hazard Risk Ranking 3-1
Table 3-2: UMass Boston Natural Hazard Risk Ranking Summary 3-3
Table 3-3: Coastal Erosion Susceptibility 3-4
Table 3-4: Risk Assessment – Coastal Erosion 3-5
Table 3-5: Qualitative Risk Assessment – Coastal Erosion Hazard 3-6
Table 3-6: Massachusetts Coastal Storm Major Disaster Declarations (1954 – Present) 3-6
Table 3-7: Coastal Storm/Nor'Easter Susceptibility 3-7
Table 3-8: Risk Assessment – Coastal Storm/Nor'Easter Hazard 3-8
Table 3-9: Qualitative Risk Assessment – Coastal Storm/Nor'Easter Hazard 3-8
Table 3-10: Massachusetts Flooding Major Disaster Declarations (1954 – Present) 3-9
Table 3-11: Flood Event Data for Suffolk County (January 1, 2000 through February 28, 2013) 3-10
Table 3-12: Flood Susceptibility 3-11
Table 3-13: Structure Loss – Flood Hazard 3-13
Table 3-14: Contents Loss – Flood Hazard 3-13
Table 3-15: Structure use and Function Loss & Total Loss – Flood Hazard 3-14
Table 3-16: Risk Assessment – Flood Hazard 3-16
Table 3-17: Qualitative Risk Assessment – Flood Hazard 3-16
Table 3-18: Drought Event Data for Suffolk County (January 1, 2000 through February 28, 2013) 3-17
Table 3-19: Drought Susceptibility 3-18
Table 3-20: Risk Assessment – Drought Hazard 3-19
Table 3-21: Qualitative Risk Assessment – Drought Hazard 3-19
Table 3-22: Recent Earthquake Events in Massachusetts 3-21
Table 3-23: UMass Boston Campus Earthquake Susceptibility 3-21
Table 3-24: UMass Boston Campus Buildings - Estimated Loss to Structure & Contents Due to Earthquake 3-24
Table 3-25: Risk Assessment – Earthquake Hazard 3-26
Table 3-26: Qualitative Risk Assessment - Earthquake 3-26
Table 3-27: UMass Boston Campus Extreme Heat Susceptibility 3-28
Table 3-28: Risk Assessment – Extreme Heat 3-29
Table 3-29: Qualitative Risk Assessment – Extreme Heat 3-29
Table 3-30: Hail Event Data for Suffolk County 2000 - 2012 3-30
Table 3-31: UMass Boston Campus Hailstorm Susceptibility 3-31
Table 3-32: Risk Assessment – Hailstorm 3-31
Table 3-33: Qualitative Risk Assessment – Hailstorm Hazard 3-31

Table 3-34: Massachusetts Hurricane Major Disaster Declarations (1954 – Present) 3-32
Table 3-35: Direct Hurricane Hits Between 1851 - 2009 3-34
Table 3-36: UMass Boston Campus Hurricane Susceptibility 3-35
Table 3-37: Risk Assessment – Hurricane 3-36
Table 3-38: Qualitative Risk Assessment - Hurricane 3-36
Table 3-39: Massachusetts Tornado Major Disaster Declarations (1954 – Present) 3-37
Table 3-40: UMass Boston Campus Tornado Susceptibility 3-38
Table 3-41: Risk Assessment – Tornado 3-39
Table 3-42: Qualitative Risk Assessment - Tornado 3-39
Table 3-43: Massachusetts Winter Storm Major Disaster Declarations (1954-Present) 3-40
Table 3-44: Winter Storm/Blizzard Data for Suffolk County (January 1, 2000 - February 28, 2013) 3-41
Table 3-45: UMass Boston Campus Winter Storm Susceptibility 3-42
Table 3-46: Risk Assessment – Winter Storm 3-43
Table 3-47: Qualitative Risk Assessment – Winter Storm Hazard 3-43
Table 3-48: Lightning Event Data for Suffolk County (January 1, 2000 – February 28, 2013) 3-44
Table 3-49: UMass Boston Campus Thunderstorm & Lightning Susceptibility 3-46
Table 3-50: Risk Assessment – Thunderstorm/Lightning 3-47
Table 3-51: Qualitative Risk Assessment – Thunderstorm/Lightning Hazard 3-47
Table 3-52: UMass Boston Campus Tsunami Susceptibility 3-48
Table 3-53: Risk Assessment – Tsunami 3-49
Table 3-54: Qualitative Risk Assessment – Tsunami Hazard 3-49
Table 3-55: UMass Boston Campus Urban Fire Susceptibility 3-50
Table 3-56: Risk Assessment – Urban Fire 3-52
Table 3-57: Qualitative Risk Assessment – Urban Fire Hazard 3-52
Table 3-58: UMass Boston Campus Wind Storm Susceptibility 3-53
Table 3-59: Risk Assessment – Wind Storm 3-53
Table 3-60: Qualitative Risk Assessment – Wind Storm Hazard 3-54
Table 3-61: Human Hazard Qualitative Risk Ranking Summary 3-55
Table 3-62: Risk Assessment – Weapons of Mass Destruction 3-56
Table 3-63: Civil Disturbance Susceptibility 3-56
Table 3-64: Assessment – Civil Disturbances 3-57
Table 3-65: Risk Assessment – SCADA Failure 3-57
Table 3-66: Hazardous Materials Incident Susceptibility 3-58
Table 3-67: Risk Assessment – Hazardous Materials Release 3-59
Table 3-68: Massachusetts Bombing Related Major Disaster Declarations 3-59
Table 3-69: Bomb Threat Susceptibility 3-60
Table 3-70: Risk Assessment – Bomb Threat 3-60
Table 3-71: Vandalism Susceptibility 3-60
Table 3-72: Risk Assessment – Vandalism 3-61
Table 3-73: Risk Assessment – Methane Emissions 3-61
Table 3-74: Risk Assessment – Proximity to Flight Path 3-62
Table 3-75: Violent Criminal Incident Susceptibility 3-62
Table 3-76: Risk Assessment – Violent Criminal Incident 3-63
Table 3-77: Robbery/Burglary Incident Susceptibility 3-63
Table 3-78: Risk Assessment – Robbery/Burglary 3-63
Table 3-79: Pandemic Health Issue Susceptibility 3-64
Table 3-80: Risk Assessment – Pandemic Health Issue 3-64
Table 3-81: Explosion Susceptibility 3-65
Table 3-82: Risk Assessment – Explosion 3-65

Table 3-83: Risk Assessment – Cyberattack/Cyberterrorism 3-66
Table 3-84: Risk Assessment – Proximity to Gas Tank at Commercial Point 3-66
Table 3-85: Active Shooter Susceptibility 3-67
Table 3-86: Risk Assessment – Armed Attack/Active Shooter 3-67
Table 3-87: Risk Assessment – Industrial Accident 3-67
Table 3-88: Infrastructure Failure Susceptibility 3-68
Table 3-89: Risk Assessment – Critical Infrastructure Failure 3-69
Table 3-90: Failure of Building Materials Susceptibility 3-69
Table 3-91: Risk Assessment – Failure of Building Materials/Building Deterioration 3-69
Table 3-92: Arson Susceptibility 3-70
Table 3-93: Risk Assessment – Arson 3-70
Table 4-1: UMass Boston Assets Evaluated During Mitigation Planning Process 4-1
Table 4-2: UMass Boston Loss of Function Cost 4-2
Table 4-3: UMass Boston Campus Buildings - Vulnerability Assessment 4-3
Table 5-1: UMass Boston Goals & Objectives 5-1
Table 6-1: UMass Boston Mitigation Projects 6-1
Table 6-2: UMass Boston Project Prioritization 6-5
Table 6-3: Administrative and Technical Capabilities 6-11
Table 6-4: Documents Relied Upon 6-15
Table 6-5: UMass Boston FY12-FY21 Capital Plan Details 6-18
Table 6-6: Legal and Regulatory Policies 6-19

LIST OF FIGURES

FIGURE **PAGE NO.**

Figure 1: Boston, MA Location Map 1-3
Figure 2: 25-Year Campus Master Plan 1-8
Figure 3: Public Meeting No. 1 Advertising Efforts 2-16
Figure 4: Hazard Posters Used During Public Participation Process 2-18
Figure 7: Earthquake in New England, United States and Canada 1990-2010 3-20
Figure 8: Earthquake Vulnerability Assessment by Building 3-25
Figure 9: Climate Change Projects 1961- 2099 3-27
Figure 10: Suffolk County Tornadoes, 1956-2011 3-37
Figure 11: Tornado Days Per Year in the United States, NOAA's (NSSL) 3-38
Figure 12: Annual Mean Total Snowfall 3-42
Figure 13: Lightning Fatalities by State, 1959-2012 3-45
Figure 14: Cloud to Ground Lightning Incidents in the U.S. – Vaisala NLDN 3-46
Figure 15: Fire Vulnerability Assessment by Building 3-51
Figure 16: UMass Boston Building Vulnerability Assessment – Non-Hazard Specific 4-4

APPENDICES

Appendix A: Bibliography of Documents Provided by UMass Boston
Appendix B: Campus Kickoff Meeting Materials
Appendix C: Interview Questionnaires
Appendix D: Hazard Identification & Risk Assessment Meeting Materials
Appendix E: Hazard Mitigation Goals, Hazard Profiles, Loss Estimates and Projects Presentation and Materials
Appendix F: Public Meeting No. 1 – Meeting Materials
Appendix G: Facilitated Draft Hazard Mitigation Plan Review Meeting Materials
Appendix H: Public Meeting No. 2 – Meeting Materials
Appendix I: Plan Approval Letter

EXECUTIVE SUMMARY

In 2012, the University of Massachusetts (UMass) campuses of UMass Boston, UMass Dartmouth, UMass Lowell and the UMass System Office began an effort to develop a Multi-Campus Hazard Mitigation Plan that would fulfill federal, state and local hazard mitigation planning requirements. The purpose of the Multi-Campus Hazard Mitigation Plan is to promote the safety of students, faculty, staff and visitors, by minimizing the impact of hazards on the University campuses physical assets and operations, and by reducing or avoiding long-term vulnerabilities from identified hazards. The campuses chose to evaluate and plan for both natural and human hazards. The UMass Boston Campus Annex Plan is one component of this larger planning effort and was written specifically for the UMass Boston campus. Funding for this project was provided by the Massachusetts Emergency Management Agency (MEMA) Hazard Mitigation Grant Program through a 75% grant and 25% campus match. Campus contributions to the effort were made through in-kind labor contributions of staff members.

UMass Boston will utilize this document moving forward as guidance in reducing its current and future risk from natural and human hazards by having resources, risk reduction strategies, responsible entities and historical information located in one place. The campus has been impacted by natural and human hazards in the past and through the development of this plan, focused on evaluating these impacts, engaging the public to understand their concerns and their understanding of mitigation planning.

Public Participation

UMass Boston established a planning process for this project that included reaching out to local, state and federal stakeholders as well as the student body and key stakeholders from the community. The effort was coordinated by Anne-Marie McLaughlin, UMass Boston Emergency Management and Business Continuity Coordinator and hired consultant, Woodard & Curran. The core planning team included over a dozen campus representatives who were involved in various aspects of the project and data collection activities and outside stakeholders were also involved. The core planning team met on a regular basis and was responsible for the following activities:

- Providing relevant information, plans, documents and data that was utilized during the preparation of the plan,
- Identifying natural and human hazards and assessing their past and potential future impact,
- Reviewing and evaluating the hazard ranking and assessment,
- Evaluating goals and objectives for mitigation activities,
- Developing potential projects that would help UMass Boston demonstrate progress in meeting goals and objectives,
- Participating as engagement stakeholders and supporting public meeting events,
- Reviewing and commenting on the plan drafts, and
- Revising, adopting and maintaining the Multi-Campus Hazard Mitigation Plan and UMass Boston Campus Annex Plan.

Hazard Identification

For the purposes of this Hazard Mitigation plan, identifying natural and human hazards included detailing geographically (if applicable) where an event has occurred historically, where is likely to occur in the future, and how substantial the event may be. Research was conducted using relevant documentation such as FEMA guidance documentation, local and state hazard mitigation plans and campus master plan and strategic planning documents. The hazards were then filtered by utilizing current and historical data points from various sources including but not limited to FEMA, NOAA, NCDC, USGS and the US Census. Finally, UMass Boston analyzed the findings of each natural and human hazard and cross referenced the information with anecdotal data points to develop a final list of hazards that have and will continue to impact UMass Boston, as listed in **Table ES-1.**

ES-Table 1: Natural & Human Hazards Impacting UMass Boston

Natural Hazards	Human Hazards
Coastal Erosion	Weapons of Mass Destruction
Coastal Storm	Civil Disturbance
Flood	SCADA Failure
Drought	HazMat Release
Earthquake	Bomb Threat
Extreme Heat	Vandalism
Hailstorm	Methane Emissions
Hurricane	Proximity to Flight Path
Tornado	Arson
Winter Storm	Violent Criminal Incident
Thunderstorm/Lightning	Robbery/Burglary
Tsunami	Pandemic
Ice Storm	Explosion
Urban Fire	Cyberattack/Cyberterrorism
Windstorm	Proximity to Gas Tank at Commercial Point
	Armed Attack/Active Shooter
	Industrial Accident (Fixed/Transport) - Construction
	Failure of Building Materials / Building Deterioration
	Critical Infrastructure Failure

Each hazard has been thoroughly profiled and discussed within the Hazard Mitigation Plan and the UMass Boston Campus Annex Plan.

Vulnerability & Impact Assessment

The purpose of assessing risks, determining vulnerability and estimating losses is to determine how UMass Boston assets may be affected by various hazard events. UMass Boston compiled a list of campus buildings and assets and then evaluated their vulnerability based on a loss of function and total damage calculation using the FEMA methodology as detailed in the Hazard

Mitigation Plan. The specific calculations were then used to identify if impacted, which buildings may sustain the most damage to structures and contents.

Goals & Objectives

UMass Boston used the identification, profiling and vulnerability assessment of natural and human hazards that have or may impact them in the future to establish planning goals and objectives that provide the basis for the development of the proposed hazard mitigation projects. The establishment of goals and objectives was based upon a clear understanding of the hazards that have a potential to impact the University community, what the risks associated with each hazard are and where vulnerabilities exist, as well as the University's commitment to reducing future vulnerability and mitigating risks where possible. Five main goals were developed, they include:

1) Protect existing and future assets from known hazards by implementing mitigation projects to minimize potential losses and ensure public health and safety.
2) Maintain a continuity of campus business operations during and after a hazard event.
3) Create and maintain a safe, secure environment for the campus population before, during and after a hazard event.
4) Communicate natural and human hazard information to the campus community and improve education and outreach efforts regarding their potential impact.
5) Proactively protect existing and future campus assets from known hazards by incorporating mitigation activities into capital improvement and infrastructure planning.

Mitigation Activities & Action Plan

Based on the vulnerability and impact assessment and goal setting phase, UMass Boston used this information to develop projects and mitigation activities. Most of the action items were focused on mitigating flooding, coastal storms, coastal erosion and hurricane impacts. The action items proposed meet the FEMA STAPLEE criteria and are generally socially acceptable to the community, technically feasible, protective of or beneficial to the environment and are backed by legal authority and consistent with current laws, consider economic benefits and costs and include environmental considerations. Each project was given a qualitative high, medium or low ranking based on these criteria.

Plan Implementation, Maintenance & Adoption

The implementation of the Hazard Mitigation Plan at UMass Boston will be overseen by the Emergency Management and Business Continuity Coordinator, Anne-Marie McLaughlin. Regular plan maintenance and revision activities have been considered and detailed in this document. Key to its success will be how well this plan is integrated into other UMass Boston planning mechanisms that either directly or indirectly relate to the Hazard Mitigation Plan.

1. INTRODUCTION

The University of Massachusetts (UMass or University) is undertaking a system-wide effort to develop hazard mitigation plans for all of its campuses. This Annex A coupled with the introductory sections of the Multi-Campus Hazard Mitigation Plan represents the Hazard Mitigation Plan for the University of Massachusetts Boston (UMass Boston). The purpose of this plan is to assist UMass Boston in the identification of natural and human hazards that could impact the campus, and reducing the risk associated from applicable hazards through the development of campus-specific hazard mitigation actions. The plan also identifies and discusses funding mechanisms to support the implementation of the mitigation actions.

The development of this plan is parallel to a time of transformational change as the campus is in the process of implementing its 25 Year Master Plan. The 25 Year Master Plan (Master Plan) is intended to "transform the UMass Boston campus into a modern, green, inviting destination." This effort involves the addition of state of the art academic buildings, renovation of existing buildings, the addition of the first campus residential hall, relocation of campus utilities and roadways, advancements in on-site energy generation, stabilization of the shoreline and other campus improvements. Through the execution of the Master Plan, the environment on campus will be extremely dynamic and involve significant development and construction activities over the next ten years.

1.1 UMASS BOSTON OVERVIEW

Located in Boston, Massachusetts (Suffolk County), at 100 Morrissey Boulevard, UMass Boston is the second largest campus in the UMass System and located three miles from downtown Boston. The campus is surrounded by Boston Harbor and Dorchester Bay and is in close proximity to Interstate-93 and Logan Airport. The campus is also located directly adjacent to the Massachusetts Archives Division and the John F. Kennedy Presidential Library and Museum which is dedicated to the United States 35th president. The building is home to the Massachusetts Archives and Commonwealth Museum, a branch of the Judicial Archives, the Massachusetts Historical Commission, the State Record Center and the future home of the Edward M. Kennedy Institute for the United States Senate.

UMass Boston is a public research university. The campus has outstanding academic resources and a diverse student body, consisting of nearly 16,000 undergraduate and graduate students. The University consists of ten colleges and schools that offer over 100 undergraduate and 50 graduate programs. The colleges and graduate schools are staffed by approximately 2,500 faculty, professional and classified employees. The campus includes the resources of a major research university, in an intimate setting with a 16:1 student-to-faculty ratio. As a result of its growing reputation and ranking among the best in the northeast by The Princeton Review, the campus is experiencing growth in enrollment and research dollars.

The UMass Boston campus is currently going through significant and transformative change as it implements its twenty-five year campus Master Plan. This effort, which will continue through the next decade and beyond, will add state of the art facilities and residence halls and redesign the traffic patterns and infrastructure layout on the campus. UMass Boston has also purchased the former Bayside Exposition Center Property (Bayside Expo) that is located in close vicinity to the campus and intends to utilize this space in the future.

1.1.1 Campus History

UMass Boston was established in 1964 and opened its doors in 1965. Its original location was in Park Square in a renovated building in downtown Boston. In order to accommodate additional enrollment, in 1968 school officials decided to move the campus to its current location. The new campus opened in January 1974 and consisted of McCormack Hall, Wheatley Hall, the Science Center, Healey Library, and the Quinn Administration Building. In 1982 Boston State College was incorporated into UMass Boston and tripled its enrollment and increased the number of undergraduate and graduate programs offered.

The campus is located on a 100 acre former municipal landfill on Dorchester Bay. Therefore, the subsurface conditions on the main portion of the campus are unique and compaction considerations are incorporated into all construction and building projects. Potential methane emissions resulting from the former landfill are mitigated via venting, monitoring and methane emission systems in existing and new buildings where necessary.

Photo: *UMass Boston 1974, http://www.umb.edu/the_university/history/roots*

1.1.1.1 Calf Pasture Pumping Station

The Calf Pasture Pumping Station, a historic sewage treatment facility located on the UMass Boston campus, is listed on the National Register of Historic Places as an individual property (listing date was August 2, 1990). The area of the UMass Boston campus was a cow pasture before it became a municipal landfill and it was used as a Boston sewer line and pumping station. This was the first sewage pumping station in the country and played a role in stopping breakouts of cholera.

Photo: Calf Pasture Pumping Station, MACRIS Database

1.1.2 City of Boston

The City of Boston is located in Suffolk County in southeastern Massachusetts and according to the 2010 US Census, has a population of approximately 617,594. The city plays a major role in a larger metropolitan area known as Greater Boston which is home to nearly 4.5 million people and known as a commuting region for hundreds of thousands of people in Massachusetts and nearby areas of New England.

Figure 1: Boston, MA Location Map

Boston is home to a large number of colleges and universities and is recognized as an area of innovation. Over two thirds of Boston's land area did not exist when it was originally founded. Over time, gravel and fill has been brought into Boston to create the area commonly known as Back Bay as well as other parts of the city, including the UMass campus.

The greater Boston area typically experiences cold, snowy winters and generally warm, humid, rainy summers but due to its location adjacent to the ocean, can be influenced by coastal weather patterns directly. Nor'easters, snowfall events and thunderstorms are common. The City of Boston's climate data for the last three decades is shown in **Table 1-1**.

Table 1-1: Climate Data for Boston 1981 - 2010

	Jan	Feb	March	April	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Average High	35.8	38.7	45.4	55.6	66.0	75.9	81.4	79.6	72.4	61.4	51.5	41.2
Average Low	22.2	24.7	31.1	40.6	49.9	59.5	65.4	64.6	57.4	46.5	38.0	28.2
Average Rainfall	3.36	3.25	4.32	3.74	3.48	3.68	3.43	3.29	3.44	3.94	3.99	3.78
Average Snowfall	14.0	11.3	7.8	1.9	0	0	0	0	0	0	1.3	8.8
Source: *NOAA Climate Data for Boston, Logan Airport (1981 – 2010)*												

1.1.3 Campus Location & Environment

UMass Boston embraces and values its urban context and proximity to the City of Boston. While somewhat separated from the City due to its location on the peninsula, surrounding areas are extremely busy and densely populated. Boston Harbor and Dorchester Bay are very active places that house harbor cruises and boat traffic.

Morrissey Boulevard is the main entrance point to campus which can be a very busy and a heavily trafficked transportation route. The portion of Morrissey Boulevard to the west of campus abutting the Bay is subject to periodic flooding that has caused this portion of the road to be closed occasionally, causing ingress and egress issues.

The campus is located on the flight path to the Logan International Airport so air traffic overhead is routine. There is also a liquefied natural gas facility located across the Bay. While currently not located on campus, residential apartments are close by and house many of the University's students. Boston College High School is also in close proximity. Less than one mile from campus is the Massachusetts Bay Transit Authority (MBTA) Red Line to the JFK/UMass subway station and the Old Colony Line commuter rail. UMass offers shuttle buses to/from the Red Line.

The UMass Boston campus includes a variety of buildings on more than 122 acres adjacent to the harbor on Columbia Point peninsula. (UMass Boston is also associated with five buildings on the island of Nantucket that were not considered for the purposes of this project.) A list of existing buildings on the campus can be found in **Table 1-2**. There are more than two million square feet of built space on campus (not considering the buildings being constructed under the campus 25 year Master Plan).

Table 1-2: UMass Boston Campus Building Information

Name of Building	Date Construction Completed	Gross Square Feet	Address in Boston, MA	Building Function
Campus Center	2004	330,000	100 Morrissey Boulevard	Office/Event
Clark Athletic Center: Gymnasium, Pool, Rink	1977	126,427	100 Morrissey Boulevard	Athletic Facilities
Healey Library	1978	337,446	100 Morrissey Boulevard	Library/Office/Classroom
McCormack Hall	1975	266,060	100 Morrissey Boulevard	Office/Classroom
Quinn Administration	1973	96,897	100 Morrissey Boulevard	Office
Salt Water Pump House	1974	4,314	100 Morrissey Boulevard	Central Utilities Distribution
Science Center	1974	297,952	100 Morrissey Boulevard	Laboratory/Classroom/Office
Service & Supply	1972	74,295	100 Morrissey Boulevard	Office/Service
Substructure/former Parking Garage	n/a	n/a	100 Morrissey Boulevard	Vacant
Utility Plant	1974	27,886	100 Morrissey Boulevard	Central Utilities Distribution
Phillis Wheatley Hall	1973	268,551	100 Morrissey Boulevard	Office/Classroom
Bayside Expo Property	Late 1960s	275,000	200 Mt. Vernon Street	* Exact construction date is unknown • 0.5 miles from campus • 20 acres • Site purchased in 2010 • Future redevelopment
Listed in National/State Register Historic Resources				
Calf Pasture Pumping Station (CPPS)	Unknown	Unknown	435 Mt. Vernon Street	Vacant/Unoccupied (Former sewage treatment facility)
Gatehouse (CPPS)	Unknown	Unknown	435 Mt. Vernon Street	Vacant/Unoccupied
West Shaft Entrance Building (CPPS)	Unknown	Unknown	435 Mt. Vernon Street	Vacant/Unoccupied

According to the 2012-2013 UMass Capital Plan update, except for the Clark Athletic Center (1979) and the Campus Center (2004), the UMass Boston campus and buildings were all built at nearly the same time, opening to students in 1974. The Commonwealth provided funding for the original construction of the "Harbor Campus," but it did not provide funding to correct

significant construction deficiencies identified shortly after the opening of the campus. Like nearly all academic institutions, the university's budget for operations, maintenance, and planned renewal has not been sufficient to prevent the accumulation of deferred maintenance. While buildings of this age are not unique on university campuses, additional challenges are presented when an entire campus of buildings reaches this juncture simultaneously.

1.1.3.1 UMass Boston Emergency Services

UMass Boston has a designated office for Emergency Management and Business Continuity with a focus on preserving and enhancing the safety of the campus. Recent projects completed by this office include reviewing and revising emergency operations and continuity of operations plans and developing a personal preparedness guide for members of the campus community.

Other departments that are closely involved with Emergency Services include the Department of Public Safety and the Environmental Health and Safety Office.

1.1.3.2 Infrastructure & Utilities

Utilities at UMass Boston are distributed from a centralized Utility Plant. In May 2010, UMass Boston completed an Energy and Utility Master Plan. According to the plan, existing water, gas, electric, telephone and CATV utilities are supplied to the campus from Mount Vernon Street and/or Morrissey Boulevard. Sanitary wastewater from the campus discharges to Mount Vernon Street and stormwater runoff discharges to Dorchester Bay and to a storm sewer on Mount Vernon Street that is managed by the Boston Water and Sewer Commission (BWSC). The utility plant located on campus provides chilled water to the campus and the heat from this infrastructure is cooled by salt water that is supplied from the on-campus salt water pump house. UMass Boston receives its drinking water from the BWSC system.

1.1.4 Future Campus Development – 25 Year Master Plan

During the hazard mitigation planning process, it is important to incorporate both existing campus conditions and future development and expansion. Given that the UMass Boston campus transformation will continue over the 5 year validity period of this plan, information regarding the specific development components of the 25year Master Plan has been incorporated throughout this plan.

In 2006, UMass Boston embarked upon a strategic planning process to discuss how to transform the school in the future and reach its potential as the only public university in Boston. The discussions about future campus development were preceded by the deteriorating condition of the existing campus substructure. One goal that was identified was to "create a physical environment that supports teaching, learning, and research." To meet this goal, the university prepared a 25-Year Master Plan for the campus. Future changes to the campus will include both building and land use changes with special attention being paid

to site locations, open space, water access and integration with the surrounding community. Currently, there are no residence hall facilities on campus; however they are included in the overall Master Plan as a component that will be added.

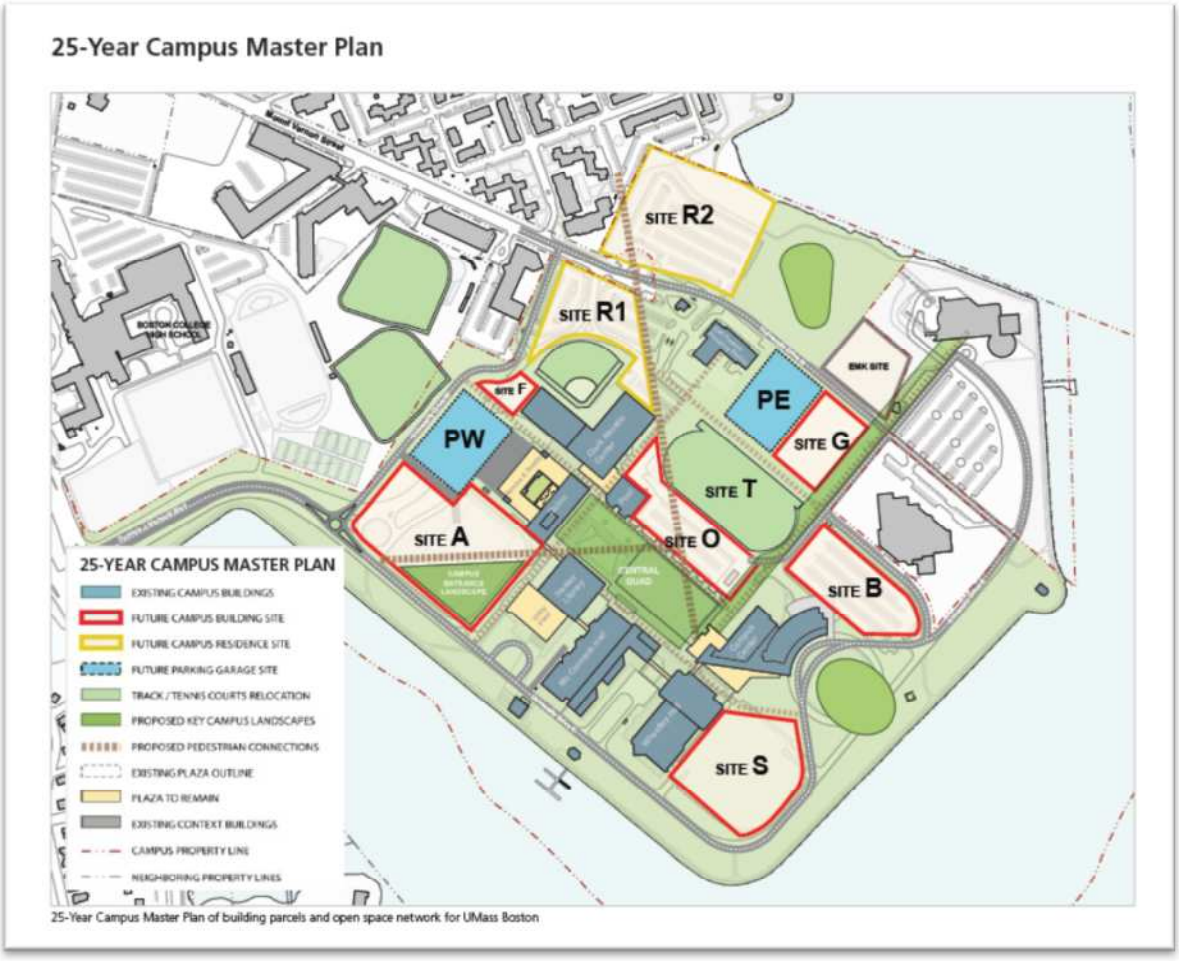
During the extensive Master Planning process that focused on addressing the physical needs of the campus there were over 160 interviews, meetings, workshops, presentations and public meetings to solicit input. The first phase of the 25-year Master Plan implementation (2008 – 2017) will result in the key projects noted in **Table 1-3.**

Table 1-3: UMass Boston 25 Year Master Plan – Future Campus Development

	Date	Square Feet	Estimated Cost
Integrated Sciences Complex	Fall 2014	220,000	$185,000,000
General Academic Building No. 1	Mid 2015	180,000	$113,000,000
McCormack Hall Renovation	2014 - 2015	No Change	TBD
Wheatley Hall Renovation	2014 - 2015	No Change	TBD
Utility Corridor and Roadway Relocation	Spring 2013	N/A	$150,000,000
Harbor Walk Improvements and Shoreline Stabilization	In design phase	800 linear feet	TBD

A summary of the major construction components of the Master Plan are shown in **Figure 2: 25-Year** Campus Master Plan

Figure 2: 25-Year Campus Master Plan



The location of any new construction on campus has an established base elevation of 5 feet above the current 100-year flood elevation. According to the February 2013 "Preparing for the Rising Tide" report, the new campus buildings will not be immediately vulnerable to surface flooding from a coastal storm. The major vulnerabilities for the UMass Boston campus include flooding of campus entrances both Morrissey Boulevard and Mount Vernon Street and flooding of the Bayside Expo property.

The 25-year Master Plan was unveiled in 2009 and included a phased plan to transform the original 1970s campus into a cutting edge environment. The first phase of implementing the Master Plan (2008 through 2017) is in progress, with various components in the design and construction phases. These components consist of the following:

- **Integrated Sciences Complex (ISC)** – The ISC will be the first new academic building to be constructed on campus in nearly 40 years. The ISC is located adjacent to the Quinn Administration Building and the Healey Library and is the first building visible when entering the campus. Groundbreaking was initiated in June of 2011. The building is currently under construction and has an anticipated completion date Fall 2014.

The building will consist of 220,000 gross square feet of space and will include state of the art research and teaching laboratories. The building will be the first green building on campus and is projected to earn a Silver certification by the U.S. Green Building Council's Leadership in Energy and the Environmental Design (LEED). The total cost of the project is $185 million.

Photo: *Integrated Sciences Complex, UMass Boston website*

- **General Academic Building No. 1 (GAB No. 1)** - The GAB No. 1 will be the second new academic building on the campus and located on the existing North Parking Lot. Groundbreaking was initiated in early 2013 and the building is projected to be complete in 2015. The building will consist of approximately 190,000 square feet within four stories and will offer general use classrooms, teaching laboratories, art studios, theater/recital halls, faculty and staff offices, specialized spaces, study areas, a student cafe and student lounge areas. This building is also projected to receive LEED Silver certification and costs approximately $131 million.

Photo: *General Academic Building No. 1, UMass Boston website*

- **McCormack Hall and Wheatley Hall Renovations** – Upon completion of the ISC and GAB No. 1, academic space within McCormack Hall and Wheatley Hall will be vacated presenting a timely opportunity for renovation. Very little renovation has been done on these buildings since they were originally constructed in the 1970s. The renovations will include gut-level lab renovations, reconfigured classrooms, modernized spaces and aesthetic improvements. This will also serve as an area to relocate the departments from the existing Science Center to enable its demolition. **Utility Corridor and Roadway Relocation (UCRR) –** In order to accommodate future buildings and enable reliable and redundant campus utility services, a new utility corridor and roadway network will be developed. The project will enable demolition of the severely deteriorated substructure housed in garages that were closed in 2006 but still contain campus utilities. This project is currently in design and construction and began in spring of 2013 with upgrades to the existing central utility plant.

  The utility corridor will centralize and bring major campus utilities together underground. It will be comprised of nearly 17 miles of new pipe and include domestic fire and water, sanitary wastewater, chilled and hot water, natural gas, electricity, telecommunications and data.

  The roadway network will reconfigure perimeter traffic patterns and incorporate bike lanes, tree lawns and sidewalks throughout the campus. The current University Drive

North roadway will be relocated to the northeast to align with the end of Mount Vernon Street. This will provide direct access to the JFK Library, the Massachusetts Archives, and the future Edward M. Kennedy Institute. Hundreds of new trees will be planted and 275 roadway and pedestrian light fixtures will be installed.

- **HarborWalk Improvements and Shoreline Stabilization –** This project was initiated in the spring of 2012 and includes an 800 linear foot section of the HarborWalk located between the JFK Library and Museum and Old Harbor Park. The goal of the project is to protect the shoreline to prevent further coastal erosion by stabilizing the existing edge and eliminating the loss of debris into the harbor and to enhance public accessibility and access to the waterfront.

Other projects associated with the 25 -year Master Plan consist of the addition of a second general academic building, parking garage, residence hall, a second utility plant, Bayside Expo Center demolition, re-use of the Calf Pasture Pumping Station, and demolition of the Science Center and substructure as discussed previously. More information will become available on these projects as planning continues. Additional information on the Bayside Expo Center and related Edward M. Kennedy Institute for the United States Senate includes:

- **Bayside Exposition Center** – UMass Boston purchased the site of the former Bayside Exposition Center in May 2010. The center is located on the waterfront a half mile from the main campus on Mt. Vernon Street in the Dorchester neighborhood. The site is 20 acres. In the short term the site will be used for temporary parking and staging during the on-going construction projects. In the future, the property represents tremendous potential for future development. Planning for future use is underway and the site will be incorporated into the 25-year Master Plan.

Photo: *Bayside Exposition Center & UMass Boston Campus, UMass Boston website*

- **Edward M. Kennedy (EMK) Institute for the United States Senate** – The EMK Institute is in the process of being built on the campus next to the JFK Library. Groundbreaking for the Institute took place in April 2011 at the future site.

This campus transformation will be considered in subsequent sections of this hazard mitigation plan. In the short term, construction activities will be continuing on campus which present their own hazards but also could impact other natural and human hazards that could occur. Aside from the building construction, the roadway relocation project will impact campus accessibility and transportation routes throughout the campus which present additional disruptions that could occur during a hazard event. While students are not currently housed on campus, this will change in the future and add a new residence hall to the campus. When finalized, should a natural or human hazard event occur requiring campus evacuation, a new element of relocating students who reside on campus will need to be considered.

1.1.5 Community Involvement

UMass Boston is connected to its environment and has partnerships with local schools and businesses and participates in various community programs and sporting activities. UMass Boston operates over 30 research centers and institutes. Through these programs, centers and events, UMass Boston brings various populations to campus for short and extended periods of time. The John F. Kennedy Presidential Library and the Massachusetts State Archives also draws various dignitaries to campus as will the future EMK Institute for the United States Senate. These unique visiting populations are important considerations in hazard mitigation planning. Three of the programs on campus that draw different populations are highlighted below. These three are just a snapshot intended to illustrate differing populations that are on campus in addition to the regular campus faculty, staff and students and are not intended to be all inclusive.

- Massachusetts Small Business Development Center Network (MSBDC) - This center supports small businesses by providing free business advisory services and workshops.
- Osher Lifelong Learning Institute (OLLI) – OLLI offers enrichment programs and courses to those ages 50 or older that are retired or partially retired.

- GoKids Boston – GoKids Boston strives to improve the health and wellness of pre-teens and teens by providing personalized support and instruction.

The above programs highlight involvement on campus from young people, business people and the older generations. UMass Boston also hosts summer programs for K-12 grades, has a large Veteran population attending classes as well as those with disabilities. Sporting events and other events also draw wide audiences of various populations.

2. PLANNING PROCESS

The Hazard Mitigation Plan planning process and stakeholders involved in this effort are outlined in the following sections. The planning process included stakeholder engagement completed through a variety of means, involving both on and off campus participation. Opportunities for involvement consisted of stakeholder meetings, interviews, focus groups, public meetings and informal opportunities to provide feedback made available throughout the process. The stakeholders involved included a wide cross section of campus representation.

2.1 PLANNING TEAM

The UMass Boston planning team efforts associated with this project were coordinated by Anne-Marie McLaughlin, UMass Boston Emergency Management and Business Continuity Coordinator. Anne-Marie McLaughlin is the UMass Boston representative on the Hazard Mitigation Planning Steering Committee and is the primary point of contact at UMass Boston for this Hazard Mitigation Plan.

The first step in the process was to establish a campus specific Hazard Mitigation Planning Team to support Emergency Management and Business Continuity Coordinator, provide input into the hazard assessments and overall plan, and represent a broad cross section of the campus. It was determined that the core essential campus stakeholders to be involved in the plan consisted of representation from Emergency Management and Business Continuity, Facilities, Environmental Health & Safety, Senior Administration and Information Technology. Through discussions of the existing groups already established on campus, it was determined that the existing campus Safety Committee consisted of a large portion of the representation desired for this hazard mitigation planning effort. The Safety Committee focuses on emergency management, preparedness and business continuity (EM/BC) and consists of representatives from Environmental Health & Safety (EHS), fire, police, campus services, parking and transportation, continuing education, contracts and compliance, food services, student affairs, customer service, Provost's office, research, and parking and transportation. For this hazard mitigation planning effort the membership of the Safety Committee was supplemented with others identified that could provide additional, important input into the Plan.

The UMass Boston Hazard Mitigation Planning Team is presented in **Table 2-1**.

Table 2-1: UMass Boston Hazard Mitigation Planning Team

Person	Title
Ellen O'Connor	Vice Chancellor, Administration & Finance
Anne-Marie McLaughlin	Emergency Management & Business Continuity Coordinator
Peter Bonitatibus	Public Safety Sargent
William Collins	Director, Diversity & ADA Compliance
Shawn Curry	Interim Deputy Director, Project Management - Facilities Administration
Denise Duggan	Deputy Director, Facilities Administration
Zehra Schneider Graham	Interim Director, EH&S

Person	Title
Debra Gursha	Fire & Life Safety Officer (EH&S)
Patricia Halon	Director, General Medicine
DeWayne Lehman	Director, Communications
Steve Martinson	Director, Parking & Transportation
Darryl Mayers	Director, Contract & Compliance
Michael McGerigle	Deputy Director, Utilities & Energy Management
Kevin Murphy	Associate Director, Institutional Research& Policy Studies
James Overton	Interim Vice Chancellor, Student Affairs
Margaret Peterson Pinkham	Director, Human Resources
Dorothy Renaghan	Assistant Vice Chancellor, Facilities Management
Jamie Soule	Director, IT Communication & Infrastructure Services
Holly Sutherland	Manager, Construction & Master Plan Communications
Chris Sweeney	Director, Marine Operations
Carine Tamasang	Office of Diversity & Inclusion

These campus representatives were involved in important aspects of the project and data collection activities, however other campus representatives as well as outside stakeholders were also involved. **Table 2-2** presents an overview of all of the stakeholders engaged in the UMass Boston Hazard Mitigation Plan. Each of the opportunities for stakeholder engagement will be discussed in **Section 2.3**.

Table 2-2: Stakeholders Engaged in UMass Boston Hazard Mitigation Plan

Person	Title	Entity	Attended Oct. 1, 2012 Steering Committee Kick-Off Meeting	Attended Nov. 13, 2012 Campus Kick-Off Meeting	March 4 & 7, 2013 Stakeholder Interviews	Attended March 11, 2013 Hazard Identification & Risk Assessment Meeting	Attended June 12, 2013 Campus Hazard Mitigation Goals, Hazard Profiles, Loss Estimates and Projects Meeting	Attended June 12, 2013 Hazard Mitigation Projects Focus Group	Attended June 12, 2013 Public Meeting #1	Attended December 4, 2013 Presentation of Draft Plan Meeting	Attended December 4, 2013 Public Meeting #2
Anne Scrivener Agee	Former Vice Provost for Information Technology and Chief Information Officer	UMass Boston			X						
Peter Bonitatibus	Sargent, Department of Public Safety	UMass Boston		X	X						
William Collins	Director of Diversity and ADA Compliance, Office of Diversity & Inclusion	UMass Boston					X		X		
Shawn Curry	Interim Deputy Director of Facilities for Project Management, Facilities Department	UMass Boston			X	X	X	X	X	X	X
Denise Duggan	Deputy Director of Facilities for Administration, Facilities Department	UMass Boston		X						X	
Marsha Florio	Senior Assistant to the Vice Chancellor of Athletics, Recreation and Special Projects & Programs, Athletics and Recreation Department	UMass Boston		X							
Richard Graham	Interim Deputy Director of Facilities for Planning and Information, Facilities Department	UMass Boston			X			X			

Person	Title	Entity	Attended Oct. 1, 2012 Steering Committee Kick-Off Meeting	Attended Nov. 13, 2012 Campus Kick-Off Meeting	March 4 & 7, 2013 Stakeholder Interviews	Attended March 11, 2013 Hazard Identification & Risk Assessment Meeting	Attended June 12, 2013 Campus Hazard Mitigation Goals, Hazard Profiles, Loss Estimates and Projects Meeting	Attended June 12, 2013 Hazard Mitigation Projects Focus Group	Attended June 12, 2013 Public Meeting #1	Attended December 4, 2013 Presentation of Draft Plan Meeting	Attended December 4, 2013 Public Meeting #2
Zehra Schneider Graham	Deputy Director of Environmental Health and Safety	UMass Boston		X	X	X	X	X		X	
Debra Gursha	Fire and Life Safety Officer, Environmental Health & Safety	UMass Boston		X	X		X	X		X	
William Hagar	Associate Dean of Schools/Colleges, CSM – Dean's Office	UMass Boston								X	
Patricia Halon	Interim Director - General Medicine, University Health Services	UMass Boston		X		X					
Jeffrey Hescock	Emergency Planning & Business Continuity Manager	UMass System	X	X			X		X		X
Gail Hobin	Assistant Vice Chancellor for Community Relations, Office of Community Relations	UMass Boston			X						
Mary House	Project Manager	Woodard & Curran	X	X	X	X	X	X	X	X	X
MaryKristin Ivanovich	Technical Lead	Woodard & Curran	X	X	X	X	X	X	X	X	X
Mark Jannoni	Associate Dean of Students, Vice Chancellor of Student Affairs Department	UMass Boston			X					X	
DeWayne Lehman	Director of Communications, Office of Communications	UMass Boston		X							

Person	Title	Entity	Attended Oct. 1, 2012 Steering Committee Kick-Off Meeting	Attended Nov. 13, 2012 Campus Kick-Off Meeting	March 4 & 7, 2013 Stakeholder Interviews	Attended March 11, 2013 Hazard Identification & Risk Assessment Meeting	Attended June 12, 2013 Campus Hazard Mitigation Goals, Hazard Profiles, Loss Estimates and Projects Meeting	Attended June 12, 2013 Hazard Mitigation Projects Focus Group	Attended June 12, 2013 Public Meeting #1	Attended December 4, 2013 Presentation of Draft Plan Meeting	Attended December 4, 2013 Public Meeting #2
Steve Martinson	Director - Parking & Transportation, Office of Transportation Services	UMass Boston		X						X	
Darryl Mayers	Assistant Vice Chancellor of Contract and Compliance, Procurement Department	UMass Boston		X	X		X	X	X	X	
Michael McGerigle	Deputy Director of Facilities for Utilities, Facilities Department	UMass Boston			X	X					
Anne-Marie McLaughlin	Emergency Manager, Office of Emergency Preparedness and Business Continuity	UMass Boston	X	X	X	X	X		X	X	X
Kevin Murphy	Associate Director of Institutional Research and Policy Studies, Office of Institutional Research and Policy Studies	UMass Boston		X						X	
Linda O'Brien	Director of Custom Service and Conference Support, Custom Service Center	UMass Boston								X	
Patrick O'Brien	Student Representative	UMass Boston			X						
Ellen O'Connor	Vice Chancellor for Administration and Finance, Administration and Finance Department	UMass Boston			X	X	X	X			
James Overton	Interim Vice Chancellor for Student Affairs, Office of the Vice Chancellor for Student Affairs	UMass Boston					X			X	

Person	Title	Entity	Attended Oct. 1, 2012 Steering Committee Kick-Off Meeting	Attended Nov. 13, 2012 Campus Kick-Off Meeting	March 4 & 7, 2013 Stakeholder Interviews	Attended March 11, 2013 Hazard Identification & Risk Assessment Meeting	Attended June 12, 2013 Campus Hazard Mitigation Goals, Hazard Profiles, Loss Estimates and Projects Meeting	Attended June 12, 2013 Hazard Mitigation Projects Focus Group	Attended June 12, 2013 Public Meeting #1	Attended December 4, 2013 Presentation of Draft Plan Meeting	Attended December 4, 2013 Public Meeting #2
Margaret Peterson Pinkham	Senior Director of Human Resource Operations, Human Resource Department	UMass Boston		X							
Dorothy Renaghan	Assistant Vice Chancellor for Facilities Management, Facilities Department	UMass Boston			X	X	X	X	X	X	X
Peter Schneider	Director of Environmental Health and Safety	UMass Boston			X						
James Soule	Manager of Information Technology Operations, Information Technology Communication & Infrastructure Services Department	UMass Boston		X						X	
Elaine Sudanowicz	Interagency Coordinator, Emergency Management Department	City of Boston			X						
Manickam Sugumaran	Professor of Biology - Protein Chemistry and Enzymology, Biology Department	UMass Boston			X						
Holly Sutherland	Manager of Master Plan and Construction Communications, Administration and Finance Department	UMass Boston		X	X	X	X			X	
Chris Sweeney	Director - Marine Operations, Marine Operations Department	UMass Boston		X		X	X			X	
Carine Tamasang	Administrative Assistant, Office of Diversity & Inclusion	UMass Boston					X				

Person	Title	Entity	Attended Oct. 1, 2012 Steering Committee Kick-Off Meeting	Attended Nov. 13, 2012 Campus Kick-Off Meeting	March 4 & 7, 2013 Stakeholder Interviews	Attended March 11, 2013 Hazard Identification & Risk Assessment Meeting	Attended June 12, 2013 Campus Hazard Mitigation Goals, Hazard Profiles, Loss Estimates and Projects Meeting	Attended June 12, 2013 Hazard Mitigation Projects Focus Group	Attended June 12, 2013 Public Meeting #1	Attended December 4, 2013 Presentation of Draft Plan Meeting	Attended December 4, 2013 Public Meeting #2
Andrew Weiss	Assistant Campus Planner, Campus Master Planning	UMass Boston								X	
Jesse Wright	Student Representative	UMass Boston			X						
Yvonne Vaillancourt	Director of Laboratories, Biology Department	UMass Boston			X						

2.2 EXISTING DATA AND REPORTS UTILIZED FOR THE PLAN

At the start of the project a data request was issued to UMass Boston for existing documentation related to hazard and vulnerability risk assessments, emergency preparedness efforts, and campus assets. The following presents a list of the information received and additional data sources that were utilized during the planning process.

- Campus Emergency Management Assessment Report - 2009
- Campus Emergency Management Assessment Report, University of Massachusetts, Boston Campus - 2009
- Epidemic/Pandemic Response Plan - 2010
- Emergency Operations Plan - 2012
- Emergency Public Information and Media Relations Plan
- Chancellor's Office Emergency Information - 2012
- UMass Boston 2011 Annual Security Report - 2011
- UMass Boston 2012 Annual Security Report - 2012
- Spill Prevention Control and Countermeasure (SPCC) Plan - 2008
- NPDES Phase II, Municipal Separate Storm Sewer System (MS4) Permit, Stormwater Management Plan, University of Massachusetts Boston - 2011
- Preparing for the Rising Tide (Douglas, Kirshen, Li, Watson, Wormser), 2013
- Multi-Hazard Mitigation Plan – Boston Annex, 2008
- City of Boston Natural Hazard Mitigation Plan – 2013
- Commonwealth of Massachusetts – State Hazard Mitigation Plan, 2010
- Campus Master Plan for University of Massachusetts Boston, 2009
- Energy and Utility Master Plan – University of Massachusetts Boston, 2010
- Marine Safety Plan, 2007
- Emergency Preparedness
- UMass Boston Fiscal Year 2012 – 2016 Capital Plan Update

Appendix A includes a bibliography of the documents that were provided by UMass Boston. Section 6.4 provides a detailed capability assessment that includes information regarding data and reports that were utilized during the planning effort.

2.3 STAKEHOLDER ENGAGEMENT

There were several opportunities for stakeholder engagement that included the above referenced response to data request, campus stakeholder meetings, one-on-one interviews, focus groups and public meetings. Each opportunity for stakeholder engagement and those involved are documented below.

2.3.1 Campus Kick-Off Meeting

On November 13, 2012 a campus kick off meeting was held at UMass Boston to initiate stakeholder engagement activities. The representatives in attendance are listed in **Table 2-2**. The meeting agenda, sign-in sheet and Power Point presentation are provided in **Appendix B**.

The topics reviewed during this meeting are presented below in **Table 2-3.**

Table 2-3: Topics Reviewed During Campus Kick-Off Meeting

Topic	Details
Project overview	Reviewed the goals of the project, background of the grant funding, and benefits to be achieved by the University.
Hazard mitigation planning	Introduced the concept of hazard mitigation planning including the planning phases, types of hazards to be included, and recent hazard events that impacted UMass campuses.
Approval process and requirements	Reviewed the requirements and expectations of FEMA/MEMA in order to achieve plan approval. Topics included the importance for documentation, stakeholder engagement, and focus on the importance of the process. FEMA's evaluation criteria was provided as a handout.
Components of hazard mitigation planning	Reviewed the planning process, hazard identification and risk assessment, mitigation strategy, and plan review, evaluation, and implementation. FEMA's hazard identification worksheet was provided as a handout.
Team roles and responsibilities	Roles and responsibilities consisted of participation in meetings, providing relevant documentation, identification and assessment of hazards, support outreach activities, review and comment on the draft Plan and support Plan implementation.
Project schedule	The project schedule was reviewed with interim and final deadlines. Approval by MEMA/FEMA is necessary by October 2014 to meet the obligations of the grant.
Project web site	Gave an overview of the project web site including login process and future content to be included.

The campus kick-off meeting provided a solid foundation upon which to move forward as a team. The meeting outlined the expectations and process to be followed to complete this Plan.

2.3.2 Stakeholder Interviews

On March 4, 2013 stakeholder interviews were completed to discuss hazards that have or could impact the campus, potential vulnerabilities to those hazards and assets that could be impacted. The interviews were completed on campus, unless otherwise noted, and each lasted up to one hour in duration. Interviews were completed both with individuals and groups and were conducted by Woodard & Curran and our teaming partner, Prism Security, who supported the human hazard risk assessment efforts. The interview matrix is provided in **Table 2-4.**

Table 2-4: UMass Boston Stakeholder Interview Matrix

	Department/Person	Department/Person
March 4, 2013		
9:00 - 10:00	IT - Anne Scrivener Agee	Administration & Finance - Ellen O'Connor
10:00 - 11:00	EHS - Peter Schneider, Zehra Schneider Graham, Debra Gursha & Darryl Mayers	Dean of Students - Mark Jannoni
11:00 - 12:00	Facilities - Dorothy Renaghan, Richard Graham, Shawn Curry & Mike McGerigle	Master Planning - Holly Sutherland
12:00 - 12:30	OPEN	OPEN
12:30 - 1:30	EM/BC - Anne-Marie McLaughlin	Student Representative - Jesse Wright
1:30 - 2:30	Department of Public Safety, Sergeant Peter Bonitatibus	Community Representative - Gail Hobin
2:30 - 3:30	College of Science & Mathematics, Laboratory Coordinator - Yvonne Vaillancourt	City of Boston Office of Emergency Management - Elaine Sudanowicz (via conference call)
3:30 - 4:30	Student Representative - Patrick O'Brien	
March 7, 2013		
	Faculty Representative - Manickam Sugumaran (via conference call)	

Interviews were conducted in an open format by one or two interviewers. An interview questionnaire (**Appendix C**) was prepared and distributed in advance, however this was intended only to give the interviewees a flavor for the types of topics to be addressed as opposed to a list of questions that would be strictly adhered to during the interview. The approach was instead to have the interviewee focus on the areas in which he/she had the most experience and information to share and not to be restrictive in the discussion.

As a result of the interviews, a series of themes were presented by the interviewees and are presented in **Table 2-5** by topic:

Table 2-5: UMass Boston Interview Topics & Themes

Topic	Themes
Campus Transformation	Campus administration is actively executing a campus master planning effort that will involve tremendous change and construction on campus over the next several years.
	There are areas of aged infrastructure and utility limitations present on campus. There is currently no redundancy in the water loop or salt water pump house. The four utility feeders come from the same substation to one central point on campus. There is a central utility plant on campus, located below grade. The utility corridor road relocation infrastructure project is intended to address many of these areas.
	Many travel at high speeds on campus roads due to the continuous circular nature of the layout. The road relocation project will address this area.
	There are challenges over the potential evacuation of the campus due to the single main point of campus access especially during on-going construction.
Utilities/Campus Assets	Buildings experience coastal impacts (salt).
	Any hazard that might shut down the University is of high concern. Utility failure is a high constant concern.
	There are interdependencies on campus associated with the JFK Library and the Massachusetts Archives.
	Water intrusion is common in many areas.
	Rare collections are located in Healey Library. The Library also houses historic information for the City of Boston and art studios.
	Catwalks located on campus are especially prone to vulnerability from structure failure, aging and potentially vulnerable.
	Motor vehicle accidents have occurred at the Morrissey Boulevard entrance.
Campus Setting and Surrounding Areas	The campus is located in a very urban environment.
	The campus is built on a former municipal landfill. Landfills are known to generate methane emissions.
	A Liquefied Natural Gas (LNG) facility is located in the harbor.
	The campus is on the flight path to the Boston airport.
	There is a dependency on Public Safety to notify neighbors of campus events (Columbia Point Associates).
Campus Population	There is a large population of people with disabilities on campus as well as a high K-12 population with various programs and events.
	There is high pedestrian movement across campus.
	In general there is an "open" feel on campus allowing accessibility to many campus areas. Many areas are not controlled by a swipe card system and in general individuals are not challenged when entering campus or campus facilities. In some cases secured areas, such as laboratories, are left open. There is also not a campus wide employee identification system.
	The campus is well known for hosting dignitaries.

All of these themes were important considerations that factored into the hazard identification and risk assessment process. Aside from these common themes, interviewees gave perspectives on hazards that had or could impact the campus and previous damages or campus impacts that had

been experienced from hazard events. A brief summary of the specific previous hazard events mentioned by interviewees includes:

- Flooding in the Morrissey Boulevard and Bayside Exposition Building areas,
- Roof damage from high wind events and Hurricane Sandy to Healey Library, Quinn Administration Building, Wheatley Hall, and Clark Athletic Center,
- Earthquakes,
- Occupy UMass Boston movement,
- Public property crimes,
- October 2012 bomb threat,
- Lab explosion and utility plant explosion,
- Property damages related to failure of building ceiling structures, and
- Access to closed areas on campus

The list is not meant to be all inclusive of past events experienced on campus and only represents events mentioned during the interviews. More specific information provided is presented in **Section 3**.

2.3.3 Hazard Identification and Risk Assessment Meeting

On March 11, 2013 a hazard identification and risk assessment meeting was held at UMass Boston to initiate the hazard identification and risk assessment process. The representatives in attendance are listed in **Table 2-2**. The meeting agenda, sign in sheet and Power Point presentation are provided in **Appendix D**.

The topics reviewed during this meeting are presented in **Table 2-6.**

Table 2-6: Topics Reviewed During Hazard Identification and Risk Assessment Meeting

Topic	Details
Overview of hazard mitigation planning process and meeting goal	A brief overview of the hazard mitigation planning process was provided as a review for meeting attendees. The meeting goal was to reach consensus on a ranked list of natural and human hazards that could impact the campus.
Overview of potential hazards	Campus specific considerations associated with hazard events were presented to the stakeholders and included summaries of previous studies, ongoing campus planning, and hazard mapping. Abbreviated hazard event profiles were presented.
Summary of interview discussions	Common themes shared by interviewees and specific hazard events mentioned were reviewed. Considerations resulting from the interviews were discussed as well as initial mitigation projects identified to address potential hazards.

Topic	Details
Hazard ranking methodology	The hazard ranking methodology was reviewed with the stakeholders and consisted of ranking the categories of frequency, severity, duration and intensity with a 0 to 5 scale. The categories were grouped into probability and consequence factors that could be weighted.
Group workshop hazard ranking	The stakeholder group reviewed the list of natural and human hazards identified and ranked each category using the 0 to 5 scale. The weighting of probability and consequence were assigned to reach a total rank for each hazard. Based on the numerical value of the ranking, each hazard was further categorized in groups of severe, high, medium and low.

Upon completion of the meeting, the campus stakeholders were provided with the finalized list of ranked hazards to reflect upon and make further modifications as necessary.

2.3.4 Hazard Mitigation Goals, Hazard Profiles, Loss Estimates, and Projects Meeting

On June 12, 2012 a hazard mitigation goals, hazard profiles, loss estimates and projects meeting was conducted at UMass Boston. The representatives in attendance are listed in **Table 2-2**. The meeting agenda, sign in sheet and Power Point presentation are provided in **Appendix E.**

The topics reviewed during this meeting are presented in **Table 2-7.**

Table 2-7: Topics Reviewed During Hazard Mitigation Goals, Hazard Profiles, Loss Estimates and Projects Meeting

Topic	Details
Hazard mitigation goals and objectives	The hazard mitigation goals, objectives and projects developed for the campus were presented to the stakeholder group for initial review and comment. Goals and objectives were tied to specific hazard events and mitigation projects were identified to address hazards.
Hazard event profiles	Detailed hazard event profiles were presented for natural hazards and the hazard rankings previously identified were reviewed against those profiles to determine if any modifications to the rankings were necessary. In a few cases, modifications to the rankings were made.
Building ratings	The methodology to assign building critically values was reviewed with the stakeholder group as well as the initial assignment of building critically values. As a result of discussion, select modifications were made to the building criticality values.
Loss estimates	The methodology for developing loss estimates was reviewed and findings associated with both specific hazards and non-hazard specific events were presented. A quantitative assessment was completed for non-hazard specific loss of function, floods and earthquakes. Qualitative assessments were completed for other hazard events.

Hazard mitigation projects	Specific hazard mitigation projects identified to address the various hazards that could impact campus were presented in relation to the specific hazard addressed and plan goals and objectives.
Public workshop	Stakeholders were briefed on the format and logistics associated with the first public workshop. All stakeholders were invited to participate. Public announcements were issued.

After the meeting, revised goals, objectives, hazard mitigation projects, and building criticality assignments were provided to the stakeholder group for further review and comment.

2.3.5 Campus Mitigation Projects Focus Groups

In order to develop the most comprehensive list of viable hazard mitigation actions and projects, small campus focus groups were held with the Facilities and EHS groups to complete a more in-depth review of the existing list of hazard mitigation actions and projects. These focus groups were also completed on June 12, 2013 and were attended by representatives outlined in **Table 2-2**. As a result of the focus groups, additional mitigation actions and projects were identified and insights were provided as to the highest priority from each group's perspective. Some of the highest priority projects discussed in each focus group are listed in **Table 2-8**:

Table 2-8: High Priority Projects Discussed by Focus Group

Facilities Hazard Mitigation Project Focus Group
1. ***Shoreline Stabilization*** - This shoreline and bank stabilization effort involves an approximate 800' area waterfront abutting the harbor which has been deteriorated and eroded as a result of natural events over time, with significant impacts from Hurricane Sandy tidal surge. Completion of this project will join two portions of the shoreline that have previously been stabilized on the JFK Library and State owned abutting areas. This area also contains a stormwater drainage system that is currently undersized, so the project will also involve armoring of the bank and an upgrade of the drainage system. The project is currently in the permitting phase and is scheduled to begin construction in the fall.
2. ***Bayside Drainage Improvements*** – Over the course of the next several years UMass Boston will be repurposing the Bayside Exposition property with current plans to demolish the existing buildings onsite and create a temporary major parking area for faculty, students and staff while parking garages on the main campus are constructed. The Bayside property experiences significant and repeat flooding during rain events, and has been identified by the City of Boston as a flood prone area. In order to safely use the property for parking and other future development, significant drainage improvements will need to be made and the site elevated. Before building demolition, a utility shed will be constructed to keep the utilities available for longer term site development. The current plan is for building demolition to occur in the fall 2013 or spring 2014.
3. ***Redundant Utility Systems*** - UMass Boston has several diesel emergency generators that are undersized for the demand in the case of an extended power outage enough oil storage capacity to continue running for approximately two days. This proposed project involves enhancing the emergency power system by building a generator farm that incorporates size upgrades; and for the use of natural gas to build utility redundancy on campus. The generator farm will relocate/replace below grade generators to reduce the potential for failure due to flooding.

Environmental Health and Safety Hazard Mitigation Project Focus Group
1. Healey Library sprinkler system and access improvements.
2. Utility interruption plan.
3. Assessment of building facades.

Other mitigation projects were discussed by the Facilities Focus Group as priorities but not in as much detail as the top mitigation projects listed above. These other mitigation projects consisted of the following:

- Healey Library sprinkler system and access improvements
- Roof replacements and improvements to McCormack Hall, the Service and Supply Building, and Clark Athletic Center
- The development and implementation of a second utility plant
- Study and potential improvements to existing methane monitoring system
- Relocation of data center into the Service and Supply building

The Environmental Health and Safety focus group noted the following additional mitigation projects that were discussed as well.

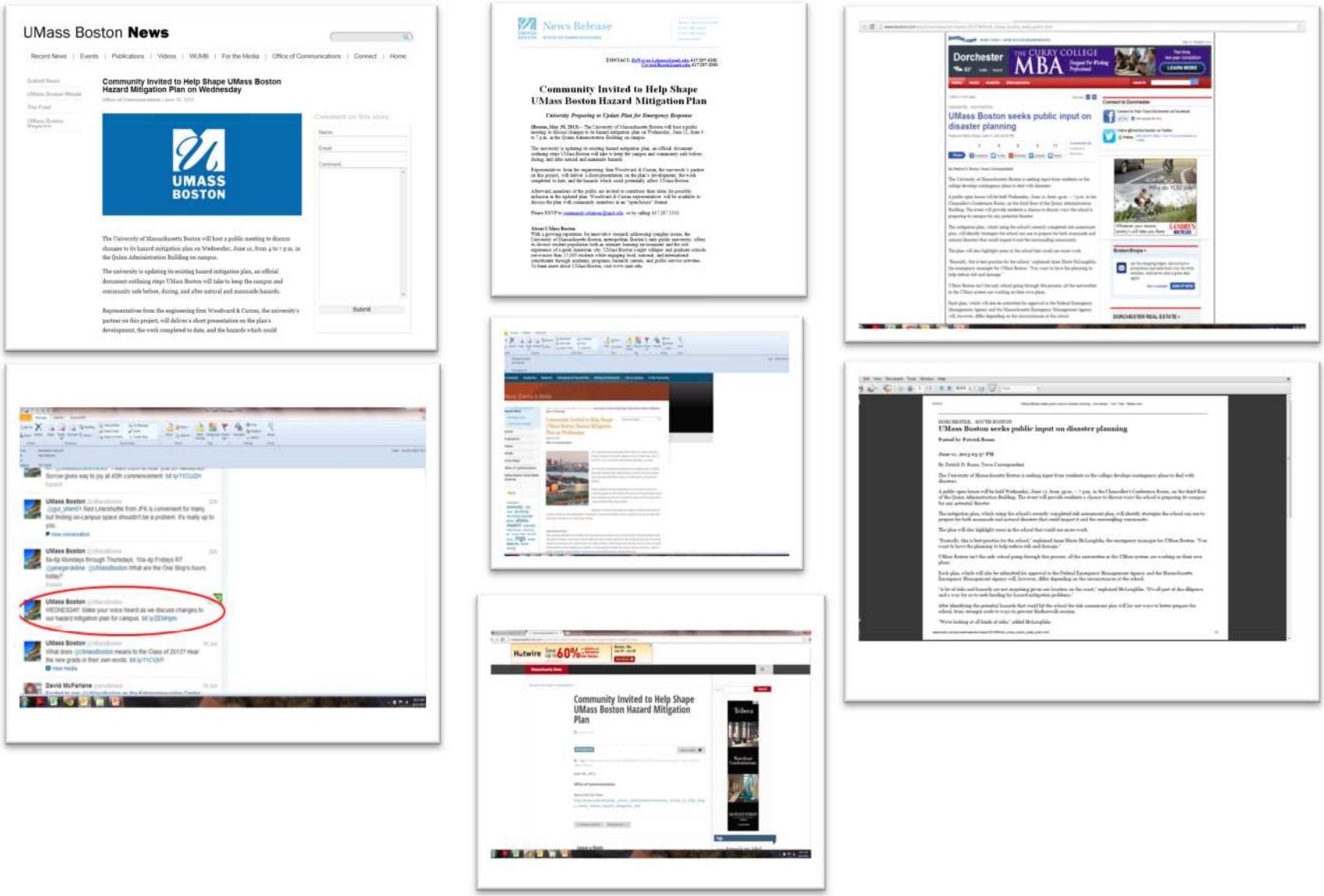
- Purchase of campus lockdown technology
- Institute an employee identification system
- Conduct annual training events for specific human hazards beyond active shooter training sessions which are already completed.

2.3.6 Public Meeting No. 1

On June 12, 2012 the first public meeting regarding this hazard mitigation planning process was held on the UMass Boston campus. The meeting was advertised using a variety of venues with support from the UMass Boston public relations department (see **Figure 3**). The means for advertising consisted of:

- Twitter
- Posting on UMass Boston web site
- UMass Boston News
- Listing on area websites
- Article featured in Your Town
- Personal email invitations

Figure 3: Public Meeting No. 1 Advertising Efforts

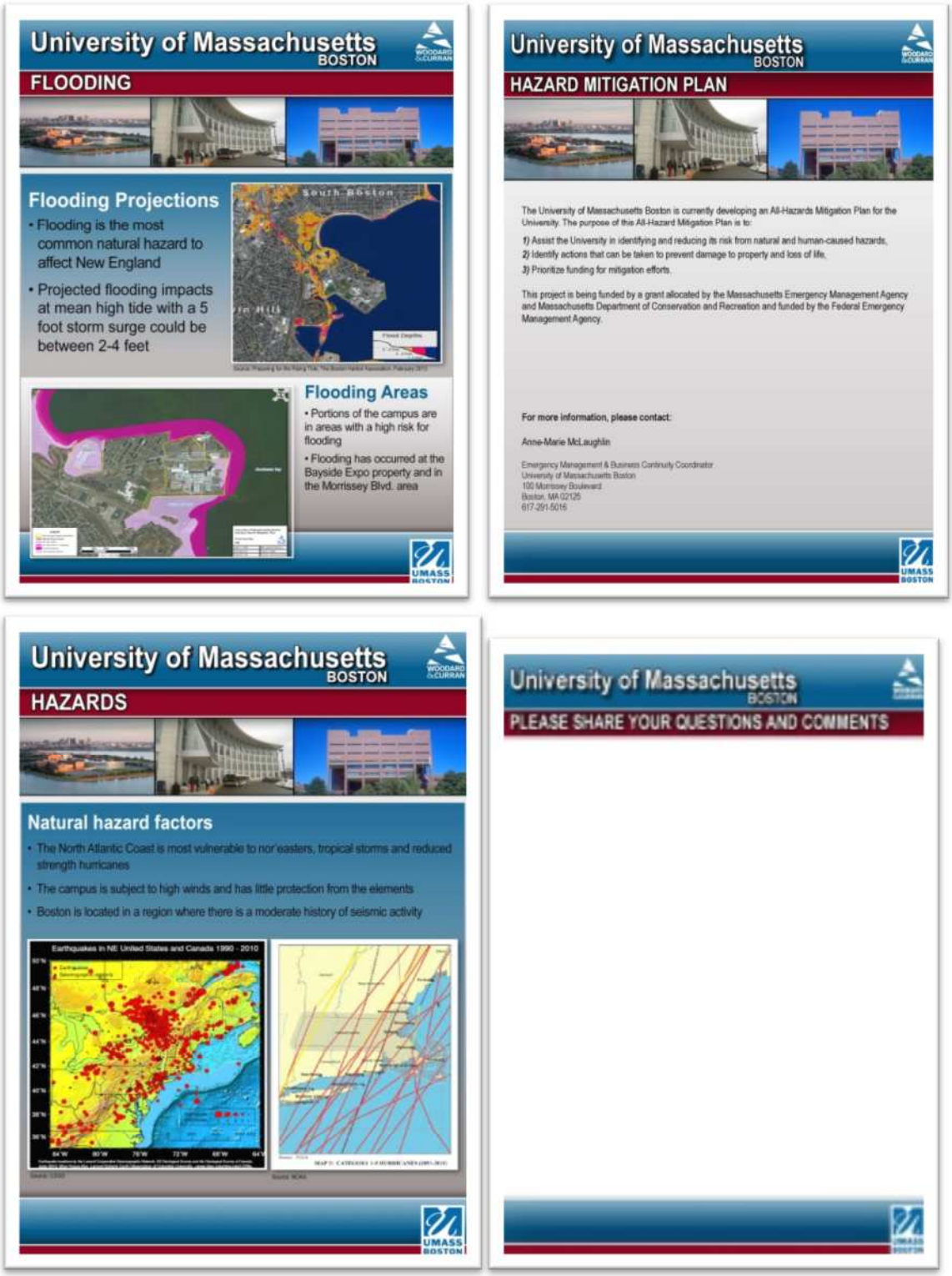


The format of the public meeting was designed to be casual and informative and conducive to receive input. The room was set up in the following stations where the public could learn about or provide input into the planning process:

- **Hazard Mitigation Power Point presentation:** An automated Power Point presentation focused on the hazard mitigation planning process was continually displayed with a new slide projected every 20-30 seconds.
- **Hazard Posters:** Posters focused on some of the top hazards to potentially impact the campus were set up for viewing purposes. One poster focused specifically on flooding, while the second poster focused on other types of common hazards such as hurricanes and earthquakes (see **Figure 4**).
- **Handout:** A handout was presented that listed the main goals of the project and who at UMass Boston to contact for further information.
- **Comments:** Throughout the room blank handouts with space to write comments, questions or thoughts were provided.

The public meeting was attended by several campus representatives, system office representative, Woodard & Curran representatives and representation from MEMA. While the planning process was discussed among the various attendees, no specific comments were provided that were not already captured in previous interviews, stakeholder meetings or focus groups. Public meeting materials are provided in **Appendix F**.

Figure 4: Hazard Posters Used During Public Participation Process



2.3.7 Presentation of Draft Hazard Mitigation Plan Facilitated Review Meeting

On December 4, 2013, a meeting was held at UMass Boston to present the written draft plan to the Hazard Mitigation Planning team and other campus stakeholders. The representatives in attendance are listed in **Table 2-2**. The meeting agenda, sign in sheet and Power Point presentation are provided in **Appendix G.**

The written draft was issued prior to the meeting such that stakeholders would have an opportunity to review the draft prior to the meeting. During the meeting a facilitated review of the draft was provided highlighting key areas to focus upon. Feedback on the draft was solicited and recorded for incorporation into the final version of the Plan. **Table 2-9** outlines the topics discussed at the meeting.

Table 2-9: Topics Reviewed During Facilitated Review Meeting of the Draft Hazard Mitigation Plan

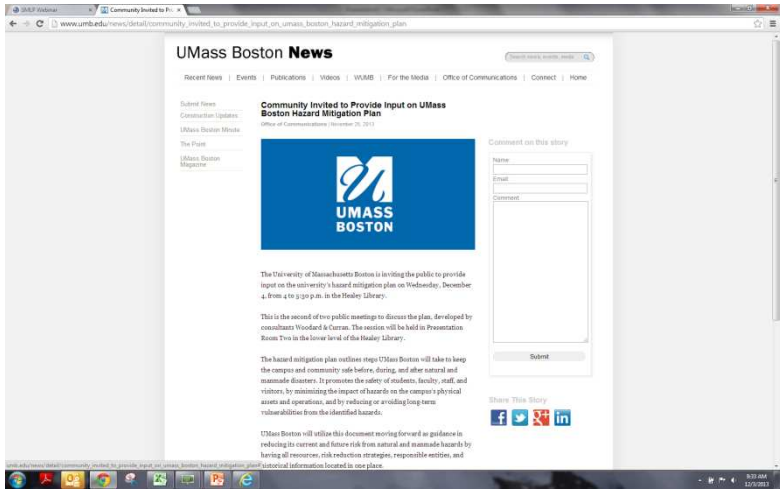
Topic	Details
Hazard Mitigation Plan Organization	The organization of the Multi-Campus Hazard Mitigation Plan was reviewed. The UMass Lowell Hazard Mitigation Plan consists of two parts: (1) the Hazard Mitigation Plan common to all participating campuses discussing the overall goals of the multi-campus effort and the methodology followed, and (2) the UMass Boston Hazard Mitigation Plan Annex which is specific to the campus and identifies hazard mitigation goals, objectives and actions.
Risk Assessment	Risk rankings were reviewed for any additional comments. Additional focus was placed on reviewing rankings for the categories of students, faculty and staff, existing buildings, future buildings, operations and critical infrastructure.
Mitigation Actions	Hazard mitigation projects were reviewed for any additional comments. Additional focus was placed on the estimated project cost, responsible party, and project priority ranking.
Plan Implementation, Maintenance & Adoption	The plan implementation, maintenance and adoption was reviewed so that the hazard mitigation planning team understood the process of plan implementation and the expectations of the team moving forward.

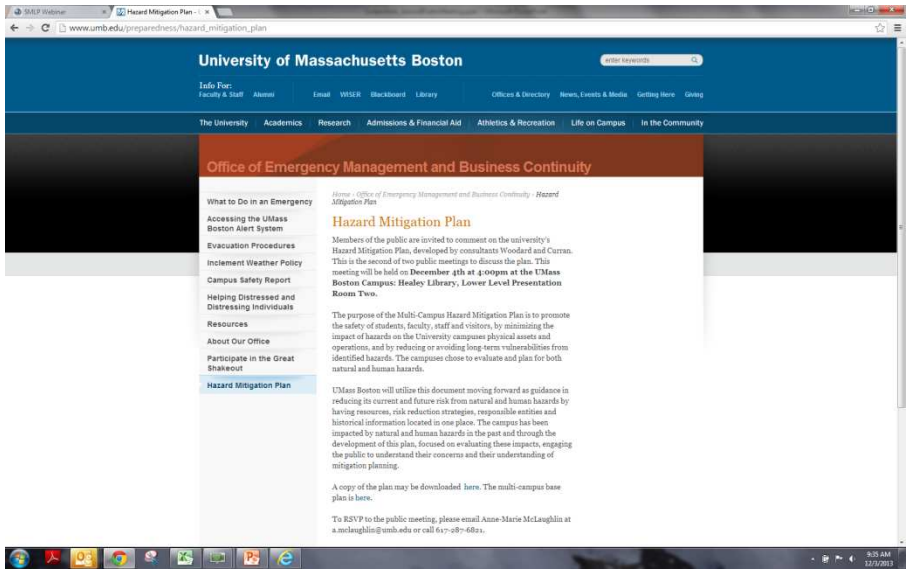
No specific comments on the draft Hazard Mitigation Plan were received during the facilitated review meeting. Upon completion of the meeting, the campus stakeholders were encouraged to complete a final review of the Hazard Mitigation Plan with a specific focus on the areas presented in Table 2-9.

2.3.8 Public Meeting No. 2

On December 4, 2013 the second public meeting presenting the draft Hazard Mitigation Plan was held on the UMass Boston campus. The meeting was advertised using a variety of venues with support from the UMass Boston public relations department (see **Figure 5**).

Figure 5: Public Meeting No. 2 Advertising Efforts





The means for advertising consisted of:

- Posting on UMass Boston web site
- UMass Boston News
- Listing on area web sites

The draft UMass Boston Hazard Mitigation Plan was posted on the UMass Boston web site prior to the meeting to provide the public with an opportunity to review and provide comment if desired.

The format of the public meeting was designed to be casual and informative and conducive to receive input. The room was set up in the following stations where the public could learn about or provide input into the Plan:

- Hazard Mitigation Plan Power Point presentation: An automated Power Point presentation focused on the major components of the Hazard Mitigation Plan was continually displayed with a new slide projected every 20-30 seconds.
- Hazard Posters: Posters focused on some of the top hazards to potentially impact the campus were set up for viewing purposes. One poster focused specifically on flooding, while the second poster focused on other types of common hazards such as winter storms.
- Hard Copy DRAFT UMass Boston Hazard Mitigation Plan: A hard copy of the full draft hazard mitigation plan was available for review.
- Comments: Throughout the room blank handouts with space to write any comments, questions or thoughts were provided.

There were no specific comments received on the draft Hazard Mitigation Plan during the public meeting. There was discussion of potential funding mechanisms for specific hazard mitigation projects and future grant opportunities that could be explored.

Public meeting materials are provided in **Appendix H.**

3. HAZARD PROFILES & RISK ASSESSMENT

For the purposes of this Multi-Campus Hazard Mitigation Plan, the term hazard is defined as an extreme natural or human event that poses a risk to people, infrastructure, operations or resources. Identifying hazards includes detailing geographically where an event has occurred historically, where it is likely to occur in the future, and how substantial the event may be. Natural hazards received their initial identification and consideration from FEMA guidance documentation and they were then filtered by utilizing both current and historical data from various sources. The human hazard identification for each campus focused on hazards that are reasonably viable and have occurred in the past, or may have occurred at other college or university campuses.

3.1 NATURAL HAZARDS IMPACTING CAMPUS

For the sections of this Hazard Mitigation Plan that focuses on natural hazards, the term hazard is defined as an extreme natural event that poses a risk to people, infrastructure or resources. Identifying hazards involves detailing geographically where an event has occurred historically, where is likely to occur in the future, and how substantial the event may be. The natural hazards that have been identified and included in this section received their initial consideration from FEMA Guidance documentation. The hazards were then filtered by utilizing current and historical data points from various sources including but not limited to NOAA, US Census and local and state Hazard Mitigation Plans. Finally, the findings of each natural hazard were analyzed and the information was cross referenced with anecdotal data points. A list of natural hazards that have and may continue to impact UMass Boston was developed.

Of the natural hazards that have been considered for this project, UMass was found to be susceptible to fifteen of them (see **Table 3-1**). A qualitative or quantitative analysis for each hazard was conducted which is detailed in the sections that follow.

Table 3-1: Quantitative/Qualitative UMass Boston Natural Hazard Risk Ranking

Natural Hazard	UMass Boston Susceptible?	Quantitative/Qualitative
Coastal Erosion	Yes	Qualitative
Coastal Storm	Yes	Qualitative
Flood	Yes	Quantitative and Qualitative
Drought	Yes	Qualitative
Earthquake	Yes	Quantitative and Qualitative
Extreme Heat	Yes	Qualitative
Hailstorm	Yes	Qualitative
Hurricane	Yes	Qualitative
Tornado	Yes	Qualitative
Winter Storm	Yes	Qualitative
Thunderstorm/Lightning	Yes	Qualitative
Tsunami	Yes	Qualitative
Ice Storm	Yes	Qualitative
Urban Fire	Yes	Qualitative

Natural Hazard	UMass Boston Susceptible?	Quantitative/Qualitative
Windstorm	Yes	Qualitative
Dam Failure	No	Not Applicable
Ice Jam	No	Not Applicable
Avalanche	No	Not Applicable
Volcano	No	Not Applicable
Landslide	No	Not Applicable
Wildfire	No	Not Applicable

As a result of on-campus interviews and a follow up group meeting, in March 2013, the UMass Boston Hazard Mitigation Planning Committee ranked the natural hazards that have or may impact the campus in the future according to a Hazard Ranking of Low, Medium, High or Severe. Each of these natural hazards is discussed in more detail in the following sections. A qualitative ranking (on a scale of 0 to 5) in the categories of frequency, severity, duration and intensity was conducted after the hazards were identified and vetted. For the UMass Boston campus, the hazards were then weighted regarding the probability (40% which included rankings of frequency, duration and intensity) that the hazard would impact the campus and the consequences (60% which included rankings of severity) that would be realized by each individual campus.

In general, hazards with a low estimated frequency, duration, severity and intensity are expected to have minimal to no impact on the campus. Hazards with a high frequency, duration, severity and intensity were given a higher mitigation priority. Higher rankings may be more likely to occur on a regular basis or within the next five years and could result in substantial impacts on campus with regard to economic damage, loss of function and operations of the campus and human injury. (**Table 3-2** provides a summary of the rankings which are also discussed in more detail in each specific hazard section.)

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Table 3-2: UMass Boston Natural Hazard Risk Ranking Summary

Natural Hazard	Frequency 0-5	Duration 0-5	Severity 0-5	Intensity 0-5	Probability F,D,I (40%)	Consequence S (60%)	Total	Ranking L,M,H,S
Drought	1	1	1	1	1.00	1.00	1.00	L
Hailstorm	1	1	1	1	1.00	1.00	1.00	L
Extreme Heat	1	2	2	2	1.67	2.00	1.87	L
Thunderstorm/Lightning	3	2	2	2	2.33	2.00	2.13	M
Coastal Erosion	1	1	3	3	1.67	3.00	2.47	M
Tornado	1	1	3	3	1.67	3.00	2.47	M
Earthquake	1	1	3	3	1.67	3.00	2.47	M
Ice Storm	1	2	3	3	2.00	3.00	2.60	M
Tsunami	0	1	4	3	1.33	4.00	2.93	M
Windstorm	4	2	3	3	3.00	3.00	3.00	H
Flood	4	2	3	3	3.00	3.00	3.00	H
Winter Storm	4	3	3	2	3.00	3.00	3.00	H
Coastal Storm	4	2	3	3	3.00	3.00	3.00	H
Urban Fire	1	2	4	3	2.00	4.00	3.20	H
Hurricane	3	4	5	4	3.67	5.00	4.47	S

3.1.1 Coastal Erosion

3.1.1.1 Previous Occurrences of the Coastal Erosion Hazard

The UMass Boston campus has been impacted directly by coastal erosion and during 2012-2013 the campus initiated a Harborwalk Shoreline Stabilization project to mitigate this natural hazard. The project will specifically serve to protect the shoreline segment of approximately 800 feet of the Harborwalk to prevent further coastal erosion, stabilize the existing edge and eliminate the continued loss of debris into Boston Harbor. Some of the criteria that was used to determine susceptibility to Coastal Erosion is provided in **Table 3-3**.

Table 3-3: Coastal Erosion Susceptibility

How Susceptibility Was Determined	Susceptibility Criteria
• State of Massachusetts (2010) and City of Boston (2008) Hazard Mitigation Plans • Review of FEMA's Multi-Hazard Identification and Risk Assessment Document • Anecdotal Information from UMass Boston Task Force • *"Preparing for the Rising Tide",* February 2013	• UMass Boston currently has an active project on the Harbor Walk to address erosion. Consideration for additional projects is being given to areas that provide access to campus and are impacted by winter road salting as well. • Boston has an expansive coastline (10 miles along Boston Harbor) and a number of islands. Much of the shoreline is located in the velocity zone (V zone). UMass Boston is a waterfront campus, portions of which are in the V Zone. Boston's waterfront areas are subject to repeated wave action and winds. These natural processes not only destabilize coastal structures, but also lead to shoreline change. • Columbia Point – the area is home to UMass, the John F. Kennedy Museum and the Harbor Point and Peninsula apartment developments. Parts of the embankment are unprotected and vulnerable to further erosion. The area is composed of fill and UMass owns the area that is unstable. • The state plan notes that regardless of the season, coastal storms typically cause erosion. With the anticipated change in climate an increase in intensity and frequency of storms is expected. This will, in turn, increase the likelihood of severe erosion episodes along the coast of Massachusetts. • The state plan notes that highest rates of erosion and the longer expanses of eroding shoreline within a community are generally located along high-wave energy, open-ocean shores.

3.1.1.2 Probability of Future Occurrence of Coastal Erosion Hazard

High rates of coastal erosion occur most frequently along long sections of shoreline which are consistently subjected to high wave energy and coastal storms. The factors that determine whether or not a community or area such as a college/university campus may exhibit greater probability for long term coastal erosion include:

- Exposure to high-energy storms,

- Exposure to high-energy storm waves,
- Sediment size and composition of eroding coastal landforms adjacent to shorelines,
- Relative sea level rise, and
- Human interference with sediment supply (seawalls, jetties).

UMass Boston, due to its location on a peninsula that juts into Dorchester Bay, is frequently exposed to high-energy storms and waves. The probability of future coastal erosion impacting the campus is certain.

3.1.1.3 Vulnerability to Coastal Erosion Hazard

UMass Boston is currently working on a project called the HarborWalk Improvement and Shoreline Stabilization project. The purpose of the project is to stabilize the northern shoreline of the campus and replace an existing pathway with a new walkway linking it to the JFK and DCR portions of the HarborWalk. Preventing further coastal erosion and stabilizing the existing edge while eliminating the continued loss of debris into Boston Harbor is one of the main goals of the project as well as enhancing public access and improving connections between campus and the waterfront.

The HarborWalk Improvement and Shoreline Stabilization project is further evidence of UMass Boston's susceptibility to the coastal erosion hazard.

3.1.1.4 Risk Assessment Methodology, Limitations and Results

After consideration of the data available for a coastal erosion hazard event and its impact to the UMass Boston campus, the risk assessment for this natural hazard has been developed as a qualitative analysis. A qualitative assessment of the frequency, duration, severity, intensity, probability and consequence of a coastal erosion hazard utilizing a low, medium, high and severe ranking system was prepared. The ranking given for UMass Boston was based on background research, future development plans, knowledge of the campus, infrastructure and past occurrences and is shown in **Table 3-4**.

Table 3-4: Risk Assessment – Coastal Erosion

	Frequency 0-5	Duration 0-5	Severity 0-5	Intensity 0-5	Probability (F,D,I) 40%	Consequence (S) 60%	Total	Risk Ranking L,M,H,S
Coastal Erosion	1	1	3	3	1.67	3.00	2.47	**M**

After reviewing the initial ranking of **medium** and conducting further research, specific consideration was given to how an event would impact students, faculty and staff, existing buildings, future buildings, operations and critical infrastructure (**Table 3-5**).

Table 3-5: Qualitative Risk Assessment – Coastal Erosion Hazard

	Coastal Erosion - Qualitative Ranking
Risk Ranking	Medium
Students, Faculty & Staff	Low
Existing Buildings	Low
Future Buildings	Medium
Operations	Low
Critical Infrastructure	Medium

As a result of considering these additional factors, the overall ranking remained **medium**.

3.1.1.5 Future Development Considerations

UMass Boston should continue to include coastal erosion hazard scenario planning during the future development endeavors of the campus. Additional measures will be considered to positively position the campus to further address this hazard, including:

- Evaluate nonstructural approaches to maximize protection of the shoreline,
- Focus on protecting and maintaining natural habitats, wetlands and other features that protect against erosion and flooding,
- Formalize a maintenance and improvement program of natural features and resources on campus that protect against flooding and erosion and maintain the Harborwalk,
- Continue to conduct stabilization efforts where necessary such as planting native vegetation, and
- Evaluate coastal erosion impacts after storm events and plan for recovery and redevelopment once existing conditions are known.

3.1.2 Coastal Storm/Nor'Easter

3.1.2.1 Previous Occurrences of Coastal Storm/Nor'Easter Hazard

According to the FEMA, there have been two Presidential Disaster Declarations made for "coastal storms" in the State of Massachusetts (**Table 3-6**). At UMass Boston, there have been varying degrees of impacts from these storms and others felt on campus.

Table 3-6: Massachusetts Coastal Storm Major Disaster Declarations (1954 – Present)

	Disaster No.	Incident Period	Date Disaster Declared	Suffolk County a Designated Area?
Severe Storms and Inland and Coastal Flooding	1701	4/15/2007 – 4/25/2007	5/16/2007	No
Coastal Storms, Flood, Ice and Snow	546	2/6/1978 – 2/8/1978	2/10/1978	Yes
Source: FEMA Disaster Declarations 1954 - Present				

The National Climatic Data Center (NCDC) tracks storm events and two events were listed for Suffolk County regarding Coastal Storm/Nor'easter occurrences.

- March 5-7, 1962
- October 28 – November 3, 1991

The New England Blizzard of 1978 and the No-Name or Halloween Storm of 1991 are examples of moderate to severe northeasters that influenced the coast of Massachusetts. The New England Blizzard brought record-breaking snowfall and hurricane-force winds that caused beach erosion, flooding, and property damage. The Halloween Storm also resulted in erosion and considerable property damage due to heavy surf and lunar-enhanced storm surges along the coast.

3.1.2.2 Probability of Future Occurrence of the Hazard

Coastal storms are certain to occur in the future and they will continue to impact the City of Boston and the UMass Boston campus. In addition to impacts from rain and heavy winds, UMass Boston will continue to see storm surge impacts as well. USGS recently reported that globally, sea level rise between 1950 and 2009 has averaged .02 inches per year while between Cape Hatteras, NY and north of Boston, it has increased on average .08 inches per year.

3.1.2.3 Vulnerability to the Hazard

UMass Boston is extremely vulnerable to future coastal storm events which are detailed in **Table 3-7**. In the past storm surge has overtopped the Harborwalk and there is a general concern over wind damage.

Table 3-7: Coastal Storm/Nor'Easter Susceptibility

How Susceptibility Was Determined	Susceptibility Criteria
• State of Massachusetts (2010) and City of Boston (2008) Hazard Mitigation Plans • Campus Emergency Management Assessment Report – University of Massachusetts, Boston Campus (February 2009) • Review of FEMA's Multi-Hazard Identification and Risk Assessment • Anecdotal Information from UMass Boston Task Force • *"Preparing for the Rising Tide",* February 2013	• The current 100-year storm surge is expected to overtop the HarborWalk and protective berm associated with UMass Boston. Sometime after 2050, annual coastal storms will likely overtop the HarborWalk as well. • Nor'easters are discussed in the state plan as a common cause of flooding and snowstorms, particularly in the coastal part of the state. • The state plan notes that Nor'easters are a common winter occurrence in New England and repeatedly result in flooding, various degrees of wave and erosion damage to structures, and erosion of natural resources, such as beaches, dunes and coastal bluffs. The erosion of coastal features commonly results in greater potential for damage to shoreline development from future storms. • The state plan notes that Nor'easters have an average frequency of 1 or 2 per year with a storm surge equal to or greater than 2.0 feet. The duration of high surge and winds in a nor'easter can be from 12 hours to 3 days. • General concern over wind damage on campus due to coastal storm. Many leaking buildings due to wind driven rain. Bayside Property is the most vulnerable with a storm coming from the northeast.

How Susceptibility Was Determined	Susceptibility Criteria
	• Concern over general isolation on campus (no current plan for sheltering in place).

3.1.2.4 Risk Assessment Methodology, Limitations and Results

After consideration of the data available for a coastal storm/Nor'Easter event and its impact to the UMass Boston campus, the risk assessment for this natural hazard has been developed as a qualitative analysis. A qualitative assessment of the frequency, duration, severity, intensity, probability and consequence of a coastal storm/Nor'easter hazard utilizing a low, medium, high and severe ranking system was prepared. The ranking given for UMass Boston was based on background research, future development plans, knowledge of the campus, infrastructure and past occurrences and is presented in **Table 3-8**.

Table 3-8: Risk Assessment – Coastal Storm/Nor'Easter Hazard

	Frequency 0-5	Duration 0-5	Severity 0-5	Intensity 0-5	Probability (F,D,I) 40%	Consequence (S) 60%	Total	Risk Ranking L,M,H,S
Coastal Storm or Nor'Easter	4	2	3	3	3.00	3.00	3.00	**H**

After reviewing the initial ranking of **high** and conducting further research, specific consideration was given to how an event would impact students, faculty and staff, existing buildings, future buildings, operations and critical infrastructure (see **Table 3-9**).

Table 3-9: Qualitative Risk Assessment – Coastal Storm/Nor'Easter Hazard

	Coastal Storm/Nor'Easter - Qualitative Ranking
Risk Ranking	High
Students, Faculty & Staff	High
Existing Buildings	High
Future Buildings	Medium
Operations	High
Critical Infrastructure	High

As a result of considering these additional factors, the overall ranking remained **high**.

3.1.2.5 Future Development Considerations

Coastal storms are of high concern to UMass Boston. For future development or redevelopment on campus, the following items will be considered:

- Evaluate nonstructural approaches to maximize protection of the shoreline,

- Focus on protecting and maintaining natural habitats, wetlands and other features that protect against erosion and flooding during coastal storms,
- Evaluate coastal storm impacts after storm events and plan for recovery and redevelopment once existing conditions are known.
- Ensure that there are multiple ingress/egress routes available for faculty, staff and students that can be utilized during a coastal storm.

3.1.3 Flood

3.1.3.1 Occurrences of the Hazard

According to the FEMA, there have been 14 Presidential Disaster Declarations made for some type of flooding incident in the State of Massachusetts and 8 of those events impacted Suffolk County (see **Table 3-10**). At UMass Boston, there have been varying degrees of impacts from flooding felt on campus.

Table 3-10: Massachusetts Flooding Major Disaster Declarations (1954 – Present)

	Disaster No.	Incident Period	Date Disaster Declared	Suffolk County a Designated Area?
Severe Winter Storm, Snowstorm, Flooding	DR-4110	2/8/2013 – 2/9/2013	4/19/2013	Yes
Severe Storm and Flooding	DR-1895	3/12/2010 – 4/26/2010	3/29/2010	Yes
Severe Winter Storm and Flooding	DR-1813	12/11/2008 – 12/18/2008	1/5/2009	No
Severe Storms, Inland and Coastal Flooding	DR-1701	4/15/2007 – 4/25/2007	5/16/2007	No
Severe Storms and Flooding	DR-1642	5/12/2006 – 5/23/2006	5/25/2006	No
Severe Storms and Flooding	DR-1614	10/7/2005 – 10/16/2005	11/10/2005	No
Flooding	DR-1512	4/1/2004 – 4/30/2004	4/24/2004	Yes
Severe Storms and Flooding	DR-1364	3/5/2001 – 4/16/2001	4/10/2001	Yes
Heavy Rain and Flooding	DR-1224	6/13/1998- 7/6/1998	6/23/1998	Yes
Severe Storms and Flooding	DR-1142	10/20/1996- 10/25/1996	10/25/1996	Yes
Severe Storms and Flooding	DR-790	3/30/1987- 4/13/1987	4/18/1987	No
Coastal Storms, Flood, Ice, Snow	DR-546	2/6/1978-2/8/1978	2/10/1978	Yes
Severe Storms, Flooding	DR-325	3/6/1972	3/6/1972	Yes
Hurricane, Floods	DR-43	8/20/1955	8/20/1955	Unknown

The NCDC tracks storm events and the information presented in **Table 3-11** was available for Suffolk County regarding flood occurrences.

Table 3-11: Flood Event Data for Suffolk County (January 1, 2000 through February 28, 2013)

Location (County/City)	Date	Type[1]	Deaths	Injury	Property Damage Estimate
SUFFOLK	2/9/2013	Coastal Flood	0	0	30.00K
SUFFOLK	10/29/2012	Coastal Flood	0	0	3.000M
SUFFOLK	6/4/2012	Coastal Flood	0	0	0.00K
SUFFOLK	6/3/2012	Coastal Flood	0	0	0.00K
SUFFOLK	11/23/2011	Coastal Flood	0	0	0.00K
SUFFOLK	12/27/2010	Coastal Flood	0	0	50.00K
SUFFOLK	3/14/2010	Coastal Flood	0	0	0.00K
SUFFOLK	1/2/2010	Coastal Flood	0	0	0.00K
SUFFOLK	10/18/2009	Coastal Flood	0	0	0.00K
SUFFOLK	4/17/2007	Coastal Flood	0	0	10.00K
SUFFOLK	4/16/2007	Coastal Flood	0	0	5.00K
SUFFOLK	4/15/2007	Coastal Flood	0	0	5.00K
SUFFOLK	1/31/2006	Coastal Flood	0	0	10.00K
BOSTON	7/10/2010	Flash Flood	0	0	500.00K
BOSTON	7/6/2005	Flash Flood	0	0	30.00K
BOSTON	7/6/2005	Flash Flood	0	0	20.00K
BOSTON	4/22/2000	Flash Flood	0	0	0.00K
SUFFOLK	5/13/2006	Flood	0	0	0.00K
SUFFOLK	3/5/2001	Flood	0	0	15.000M
Totals:			**0**	**0**	**18.7M**
Source: NCDC Storm Events Database http://www.ncdc.noaa.gov/stormevents/					

3.1.3.2 Significant Flood Events

Specific details from the more significant coastal, flash, and other flood events noted in the table above that have occurred in Suffolk County include:

- **October 29, 2012** – Sandy, a hybrid storm with tropical and extra-tropical characteristics brought high winds and coastal flooding to southern New England. In Boston, minor coastal flooding closed the ramp for Morrissey Boulevard off of Interstate 93 and occurred at Columbia Point over the Harborwalk. The Savin Hill beach was washed over the seawall.
- **December 27, 2010** – Moderate to major coastal flooding affected the eastern Massachusetts coast during early morning high tide. A portion of Morrissey Boulevard near UMass Boston was closed.
- **July 10, 2010** – Two to four inches of rain fell within an hour's time and produced significant urban flash flooding in and around the city of Boston.
- **March 14, 2010** – Stacked low pressure system (surface low and upper level low on top of each other) moved southeast of Nantucket, spreading rain across southern New England. This resulted in widespread rainfall totals of three to six inches. Heavy rains

resulted in flooding across much of Boston. In eastern Massachusetts, a strong southeasterly low level jet stream pumped ample moisture into the area, resulting in six to ten inches or rainfall. The Massachusetts governor declared a state of emergency.

- **July 6, 2005** – Showers and thunderstorms resulted in local heavy downpours. In Suffolk County, Storrow Drive, Soldiers' Field Road, and Memorial Drive were closed due to flash flooding.
- **March 5, 2001** – Major winter storm impacted the Bay state with near blizzard conditions, high winds, and coastal flooding.

3.1.3.3 Probability of Future Occurrence of the Hazard

The State of Massachusetts Hazard Mitigation plan notes that flooding is the most common hazard to affect New England. It is certain that flood events will continue to impact the City of Boston and the UMass Boston campus.

3.1.3.4 Vulnerability to the Hazard

Throughout Massachusetts, there are no areas that are exempt from flooding impacts. What varies is the type of flooding. Flooding is frequently associated with coastal storms and storm surge, rivers and streams but it can also be an issue due to aging, undersized or poorly maintained infrastructure and drainage systems. **Table 3-12** indicates additional details regarding UMass Boston's vulnerability to a flood hazard event.

Table 3-12: Flood Susceptibility

How Susceptibility Was Determined	Susceptibility Criteria
• State of Massachusetts (2010) and City of Boston (2008) Hazard Mitigation Plans • Campus Emergency Management Assessment Report (CEMAR)– University of Massachusetts, Boston Campus (February 2009) • Review of FEMA's Multi-Hazard Identification and Risk Assessment • Anecdotal Information from UMass Boston • *"Preparing for the Rising Tide",* February 2013	• The state plan notes that flooding is the most common hazard to affect New England. • CEMAR for UMass Boston noted that during heavy rain storms, portions of the outer campus roadway become flooded and incoming utility feeds may be disrupted due to water infiltration. No direct impact to campus buildings is anticipated. • Vulnerable areas are campus entrances on Morrissey Boulevard and Mt. Vernon Street, and flooding of the Bayside Expo property (purchased in 2010). • Morrissey Boulevard and Mt. Vernon Street flooding during coastal storm events has caused disruption for ingress and egress to the campus in the past. • Morrissey Boulevard entrance is currently the primary entrance to the UMass-Boston campus. A significant portion of this street, especially south of the campus entrance, is low-lying and is prone to flooding even under present day conditions (storm surge or heavy rainfall events). • Morrissey Boulevard floods a few times a year and it can be closed for a few hours at a time which impacts traffic flow. • Section of the Harbor Walk around the JFK Library has flooded out.

How Susceptibility Was Determined	Susceptibility Criteria
	• Water intrusion in the Healey Library has occurred in the past. • The Bayside Expo center region, purchased in 2010 is slated to undergo redevelopment. The area is prone to potential flooding, especially the low-lying parking lot regions (one of the lowest elevations in the region). There is potential for poor drainage and flooding of this area (approximately 30 acres) even during contemporary rainfall storm events. Catch basins and storm drains on/near the property have been cleaned out, allowing stormwater to drain more readily from the property and decrease stormwater flooding impacts. (One potential future plan is to build up Bayside by 12 feet). • The southeastern end of Mt. Vernon Street is under consideration as a potential location for a secondary entrance to the UMass Boston campus. This area currently experiences storm water drainage delays and issues.

3.1.3.4.1 Loss Estimate

A loss estimate was prepared to further determine how UMass Boston's assets would be affected by a flood hazard event. Utilizing the FEMA guidance document *"Understanding Your Risks – Identifying Hazards and Estimating Losses (FEMA 386-2)"* calculations were conducted for Structure Loss, Contents Loss and Structure Use and Function Loss to determine a Total Loss for the Hazard Event. The main criteria for determining which buildings would receive a loss estimate analysis was based on those that are located either fully or partially in a flood hazard zone (see maps that were presented in the Hazard Mitigation Plan). The information presented in **Table 3-13**, **Table 3-14**, and **Table 3-15** are rough estimates and should not be used for any other purpose other than this hazard mitigation planning effort**. Figure 6** indicates graphically which buildings would be impacted based on the Total Loss for Hazard Event dollar values in **Table 3-15** and a high, medium or low ranking level was assigned based on these calculations.

Table 3-13: Structure Loss – Flood Hazard

	Insurable Replacement Value $	x	Percent Damage (%)	=	Loss to Structure ($)
Campus Center	**$123,199,871**	**x**	**10%**	**=**	**$12,319,987**
Calf Pasture Pumping Station	Unknown	x	0%	=	$0
Phillis Wheatley Hall	$92,382,713	x	0%	=	$0
Salt Water Pump House	**$727,371**	**x**	**20%**	**=**	**$145,474**
McCormack Hall	$97,035,922	x	0%	=	$0
Science Center	$102,512,053	x	0%	=	$0
Utility Plant	$6,621,302	x	0%	=	$0
Healey Library	$108,128,176	x	0%	=	$0
Quinn Administration	$31,620,278	x	0%	=	$0
Clark Athletic Center	$38,821,751	x	0%	=	$0
Service & Supply	$24,060,563	x	0%	=	$0
UMass Bayside Expo Center	**$41,250,000**	**x**	**100%**	**=**	**$41,250,000**

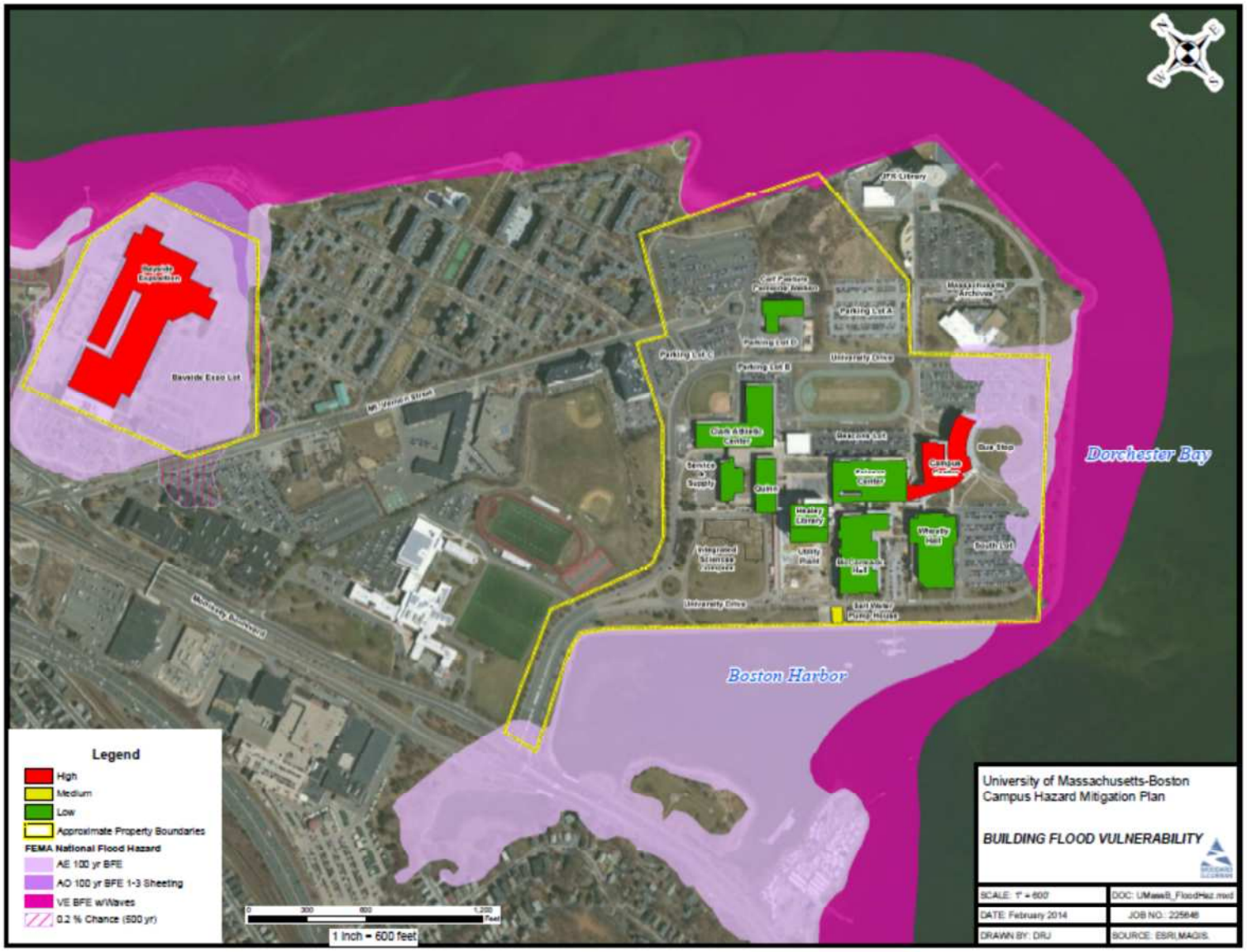
Table 3-14: Contents Loss – Flood Hazard

	Replacement Value of Contents ($)	x	Percent Damage (%)	=	Loss to Contents ($)
Campus Center	**$184,799,807**	**x**	**10%**	**=**	**$18,479,981**
Calf Pasture Pumping Station	Unknown	x	0%	=	$0
Phillis Wheatley Hall	$138,574,070	x	0%	=	$0
Salt Water Pump House	**$1,091,057**	**x**	**20%**	**=**	**$218,211**
McCormack Hall	$145,553,883	x	0%	=	$0
Science Center	$153,768,080	x	0%	=	$0
Utility Plant	$9,931,953	x	0%	=	$0
Healey Library	$162,192,264	x	0%	=	$0
Quinn Administration	$47,430,417	x	0%	=	$0
Clark Athletic Center	$58,232,627	x	0%	=	$0
Service & Supply	$36,090,845	x	0%	=	$0
UMass Bayside Expo Center	**$61,875,000**	**x**	**100%**	**=**	**$18,562,500**

Table 3-15: Structure use and Function Loss & Total Loss – Flood Hazard

	Average Daily Operating Budget	x	Functional Downtime (# of Days)	+	Displacement Cost Per Day ($)	x	Displacement Time	=	Structure Use and Function Loss		Structure Loss + Content Loss + Function Loss
Campus Center	**$746,788**	**x**	**7**	**+**	**$3,287.67**	**x**	**7**	**=**	**$5,250,527.45**		**$36,050,495.20**
Calf Pasture Pumping Station	Unknown	x	N/A	+	N/A	x	N/A	=	N/A		N/A
Phillis Wheatley Hall	$607,729	x	N/A	+	N/A	x	N/A	=	N/A		N/A
Salt Water Pump House	**$13,017**	**x**	**7**	**+**	**$13,017**	**x**	**7**	**=**	**$182,234.30**		**$545,919.80**
McCormack Hall	$602,092	x	N/A	+	N/A	x	N/A	=	N/A		N/A
Science Center	$1,123,772	x	N/A	+	N/A	x	N/A	=	N/A		N/A
Utility Plant	$105,176	x	N/A	+	N/A	x	N/A	=	N/A		N/A
Healey Library	$1,018,184	x	N/A	+	N/A	x	N/A	=	N/A		N/A
Quinn Administration	$292,370	x	N/A	+	N/A	x	N/A	=	N/A		N/A
Clark Athletic Center	$476,839	x	N/A	+	N/A	x	N/A	=	N/A		N/A
Service & Supply	$224,172	x	N/A	+	N/A	x	N/A	=	N/A		N/A
UMass Bayside Expo Center	**$622,323**	**x**	**7**	**+**	**$821.92**	**x**	**7**	**=**	**$4,362,014.88**		**$64,174,514.88**
											TOTAL LOSS for HAZARD EVENT

Figure 6 : Flood Vulnerability Assessment by Building



3.1.3.5 Risk Assessment Methodology, Limitations and Results

After consideration of the data available for a flood event and its impact to the UMass Boston campus, the risk assessment for this natural hazard has been developed as both a qualitative and quantitative analysis. A qualitative assessment of the frequency, duration, severity, intensity, probability and consequence of a flood hazard utilizing a low, medium, high and severe ranking system was prepared. The ranking given for UMass Boston was based on background research, future development plans, knowledge of the campus, infrastructure and past occurrences and is presented in **Table 3-16**.

Table 3-16: Risk Assessment – Flood Hazard

	Frequency 0-5	Duration 0-5	Severity 0-5	Intensity 0-5	Probability (F,D,I) 40%	Consequence (S) 60%	Total	Risk Ranking L,M,H,S
Flood	4	2	3	3	3.00	3.00	3.00	**H**

After reviewing the initial ranking of **high** and conducting further research, specific consideration was given to how an event would impact students, faculty and staff, existing buildings, future buildings, operations and critical infrastructure (see **Table 3-17**).

Table 3-17: Qualitative Risk Assessment – Flood Hazard

	Flood - Qualitative Ranking
Risk Ranking	High
Students, Faculty & Staff	Medium
Existing Buildings	High
Future Buildings	Medium
Operations	Medium
Critical Infrastructure	High

As a result of considering these additional factors, the overall ranking remained **high**.

3.1.3.6 Future Development Considerations

Flooding is a concern to the to the UMass Boston campus. For future development or redevelopment the university may want to consider the following:

- Ensure that critical infrastructure/generators are located in places on campus with minimum susceptibility for flooding impacts,
- Consider flood control/mitigation with any future Boston Expo redevelopment plans,
- Work with City of Boston officials on emergency procedures should the ingress/egress routes to campus be dramatically impacted by floodwaters,
- Evaluate structural and nonstructural approaches to maximize flood control,
- Evaluate green infrastructure techniques that can be implemented to minimize flood occurrences,

- Focus on protecting and maintaining natural habitats, wetlands and other features that protect against flooding during coastal storms,
- Track, evaluate and plan for areas of the university frequently impacted by flooding and consider drainage/engineering solutions that would minimize future occurrences, and
- Evaluate flooding impacts after storm events and plan for recovery and redevelopment once impacts are known.

3.1.4 Drought Hazard

3.1.4.1 Previous Occurrences of the Hazard

According to FEMA, there has never been a Presidential Disaster Declaration made for a drought in the State of Massachusetts. At UMass Boston, there are no records of a drought impacting campus. Two droughts have occurred in Suffolk County in the past several years as shown in **Table 3-18**.

Table 3-18: Drought Event Data for Suffolk County (January 1, 2000 through February 28, 2013)

Location (County)	Date	Death	Injury	Property Damage
Suffolk	5/1/2012	0	0	0.00K
Suffolk	4/12/2012	0	0	0.00K
Totals:		**0**	**0**	**0.00K**
Source: NCDC Storm Events Database http://www.ncdc.noaa.gov/stormevents/				

For eastern Massachusetts in general, specific details from the NCDC Storm Events Database were available regarding two drought occurrences between 2000 and 2013.

- **April/May 2012** – The U.S. Drought Monitor declared a severe drought across the eastern half of Massachusetts, Rhode Island and a portion of Connecticut from April 12 – May 15, 2012. Precipitation has been half of the normal amount between January 2012 and April 2012 and rivers and streams were running at low levels during the spring run-off season. One major impact of this meteorological drought was an increase in fire danger.
- **Winter 2001/2002** – The Northeast experienced record warmth during the December 2001 through February 2002 winter season which coincided with below normal precipitation and led to widespread drought conditions throughout New England.

According to the Northeast Regional Climate Center (NRCC) associated with Cornell University, for the Massachusetts Coastal Climate Division (of which Boston is a part) during the period of record between 1901 and 1966, there were 6 drought events that lasted 10 or more months each.

3.1.4.2 Probability of Future Occurrence of Drought

While drought is noted in the State Hazard Mitigation Plan as having a widespread statewide impact, it was ranked as having a low frequency of occurrence. The most severe drought on record in Massachusetts occurred between 1961 – 1969. The eastern portion of Massachusetts

has experienced 2 drought scenarios of note in the past ten years, or an average of .18 drought events per year. Past drought occurrences can be an indicator of the probability of future drought events, both long and short term.

3.1.4.3 Vulnerability to the Hazard

The UMass Boston campus receives 100% of its water from the Massachusetts Water Resources Authority (MWRA) Quabbin Reservoir which the City of Boston is connected to and is located 65 miles to the west. As of May 1, 2013, the Quabbin Reservoir was at 91.7% of its 412 billion gallon maximum capacity to serve 47 communities in the Metro Boston area. Monitoring drought conditions for the state of Massachusetts is important to the UMass Boston campus not only directly, but indirectly as a result of where their water source is actually located. **Table 3-19** summarizes drought information reviewed for the geographic areas (local, regional, state) that are associated with overall drought conditions and UMass Boston's specific location.

Table 3-19: Drought Susceptibility

How Susceptibility Was Determined	Susceptibility Criteria
• State of Massachusetts (2010) and City of Boston (2008) Hazard Mitigation Plans • Review of FEMA's Multi-Hazard Identification and Risk Assessment • Anecdotal Information from UMass Boston • NOAA NCDC North American Drought Monitor Map and data	• According to the NCDC North American drought monitor, Massachusetts is not currently (as of January 2013) suffering from any type of drought condition. • Drought was ranked in the State Hazard Mitigation Plan as having a low frequency of occurrence, with minor to serious severity, and having a widespread statewide impact. • MA has a Drought Management Task Force who prepared a Drought Management Plan that notes western Massachusetts may be more vulnerable than eastern Massachusetts to severe drought conditions. • Massachusetts has experienced multi-year drought periods and the most severe drought on record in the northeastern U.S. was during 1961-69.

3.1.4.4 Risk Assessment Methodology, Limitations and Results

After careful consideration of the data available for a drought hazard event and its impact to UMass Boston, the risk assessment for this natural hazard has been developed as a qualitative analysis. UMass Boston prepared a qualitative assessment of the frequency, duration, severity, intensity, probability and consequence of an earthquake utilizing a low, medium, high and severe ranking system. The ranking given for the campus was based on background research, knowledge of the campus and facilities and past occurrences (see **Table 3-20**).

Table 3-20: Risk Assessment – Drought Hazard

	Frequency 0-5	Duration 0-5	Severity 0-5	Intensity 0-5	Probability (F,D,I) 40%	Consequence (S) 60%	Total	Ranking L,M,H,S
Drought	1	1	1	1	1.00	1.00	1.00	L

After reviewing the initial ranking of **low** and conducting further research, specific consideration was given to how an event could impact students, faculty and staff, existing buildings, future buildings, operations and critical infrastructure (see **Table 3-21**).

Table 3-21: Qualitative Risk Assessment – Drought Hazard

	Drought Hazard - Qualitative Ranking
Risk Ranking	Low
Students, Faculty & Staff	Low
Existing Buildings	Low
Future Buildings	Low
Operations	Low
Critical Infrastructure	Low

As a result of considering these additional factors, the overall ranking remained low.

3.1.4.5 Future Development Considerations

UMass Boston will consider drought hazard scenario planning during the future development endeavors of the campus. Measures should be in place to position the campus favorably should a drought scenario occur that would impact the water supply to the campus and/or the ability of the campus to conduct day to day activities such as dining service, landscaping and continued research functions. The following considerations will be incorporated into future planning activities.

- Adequate fire suppression ability for emergency response activities on campus,
- Delivery of water in all new buildings
- Possibility of capturing and reusing water on campus for a variety of purposes,
- Development of emergency procedures, or a clear understanding of City of Boston emergency procedures for back up or interim water supply options and connections should there be disruption of service to the City or area served by the Quabbin Reservoir.

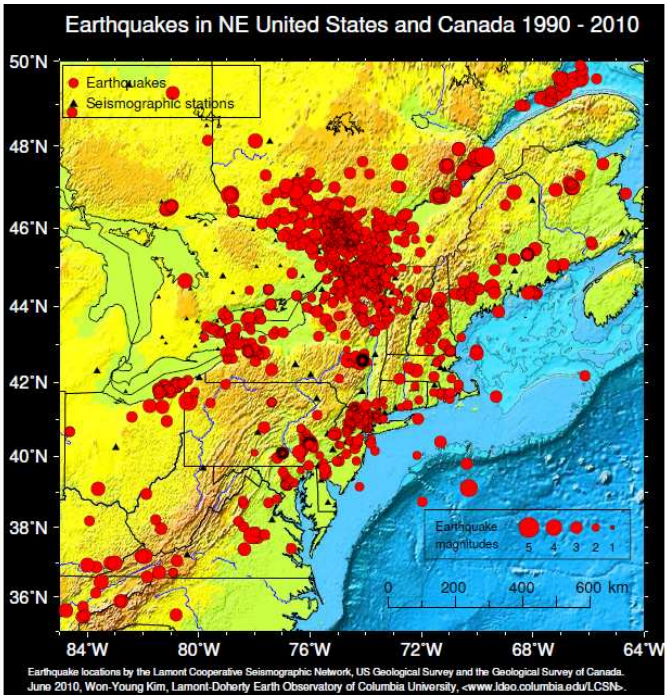
3.1.5 Earthquake

3.1.5.1 Previous Occurrences of the Hazard

According to FEMA, there has never been a Presidential Disaster Declaration made for an earthquake in the State of Massachusetts. At UMass Boston, there have been several instances in the recent past where a minor earthquake has impacted the campus.

Between 1668 – 2007, Massachusetts has experienced 355 earthquakes of varying magnitudes.[1] According to the State Hazard Mitigation Plan, the last major earthquake to affect Massachusetts was more than 200 years ago in 1755 with an estimated magnitude of about 6.0 to 6.25. The epicenter was probably located off the coast of Cape Ann, north of Boston. The area of greatest damage in Massachusetts stretched along the northern coast of the state from Cape Ann to Boston. There have been other damaging earthquakes centered in New England in the past. The 1727 earthquake at Newbury, Massachusetts caused local damage to masonry chimneys and buildings; its magnitude is estimated to have been about 5.6. In 1940 there was a pair of magnitude 5.5 earthquakes centered in the Ossipee Mountains of New Hampshire, and in 1904 there was a magnitude 5.7 earthquake at Eastport, Maine. Both of these earthquakes caused minor damage near their epicenters and were felt throughout Massachusetts. **Figure 7** shows earthquakes in New England, the U.S., and Canada from 1990-2010. According to a recent newspaper article published by US News[2], in the past year, 12 small earthquakes have occurred off the coast of Boston, which now, could indicate that the City is at risk for tsunami activity in the future. Other earthquake events relevant to the Boston area are listed in **Table 3-22**.

Figure 7: Earthquake in New England, United States and Canada 1990-2010



[1] The Northeast States Emergency Consortium, "Earthquakes," [http://www.nesec.org/hazards/earthquakes.cfm.html#history], May 2013

[2] Jason Koebler, "Study: Boston, New England at Greatest Tsunami Risk in US," online [http://www.usnews.com/news/articles/2013/04/19/study-boston-new-england-at-greatest-tsunami-risk-in-us], May 2013

Table 3-22: Recent Earthquake Events in Massachusetts

Date	Magnitude	Location
May 15, 2011	2.1	Buzzard's Bay
July 22, 2003	3.6	Offshore
October 25, 1965	5	Nantucket
April 24, 1924	5	Wareham
August 8, 1847	4.2	Brewster
January 2, 1785	5.4	Off Shore
November 18, 1755	6.0	Cape Ann

Table 3-23 indicates additional details regarding UMass Boston's vulnerability to an earthquake hazard.

Table 3-23: UMass Boston Campus Earthquake Susceptibility

How Susceptibility Was Determined	Susceptibility Criteria
• State of Massachusetts (2010) and City of Boston (2008) Hazard Mitigation Plans • Review of FEMA's Multi-Hazard Identification and Risk Assessment • Anecdotal Information from UMass Boston • Campus Emergency Management Assessment Report – University of Massachusetts, Boston Campus (February 2009)	• The state plan discusses earthquakes and the fact that they have been detected all over New England. • The state plan notes that northeastern MA, especially along the MA coastline from the northern portion of Plymouth County through the Boston Metropolitan area to the New Hampshire border, has greater vulnerability to potential earthquake activity than the rest of the state. • The CEMAR plan indicates that based on an evaluation using AIR Corporations' Cat Station, the probability of UMass Boston experiencing an earthquake producing shaking which could equal or exceed VII on the Modified Mercalli Intensity Scale is .67% in 30 years. Impacts could be heavy damage in structurally compromised buildings. • Two earthquakes have occurred on campus in the recent past and some faculty/staff didn't know what to do. Many went outside in an open area near the Healey Library and responded as if it were a fire. • In August 2011, UMass Boston cancelled classes and on-campus events after an early afternoon earthquake that caused tremors in Boston. Public safety services on campus evacuated students and faculty as a precaution. • There is concern about structural integrity in the plaza area – the facilities department has conducted studies with seismographic data and photographic surveys that have shown low potential for impact.

3.1.5.2 Probability of Future Occurrence of the Hazard

According to USGS, known faults and fault lines east of the Rocky Mountains are unreliable guides to the likelihood of earthquakes. However, an earthquake is as likely to occur on an unknown fault as it is on a fault that has been documented and studied, if not more likely. Fault lines east of the Rocky Mountains are unreliable in terms of predicting where

earthquakes are likely to occur. Earthquakes are most likely to occur in places or regions that they have been located in during the past.

Boston, MA is located in a region where there is a moderate history of seismic activity and several historic events have occurred at a magnitude of 6.0. Earthquake events can't be predicted and they can occur anytime. The UMass Boston campus is situated on a peninsula that was formerly a cow pasture and a landfill site. The artificial fill in this area generally consists of loose to dense sand, gravelly sand and sandy gravel that is intermixed with amounts of silt, clay, cobbles, boulders, and other materials like brick, ash, rubble or trash. Regions in Boston that are artificial areas are considered to have the highest liquefaction potential. Fill that is used for newer buildings in Boston is of higher quality, properly placed and compacted giving it a solid denseness. The possibility does exist that a future earthquake could occur at a substantial magnitude to cause severe impacts to the campus and surrounding area.

3.1.5.3 Vulnerability to the Hazard

According to the State Hazard Mitigation Plan, based on the data provided by Weston Observatory, and on the national earthquake hazards map, it appears that northeastern Massachusetts, especially along the Massachusetts coastline from the northern portion of Plymouth County through the Boston Metropolitan area to the New Hampshire border, has greater vulnerability to potential earthquake activity than the rest of the state. The City of Boston, due to its dense population and older, more historic structures that are not designed to withstand the impacts seismic activity is vulnerable to an earthquake event.

The UMass Boston campus buildings were constructed right around the time that building seismic codes were introduced in the City of Boston in 1973 and adopted statewide in 1975. Future development within the campus Master Plan will be done within the seismic code guidelines and lessen the vulnerability of certain campus assets to this type of natural hazard event.

3.1.5.4 Loss Estimate

A loss estimate was prepared to further determine how UMass Boston's assets would be affected by an earthquake hazard event.[3] Utilizing the FEMA guidance document *"Understanding Your Risks – Identifying Hazards and Estimating Losses (FEMA 386-2)"* calculations were conducted for Estimated Building Damage Sustained, Contents Damage Ratio, Estimated Contents Damage Sustained and then a Total Damage Sustained was calculated (see **Table 3-24**). The information presented in this table is a rough estimate and should not be used for any other purpose other than this hazard mitigation planning effort.

[3] For the purposes of calculating losses to structures due to earthquakes, FEMA 386-2 guidance documentation was utilized. The loss estimation tables by category did not include an educational institution, so for the purposes of this analysis, Professional Office category was utilized. Once the category was selected, a PGA value of .05 was assigned to select the appropriate building damage ratio % and loss of function days.

There are no historical records available regarding an earthquake's damage to UMass Boson or its assets. The quantitative assessment for earthquake event is based on if an event damaged 5% of the assets. Damages to human life are not considered in this calculation.

For the purposes of calculating losses to structures due to earthquakes FEMA 386-2 guidance was utilized. The loss estimation tables by category did not include an educational institution, so for the purposes of this analysis, the Professional Office category was utilized. Once the category was selected, a PGA value of .05 was assigned to select the appropriate building damage ratio % and loss of function days.

Figure 8 indicates graphically which buildings would be impacted based on the ranking in **Table 3-24** where a high, medium or low ranking level was assigned based on these calculations. The Building Damage Ratio percentages are based on a FEMA formula for Repair Cost/Replacement Value and the Contents Damage Ratio percentage is one half of the percent structural damage and derived from the FEMA 386-2 guidance document.

Table 3-24: UMass Boston Campus Buildings - Estimated Loss to Structure & Contents Due to Earthquake

Existing Buildings	Year Constructed	Insurable Replacement Value	PGA Zone	Building Damage Ratio (%)	Estimated Building Damage Sustained ($)	Contents Damage Ratio (%)	Estimated Contents Damage Sustained ($)	Total Damage Sustained	Loss of Function (Days)	Ranking
Campus Center	2004	$123,199,871	0.05	0.0%	$0.0	0.00%	$0.00	$0.00	0	Low
Calf Pasture Pumping Station	1883	Unknown	0.05	0.2%	Unknown	0.10%	Unknown	Unknown	1	Medium
Phillis Wheatley Hall	1973	$92,382,713	0.05	0.1%	$92,382.71	0.05%	$46,191.36	$138,574.07	0	High
Salt Water Pump House	1974	$727,371	0.05	0.1%	$727.37	0.05%	$363.69	$1,091.06	0	Low
McCormack Hall	1975	$97,035,922	0.05	0.0%	$0.0	0.00%	$0.00	$0.00	0	Low
Science Center	1974	$102,512,053	0.05	0.1%	$102,512.05	0.05%	$51,256.03	$153,768.08	0	High
Utility Plant	1974	$6,621,302	0.05	0.1%	$6,621.30	0.05%	$3,310.65	$9,931.95	0	Medium
Healey Library	1978	$108,128,176	0.05	0.0%	$0.0	0.00%	$0.00	$0.00	0	Low
Quinn Administration	1973	$31,620,278	0.05	0.1%	$31,620.28	0.05%	$15,810.14	$47,430.42	0	Medium
Clark Athletic Center	1977	$38,821,751	0.05	0.0%	$0.0	0.00%	$0.00	$0.00	0	Low
Service & Supply	1972	$24,060,563	0.05	0.1%	$24,060.56	0.05%	$12,030.28	$36,090.84	0	Medium
UMass Bayside Expo Center	1968**	$41,250,000	0.05	0.2%	$82,500.0	0.10%	$41,250.00	$123,750.00	1	High

Note: Utilized FEMA 386-2. loss estimation tables by category did not include an educational institution, so for the purposes of this analysis, we utilized the Professional Office category. Once the category was selected, we utilized a PGA value of .05 to select the appropriate building damage ratio % and loss of function days.

Figure 8: Earthquake Vulnerability Assessment by Building

3.1.5.5 Risk Assessment Methodology, Limitations and Results

The UMass Boston team prepared a qualitative assessment of the frequency, duration, severity, intensity, probability and consequence of an earthquake utilizing a low, medium, high and severe ranking system. The ranking given for the campus was based on background research, knowledge of the campus and facilities and past occurrences and is presented in **Table 3-25**.

Table 3-25: Risk Assessment – Earthquake Hazard

	Frequency 0-5	Duration 0-5	Severity 0-5	Intensity 0-5	Probability (F,D,I) 40%	Consequence (S) 60%	Total	Ranking L,M,H,S
Earthquake	1	1	3	3	1.67	3.00	2.47	M

After reviewing the initial ranking of **medium** and conducting further research, specific consideration was given to how an event would impact students, faculty and staff, existing buildings, future buildings, operations and critical infrastructure and is presented in **Table 3-26**.

Table 3-26: Qualitative Risk Assessment - Earthquake

	Earthquake Hazard - Qualitative Ranking
Risk Ranking	Medium
Students, Faculty & Staff	Medium
Existing Buildings	High
Future Buildings	Medium
Operations	Medium
Critical Infrastructure	High

As a result of considering these additional factors, the overall ranking remained medium.

3.1.5.6 Future Development Considerations

UMass Boston will include earthquake hazard scenario planning during future development and redevelopment efforts. Mitigation measures to lessen the impact of an earthquake occurrence for consideration include:

- Stay familiar with changes to the International Code Council (ICC) building codes which are published every three years. In addition, work with City of Boston officials to stay informed regarding any regulatory changes that could impact campus.
- Continue to communicate with the campus population regarding consistent messaging, information, and instructions via public broadcast, websites, email, and social media for emergency information including safety information, the location of shelters, and additional information.
- Coordinate emergency information with City of Boston officials and other UMass System campuses.

3.1.6 Extreme Heat

3.1.6.1 Previous Occurrences of the Hazard

According to the FEMA, there has never been a Presidential Disaster Declaration made for extreme temperatures in the State of Massachusetts. At UMass Boston, there are no records of extreme heat impacting campus. For Suffolk County, specific details from the NCDC Storm Events Database were available regarding one excessive heat occurrence between 2000 and 2013.

- **July 6, 2010 –** High humidity and temperatures nearing 100 degrees were reported. Heat index values were in the range of 100 to 106 for most of Southern New England.

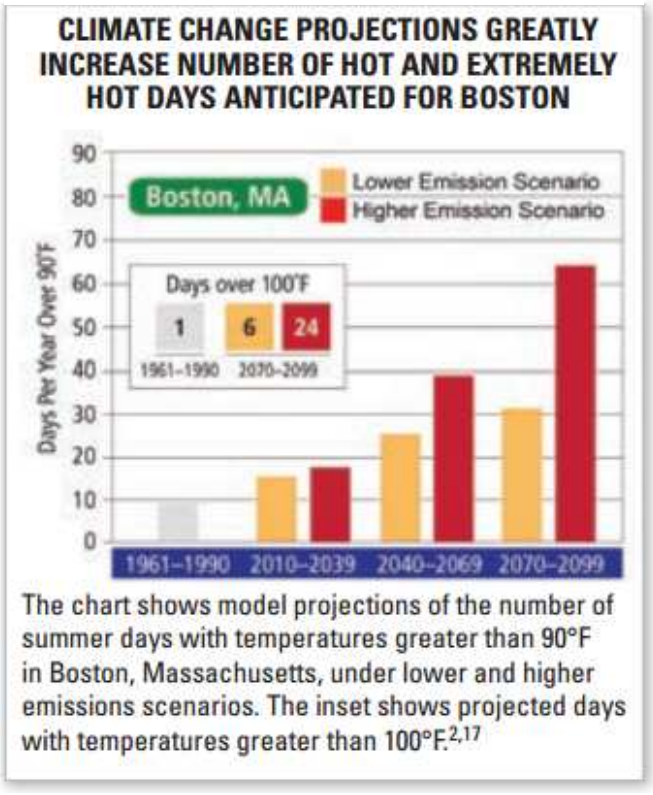
Other data sources note the following information about Massachusetts extreme heat events:

- **2012** - In 2012, Massachusetts experienced a total of 27 broken heat records.
- **July 22, 2011** – Very hot temperatures were experienced in Southern New England. A moist southwest low level flow increased humidity levels such that heat index values rose above 105 degrees for a period of a few hours.

3.1.6.2 Probability of Future Occurrence of the Hazard

The probability of future extreme heat events occurring in Massachusetts and the City of Boston is certain. According to a report by the Center for Disease Control (CDC), *"Climate Change and Extreme Heat Events,"* the number of hot and extremely hot days for Boston is anticipated to increase exponentially in the next 100 years.

Figure 9: Climate Change Projects 1961- 2099



According to the City of Boston's Hazard Mitigation Plan (updated 2013), *"between 1961 and 1990, Boston experienced an average of 11 days per year over 90°F. That could triple to 30 days per year by 2095 under the low emissions scenario, and increase to 60 days per year under the high emissions scenario. Days over 100°F could increase from the current average of one day per year to 6 days with low emissions or 24 days with high emissions By 2099, Massachusetts could have a climate similar to Maryland's under the low emissions scenario, and similar to the Carolinas' with high emissions (see* ***Figure 9****). Furthermore, the number of days with poor air quality could quadruple in Boston by the end of the*

21st century under higher emissions scenario, or increase by half under the lower emissions scenario. This would have significant impacts on public health, particularly for those individuals with asthma and other respiratory system conditions, which typically affect the young and the old more severely."

3.1.6.3 Vulnerability to the Hazard

According to the International Council for Local Environmental Initiatives (ICLEI), Boston is one of the top 10 cities in the country that is most susceptible to extreme heat events. Though the UMass Boston campus does have the benefit of cooling impacts from ocean breezes, vulnerability to extreme heat is expected to continue. A May 2010 report, "*Preparing for Heat Waves in Boston"* referenced the City's dark colored infrastructure and lack of vegetation which creates an urban heat island effect as one reason for its vulnerability to extreme heat events. **Table 3-27** indicates the susceptibility criteria used to determine vulnerability to extreme heat.

Table 3-27: UMass Boston Campus Extreme Heat Susceptibility

How Susceptibility Was Determined	Susceptibility Criteria
• State of Massachusetts (2010) • Tufts University Report -*"Preparing for Heat Waves in Boston"*	• The state plan notes that temperature extremes can occur throughout the entire state. The coastal areas have lower daily averages than the inland parts of the state, but do not carry the same extreme temperature records. Areas that are more prone to heat include inland urban areas. • All areas of Massachusetts are vulnerable to electricity shortages. Shorter-duration heat waves (2-3 days) may cause demand surges, generator stresses/outages, and transmission problems. A prolonged heat wave may lead to electricity supply problems, rolling blackouts, and health and safety risks if priority users cannot be supplied with power. • The likelihood of heat waves occurring in Boston is increasing. The historical data show that the City of Boston is twice as likely to experience a heat wave today as in 1950 and thus the number of declared heat emergency declarations will certainly increase.

3.1.6.4 Risk Assessment Methodology, Limitations and Results

With careful consideration of the data available for an extreme heat hazard event and its impact to UMass Boston, the risk assessment for this natural hazard has been developed as a qualitative analysis as presented in **Table 3-28**.

Table 3-28: Risk Assessment – Extreme Heat

	Frequency 0-5	Duration 0-5	Severity 0-5	Intensity 0-5	Probability (F,D,I) 40%	Consequence (S) 60%	Total	Ranking L,M,H,S
Extreme Heat	1	2	2	2	1.67	2.00	1.87	L

After reviewing the initial ranking of **low** and conducting further research, specific consideration was given to how an event would impact students, faculty and staff, existing buildings, future buildings, operations and critical infrastructure and is presented in **Table 3-29.**

Table 3-29: Qualitative Risk Assessment – Extreme Heat

	Extreme Heat Hazard - Qualitative Ranking
Risk Ranking	Low
Students, Faculty & Staff	Low
Existing Buildings	Low
Future Buildings	Low
Operations	Low
Critical Infrastructure	Low

As a result of considering these additional factors, the overall ranking remained low.

3.1.6.5 Future Development Considerations

UMass Boston will monitor and participate in any Extreme Heat Programs implemented by the City of Boston. UMass Boston will also consider developing an Extreme Heat Program specifically for the campus. Elements of an effective program[4] may include:

- A written and publicly approved program plan that identifies program partners and vulnerable populations
- Clear criteria that define extreme heat events and help to evaluate weather forecasts and conditions
- Coordinated outreach to public and partners, with consistent messaging, information, and instructions via public broadcast, websites, email, and social media
- Strategic action plans that include formal check-in and buddy systems and in-person assessments for vulnerable persons,
- Designated public cooling shelters
- Cancellation policies for outdoor activities and events
- Post-season reviews of program performance by partners, and
- Obtaining public input on ways to improve the program

[4] Center for Disease Control, *"Climate Change and Extreme Heat Events"*

3.1.7 Hailstorm

3.1.7.1 Previous Occurrences of the Hazard

According to FEMA, there has not been a Presidential Disaster Declaration made for hailstorm in the State of Massachusetts. At UMass Boston, there are no records of a hailstorm impacting campus. The NCDC tracks storm events and the information below in **Table 3-30** was available for Suffolk County regarding hail occurrences.

Table 3-30: Hail Event Data for Suffolk County 2000 - 2012

Location	Date	Size	Death	Injury	Property Damage
REVERE	7/18/2012	1.25 in.	0	0	0.00K
REVERE	7/18/2012	0.75 in.	0	0	0.00K
DORCHESTER	6/8/2012	0.75 in.	0	0	0.00K
CHARLESTOWN	8/19/2011	0.75 in.	0	0	0.00K
BOSTON	8/19/2011	1.00 in.	0	0	0.00K
DORCHESTER	6/5/2010	0.75 in.	0	0	0.00K
DORCHESTER	5/8/2010	1.00 in.	0	0	0.00K
DORCHESTER	8/10/2008	0.88 in.	0	0	0.00K
DORCHESTER	6/23/2006	1.00 in.	0	0	0.00K
BOSTON	7/2/2004	0.75 in.	0	0	0.00K
BRIGHTON	7/18/2000	1.00 in.	0	0	0.00k
Source: NCDC Storm Events Database http://www.ncdc.noaa.gov/stormevents/					

Significant hail events that result in death, injury, or property damage have not occurred in Suffolk County from January 1, 2000 through February 28, 2013. Specific details from the more substantial hail events noted in the table above include the following:

- **July 18, 2012** – Severe weather brought large hail and flash flooding throughout southern New England. Hail 1.25 inches in diameter was reported in Revere.
- **August 19, 2011** – Severe thunderstorms produced large hail and damaging winds. Hail 1.00 inch in diameter was reported in Boston.
- **July 2, 2004** – Severe weather brought large hail, downed trees, and power lines throughout eastern Massachusetts. Hail 0.75 inches in diameter was reported in Boston.

3.1.7.2 Probability of Future Occurrence of the Hazard

The probability of a future hail event in Massachusetts and the City of Boston that could impact UMass Boston is likely. Boston is in an area of Massachusetts that typically experiences several hail events on an annual basis.

3.1.7.3 Vulnerability to the Hazard

Although not a frequent occurrence, hail can occur in any location of Massachusetts. The UMass Boston campus is located in a region that is vulnerable to hail events. Hailstorm susceptibility for UMass Boston is outlined in **Table 3-31**.

Table 3-31: UMass Boston Campus Hailstorm Susceptibility

How Susceptibility Was Determined	Susceptibility Criteria
• State of Massachusetts (2010) and City of Boston (2008) Hazard Mitigation Plans	• Hail is discussed as part of thunderstorm events the state plan which notes that the entire state is susceptible. It notes that one of the more damaging storms was in 1998 and impacted Suffolk, Worcester, Bristol and Middlesex County among others.

3.1.7.4 Risk Assessment Methodology, Limitations and Results

With careful consideration of the data available for hailstorm hazard event and its impact to UMass Boston, the risk assessment for this natural hazard has been developed as a qualitative analysis (see **Table 3-32**).

Table 3-32: Risk Assessment – Hailstorm

	Frequency 0-5	Duration 0-5	Severity 0-5	Intensity 0-5	Probability (F,D,I) 40%	Consequence (S) 60%	Total	Ranking L,M,H,S
Hailstorm	1	1	1	1	1.00	1.00	1.00	L

After reviewing the initial ranking of **low** and conducting further research, specific consideration was given to how an event would impact students, faculty and staff, existing buildings, future buildings, operations and critical infrastructure and is presented in **Table 3-33.**

Table 3-33: Qualitative Risk Assessment – Hailstorm Hazard

	Hailstorm Hazard - Qualitative Ranking
Risk Ranking	Low
Students, Faculty & Staff	Low
Existing Buildings	Low
Future Buildings	Low
Operations	Low
Critical Infrastructure	Low

As a result of considering these additional factors, the overall ranking remained low.

3.1.7.5 Future Development Considerations

UMass Boston will consider hailstorm hazard scenario planning during their future development endeavors and continue to implement measures to mitigate the impact of hail occurrences. Preventing a hail event is not plausible, but limiting the effects on the general campus is feasible. Future considerations include the following:

- Coordinate communication and tracking of weather and emergency information with City of Boston officials, and

- Coordinate outreach to public with consistent messaging, information, and instructions via public broadcast, websites, email, and social media for watches and warnings issued by the National Weather Service.

3.1.8 Extreme Wind Events

Wind is defined as air that is in constant motion in relation to the earth's surface. Extreme wind events are commonly related to natural hazards such as tornadoes, hurricanes, destructive winds associated with coastal storms or thunderstorms or they can occur on their own as a windstorm. In addition, they can threaten life, property and operations due to debris such as wood, rocks, metal or other objects that may become airborne or down trees and power lines that can occur during an extreme wind event. For the purposes of this section, we have included tornadoes and hurricanes as extreme wind events.

3.1.8.1 Hurricane

3.1.8.1.1 Occurrences of the Hazard[5]

Since 1954, there have been 6 Major Disaster Declarations in the State of Massachusetts due to a hurricane or tropical storm and 4 of those have resulted in Suffolk County receiving a designated area status from FEMA (see **Table 3-34**).

Table 3-34: Massachusetts Hurricane Major Disaster Declarations (1954 – Present)

	Disaster No.	Incident Period	Date Disaster Declared	Suffolk County a Designated Area?	Notes
Hurricane Sandy	4097	10/27/2012 – 11/08/2012	12/19/2012	Yes	Second costliest hurricane in U.S. history. Impacted 24 states with severe damage in New York and New Jersey.
Tropical Storm Irene	4028	8/27/2011 – 8/29/2011	9/23/2011	No	Impacted most of east coast and is ranked as 6th costliest hurricane in United States history.
Hurricane Bob	914	8/19/1991	8/26/1991	Yes	60% southern MA and RI residents lost power and the storm surge in Buzzards Bay was 10-15 feet.
Hurricane Gloria	751	9/27/1985	10/28/1985	Yes	Dramatic coastal impact including beach erosion

[5] For the purposes of this plan, since it is for specific UMass Boston campuses, occurrences of the Hazard have been focused to the extent possible at the City and County level. Broader information is available at the State level for other areas that have been impacted by various natural hazards.

	Disaster No.	Incident Period	Date Disaster Declared	Suffolk County a Designated Area?	Notes
					and many flooding issues caused and over 2 million without power.
Hurricane Diane	43	8/20/1955	8/20/1955	Yes	Was a Tropical Storm when it reached New England, had heavy rain of 10" – 20", setting flood records for the time.
Hurricane	22	9/2/1954	9/2/1954	Unknown	There was heavy storm surge to Narragansett Bay and New Bedford Harbor, water up to 12 feet in downtown Providence, and massive power loss.
Source: FEMA Major Disaster Declarations 1954 – Present, State of Massachusetts Hazard Mitigation Plan 2010					

Some of the more notable hurricane events include:

- **Hurricane Sandy (2012)** – In the fall of 2012, Hurricane Sandy had a major impact on the New York and New Jersey coastline. The storm broke an all-time record for storm surge height in New York harbor, caused over 100 fatalities, and has reached a cost of over $79 billion for federal aid to cover damages, recovery and mitigation measures. In Massachusetts, Sandy knocked out power to over 200,000 customers, disrupted travel and closed schools. Downed trees, power lines and flooding were also present during and after the storm.
- **Hurricane Bob (1991)** – Made landfall in Rhode Island on Block Island and left extensive damage throughout New England totaling over $1 billion.
- **Hurricane Gloria (1985)** – A storm that hit Long Island, NY and New Jersey that caused minor storm surge, erosion damage and substantial wind damage.
- **Long Island Express Hurricane (1938)** – This storm moved up the east coast from New York through New England and caused widespread storm surge and wind damage to buildings. It is used today as a benchmark for predicting worst-case scenario damage in the region.

Table 3-35 details how many hurricanes have directly hit each New England state between 1951 – 2009.

Table 3-35: Direct Hurricane Hits Between 1851 - 2009

	Saffir-Simpson Hurricane Wind Scale Category					
Area	**1**	**2**	**3**	**4**	**5**	**All**
Connecticut	4	3	3	0	0	10
Rhode Island	3	2	4	0	0	9
New Hampshire	1	1	0	0	0	0
Maine	5	1	0	0	0	6
Massachusetts	**5**	**2**	**3**	**0**	**0**	**10**
Source: FEMA Coastal Construction Manual, 2001 (Blake, 2005 & Jarrell 2001, NOAA)						

Specific damage to the UMass Boston campus occurred during Hurricane Sandy in the fall of 2012, including[6]:

- Portable bathrooms and several fences surrounding construction sites on campus were blown away,
- A sliding door to the Campus Center was damaged,
- Trees were uprooted and high waves caused damage to the northern side of the Harbor Walk, and
- Roof of the Healey Library was partially damaged and resulted in water leaking into classrooms on the 10th and 11th floors.

3.1.8.1.2 Probability of Future Occurrence of the Hazard

UMass Boston's proximity to the coastline gives it greater exposure to the risk of future hurricanes. Based on NOAA's Adapting to Climate Change Guide[7], the power and frequency of Atlantic Ocean hurricanes has increased in recent decades and the intensity of Atlantic hurricanes is likely to increase over the extended long term. Within the short term, NOAA makes predictions on a yearly basis at the start of hurricane season to forecast the number of Atlantic Ocean based hurricanes. For 2013, NOAA is forecasting an active or extremely active season with a 70 percent likelihood of 13 to 20 named storms, of which 7 to 11 could become hurricanes. These ranges are above the seasonal average of 12 named storms, 6 hurricanes, and 3 major hurricanes. According to the State Hazard Mitigation Plan, based on past hurricane landfalls and the frequency of tropical systems to hit Massachusetts is once out of every six years on average.

3.1.8.1.3 Vulnerability to the Hazard

According to the State of Massachusetts Hazard Mitigation Plan, Massachusetts is susceptible to hurricanes (and tropical storms). Impacts to the Commonwealth in addition to a direct hit can include effects from tropical remnants such as heavy rain, localized flooding and storm surge. **Table 3-36** details the susceptibility of UMass Boston to hurricanes.

[6] "Hurricane Sandy Impact on UMass", Mass Media - UMass Boston Independent Student Newspaper, October 31, 2012

[7] Source: NOAA's Adapting to Climate Change: A Planning Guide for State Coastal Managers (2010)

Table 3-36: UMass Boston Campus Hurricane Susceptibility

How Susceptibility Was Determined	Susceptibility Criteria
• State of Massachusetts (2010) and City of Boston (2008) Hazard Mitigation Plans • Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NOAA historical tropical cyclone tracks • Anecdotal Information from UMass Boston • Campus Emergency Management Assessment Report – University of Massachusetts, Boston Campus (February 2009)	• Hurricanes are discussed in the state hazard mitigation plan which notes that the entire state of MA is susceptible to hurricanes with coastal areas being susceptible to both wind damage and storm surge damage. • NOAA's historical tropical cyclone tracks show the paths that tropical storms/hurricanes have taken through the Commonwealth. • The state plan notes that between 1851 and 2004, approximately 32 tropical storms; five Category 1 hurricanes, two Category 2 hurricanes and three Category 3 hurricanes have made landfall. To date, the Commonwealth has not experienced a Category 4 or 5 hurricane. • The state plan notes that based on past hurricane and tropical storm landfalls, the frequency of tropical systems to hit the Massachusetts coastline is an average of once out of every six years. • CEMAR for UMass Boston notes the campus is exposed to high winds and wave action from Boston Harbor. Past winds have produced moderate roof damage and a storm surge of 15-20 feet may be possible. • Numerous leaking buildings due to wind driven rain (Healey Library has a persistent problem with roof damage from Hurricane Sandy). • In Wheatley, Quinn and Clark – buckets are frequently placed to catch water. • Any new construction on campus will have windows rated against 100 mile wind standard. • There is a question about structural integrity in the plaza area. • Hurricane plan is in place. • No sound system notification in some buildings to provide instruction on how to evacuate.

3.1.8.1.4 Risk Assessment Methodology, Limitations and Results

After consideration of the data available for a hurricane event and its impact to the UMass Boston campus, the risk assessment for this natural hazard has been developed as a qualitative analysis. A qualitative assessment of the frequency, duration, severity, intensity, probability and consequence of a hurricane hazard utilizing a low, medium, high and severe ranking system was prepared. The ranking given for UMass Boston was based on background research, future development plans, knowledge of the campus, infrastructure and past occurrences and is presented in **Table 3-37**.

Table 3-37: Risk Assessment – Hurricane

	Frequency 0-5	Duration 0-5	Severity 0-5	Intensity 0-5	Probability (F,D,I) 40%	Consequence (S) 60%	Total	Risk Ranking L,M,H,S
Hurricane	3	4	5	4	3.67	5.00	4.47	S

After reviewing the initial ranking of **severe** and conducting further research, specific consideration was given to how an event could impact students, faculty and staff, existing buildings, future buildings, operations and critical infrastructure (see **Table 3-38**).

Table 3-38: Qualitative Risk Assessment - Hurricane

	Hurricane Hazard - Qualitative Ranking
Risk Ranking	Severe
Students, Faculty & Staff	Severe
Existing Buildings	High
Future Buildings	High
Operations	Severe
Critical Infrastructure	High

As a result of considering these additional factors, the overall ranking remained severe.

3.1.8.1.5 Future Development Considerations

UMass Boston will give consideration to hurricane hazards during future development and redevelopment efforts. Additional considerations include:

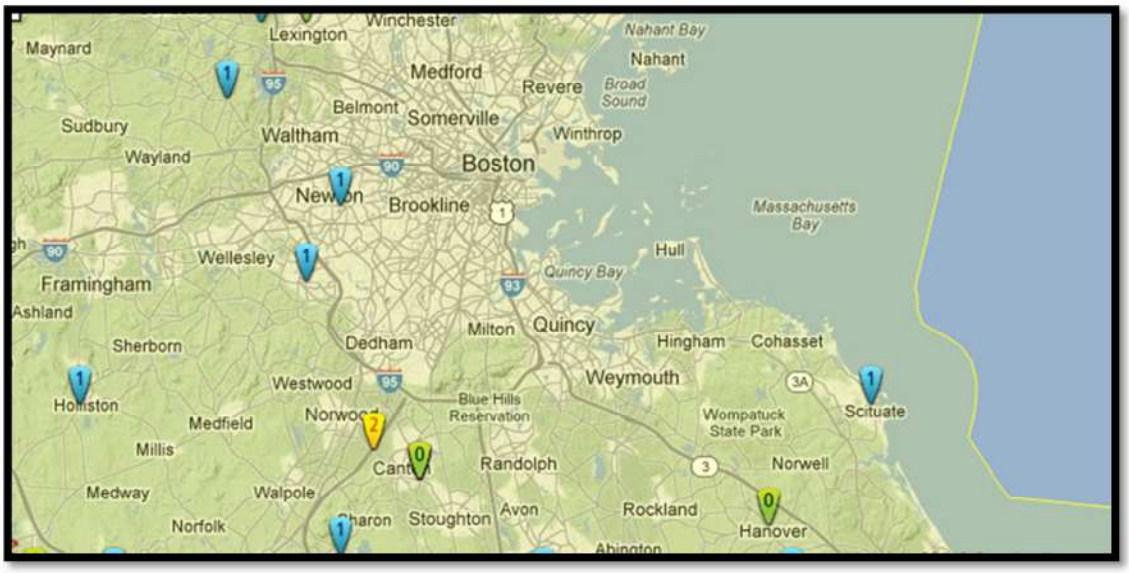
- Continued enforcement of local and state regulations that address coastal erosion, coastal storms, and flooding and considerations.
- Implement building code requirements in building rehabilitations or new construction that relate to FEMA policies and guidelines that may be included in City of Boston regulations.
- Coordinate weather and emergency information with City of Boston officials.
- Coordinate outreach to public with consistent messaging, information, and instructions via public broadcast, websites, email, and social media for watches and warnings issued by the National Weather Service, hurricane evacuation routes, and homeowner guidance for hurricane preparation.
- Develop a shelter in place plan for the campus population and particularly when new residence halls are constructed on campus in the future.

3.1.8.2 Tornado

3.1.8.2.1 Occurrences of the Hazard

There have been no recorded tornadoes in Suffolk County between the 1956 and 2011 timeframe for when data is available. However, there have been several tornadoes in nearby counties (see **Figure 10**).

Figure 10: Suffolk County Tornadoes, 1956-2011



Source: www.tornadohistoryproject.com

Since 1954, there have been 2 Major Disaster Declarations in the State of Massachusetts for Tornadoes (see **Table 3-39**). Neither of these instances has impacted Suffolk County directly.

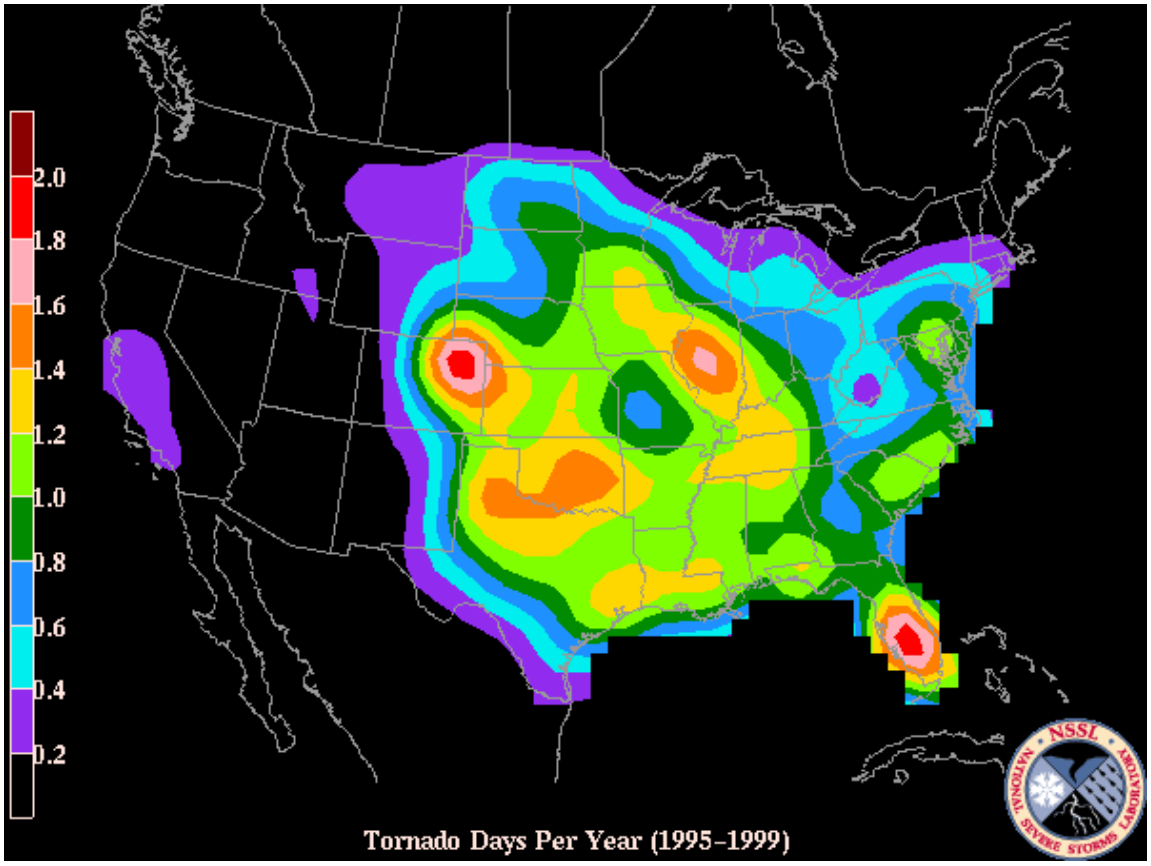
Table 3-39: Massachusetts Tornado Major Disaster Declarations (1954 – Present)

	Disaster No.	Incident Period	Date Disaster Declared	Suffolk County a Designated Area?
Severe Storms and Tornadoes	1994	6/1/2011	6/15/2011	No
Tornado	7	6/11/1953	6/11/1953	Unknown
Source: FEMA Disaster Declarations 1954 - Present				

3.1.8.2.2 Probability of Future Occurrence of the Hazard

NOAA's National Severe Storm Laboratory (NSSL) has estimated the likelihood for a tornado on a given day in the United States. **Figure 11** shows that the probability for a tornado in Massachusetts is 0.2 to 0.4 days per year based on tornado data collected from 1995 to 1999.

Figure 11: Tornado Days Per Year in the United States, NOAA's (NSSL)



3.1.8.2.3 Vulnerability to the Hazard

The Massachusetts State Hazard Mitigation Plan notes that the state has a definite vulnerability towards tornadoes (see **Table 3-40**).

Table 3-40: UMass Boston Campus Tornado Susceptibility

How Susceptibility Was Determined	Susceptibility Criteria
• State of Massachusetts (2010) and City of Boston (2008) Hazard Mitigation Plans • Review of FEMA's Multi-Hazard Identification and Risk Assessment • Anecdotal Information from UMass Boston Task Force	• The state plan notes that a Tornado may occur anywhere in MA with the right atmospheric conditions. • The state plan and several of the regional/city plans acknowledge that Massachusetts has a definite vulnerability to tornadoes, with an average annual occurrence of 2.6 tornadoes per year since 1951. • According to the NCDC, between 1991 – 2010, Massachusetts has averaged one tornado per year. • Tornadoes are ranked as a medium threat in terms of frequency, with the potential for causing serious or extensive damage in the State Hazard Mitigation Plan.

How Susceptibility Was Determined	Susceptibility Criteria
• Tornado History Project (online) • Campus Emergency Management Assessment Report – University of Massachusetts, Boston Campus (February 2009)	• Between 1951 and 2011, there have been 156 tornadoes in Massachusetts which have resulted in 105 fatalities and 1,559 injuries. • Between 1951 – 2011, Suffolk County has recorded 0 tornados, Bristol County has recorded 9, Middlesex County has recorded 17 and Worcester County has recorded 39. • CEMAR noted that a tornado event is unlikely to strike UMass Boston. However, if there was a direct hit, there could be substantial damage to campus buildings and expose staff and students to flying debris. • Concern at UMass Boston over any event that would have high winds.

3.1.8.2.4 Risk Assessment Methodology, Limitations and Results

After consideration of the data available for a tornado event and its impact to the UMass Boston campus, the risk assessment for this natural hazard has been developed as a qualitative analysis. A qualitative assessment of the frequency, duration, severity, intensity, probability and consequence of a tornado hazard utilizing a low, medium, high and severe ranking system was prepared. The ranking given for UMass Boston was based on background research, future development plans, knowledge of the campus, infrastructure and past occurrences and is presented in **Table 3-41.**

Table 3-41: Risk Assessment – Tornado

	Frequency 0-5	Duration 0-5	Severity 0-5	Intensity 0-5	Probability (F,D,I) 40%	Consequence (S) 60%	Total	Risk Ranking L,M,H,S
Tornado	1	1	3	3	1.67	3.00	2.47	M

After reviewing the initial ranking of **medium** and conducting further research, specific consideration was given to how an event could impact students, faculty and staff, existing buildings, future buildings, operations and critical infrastructure (see **Table 3-42**).

Table 3-42: Qualitative Risk Assessment - Tornado

	Tornado Hazard - Qualitative Ranking
Risk Ranking	Medium
Students, Faculty & Staff	High
Existing Buildings	Medium
Future Buildings	Medium
Operations	Medium
Critical Infrastructure	Medium

As a result of considering these additional factors, the overall ranking remained **medium**.

3.1.8.2.5 Future Development Considerations

UMass Boston should include tornado hazard scenario planning during their future development and redevelopment efforts and continue to implement measures to mitigate the impact of tornado occurrences. This includes the following mitigation measures:

- Coordinate weather and emergency information with City of Boston officials.
- Coordinate outreach to public with consistent messaging, information, and instructions via public broadcast, websites, email, and social media for watches and warnings issued by the National Weather Service.
- Coordinate outreach to the campus population for tornado guidance preparation.

3.1.9 Severe Winter Storm

3.1.9.1 Occurrences of the Hazard

Since 1954, there have been 6 Major Disaster Declarations in the State of Massachusetts due to some form of winter storm and 3 of those have resulted in Suffolk County receiving a designated area status from FEMA (see **Table 3-43**).

Table 3-43: Massachusetts Winter Storm Major Disaster Declarations (1954-Present)

	Disaster No.	Incident Period	Date Disaster Declared	Suffolk County a Designated Area?
Severe Winter Storm, Snowstorm, Flooding	4110	2/8/2013 – 2/9/2013	4/19/2013	Yes
Severe Storm and Snowstorm	4051	10/29/2011 – 10/30/2011	1/6/2012	No
Severe Winter Storm and Flooding	1813	12/11/2008 – 12/18/2008	1/5/2009	No
Blizzard	1090	1/7/1996 – 1/13/1996	1/24/1996	No
Winter Coastal Storm	975	12/11/1992 – 12/13/1992	12/21/1992	Yes
Coastal Storm, Flood, Ice, Snow	546	2/6/1978 – 2/8/1978	2/10/1978	Yes
Source: FEMA Disaster Declarations 1954 - Present				

The NCDC tracks storm events and the information in **Table 3-44** was available for Suffolk County regarding winter storm and blizzard occurrences.

Table 3-44: Winter Storm/Blizzard Data for Suffolk County (January 1, 2000 - February 28, 2013)

Location (County)	Date	Type	Death	Injury	Property Damage
SUFFOLK	2/8/2013	Blizzard	0	0	0.00K
SUFFOLK	2/1/2011	Winter Storm	0	0	432.00K
SUFFOLK	1/21/2011	Winter Storm	0	0	0.00K
SUFFOLK	1/12/2011	Winter Storm	0	0	50.00K
SUFFOLK	12/26/2010	Winter Storm	0	0	0.00K
SUFFOLK	3/16/2007	Winter Storm	0	0	0.00K
SUFFOLK	2/14/2007	Winter Storm	0	0	0.00K
SUFFOLK	2/12/2006	Winter Storm	0	0	10.00K
SUFFOLK	12/5/2003	Winter Storm	0	0	0.00K
SUFFOLK	2/17/2003	Winter Storm	0	0	0.00K
SUFFOLK	12/25/2002	Winter Storm	0	0	15.00K
Totals:			**0**	**0**	**507.00K**
Source: NCDC Storm Events Database http://www.ncdc.noaa.gov/stormevents/					

Specific details from the more significant events noted in the table above that have impacted the City of Boston include:

- **February 8, 2013** – A historic winter storm deposited large amounts of snow all over southern New England between February 8-9, 2013. Most locations received 2 to 2.5 feet of snow. The blizzard produced a prolonged period of strong winds and moderate to major coastal flooding. Along the coastline, storm surge reached 3-4 feet.
- **December/February 2011** - A series of significant heavy snow events occurred between December 26, 2010 and February 2, 2011. Snow for the winter season totaled 86.4 inches, most of which fell during this period. Across Massachusetts, numerous roof collapses due to heavy snow load occurred following the February 2nd storm.
- **January 12, 2011** - Fourteen to nineteen inches of snow fell across Suffolk County. Strong winds combined with the heavy snow resulting in numerous trees and limbs downed in Boston and Chelsea.

At UMass Boston, there have been several winter storm impacts related to campus and there are some general concerns including access off campus due to the student commuter population, student shuttling from Bayside during inclement weather and weight of snow on roofs.

3.1.9.2 Probability of Future Occurrence of the Hazard

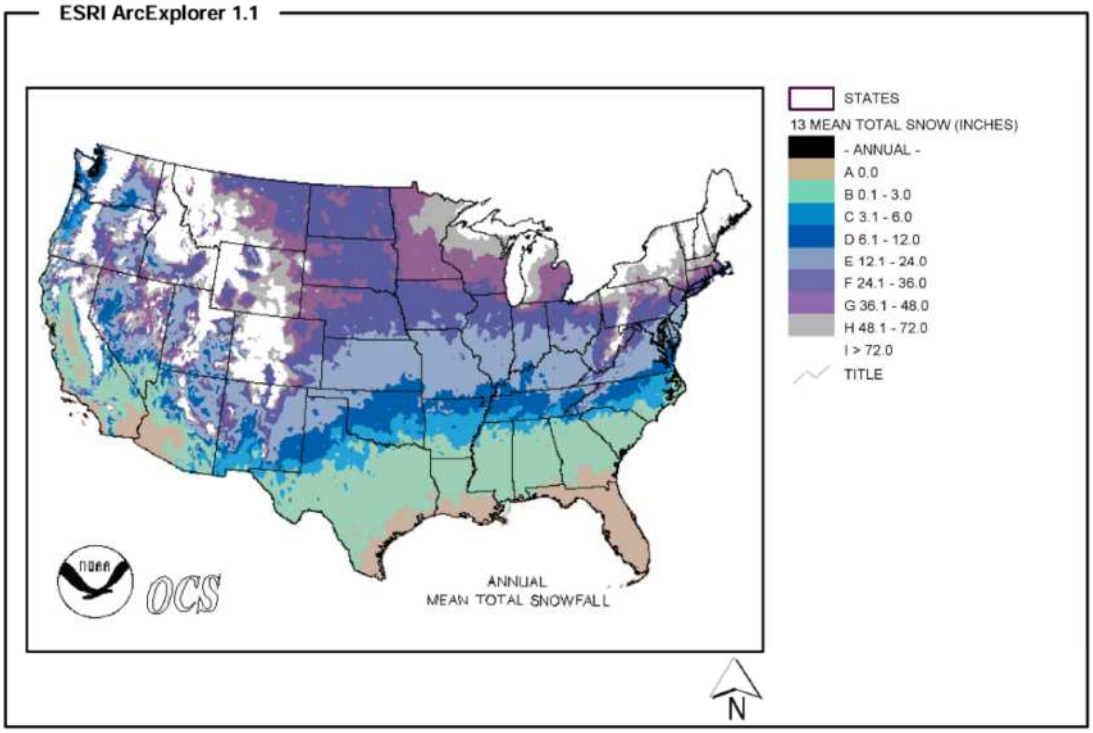
The probability of future winter storms impacting the UMass Boston campus is virtually certain on an annual basis. According to the City of Boston Hazard Mitigation plan update, winter storms are the most common and familiar of the region's hazards that affect large geographic areas.

3.1.9.3 Vulnerability to the Hazard

Data gathered by the National Climatic Data Center (NCDC) indicates that Massachusetts has an annual mean total snowfall between 48" and 72." The City of Boston Hazard Mitigation Plan update notes that the average annual snowfall for the northern portion of Boston (including

Jamaica Plain Roxbury, Mattapan, north Dorchester, South End, South Boston, Allston/Brighton, Back Bay, Beacon Hill, the Financial District, North End, East Boston, and Charlestown) falls within a range of 38.1 to 48 inches while the southern portion of the city, including Roslindale, West Roxbury, and Hyde Park, are in the range of 48.1 - 72 inches of snow annually (see **Figure 12**).

Figure 12: Annual Mean Total Snowfall



Some of the criteria that was used to determine susceptibility to a winter storm is provided in **Table 3-45.**

Table 3-45: UMass Boston Campus Winter Storm Susceptibility

How Susceptibility Was Determined	Susceptibility Criteria
• State of Massachusetts (2010) and City of Boston (2008) Hazard Mitigation Plans • Review of FEMA's Multi-Hazard Identification and Risk Assessment • Anecdotal Information from UMass Boston	• The state plan notes that although the entire state may be considered at risk, higher snow accumulations appear to be prevalent at higher elevations in Western and Central Massachusetts, and along the coast where snowfall can be enhanced by additional ocean moisture. • The state plan notes that ice storms can arise in any part of the state, however they most frequently occur in the higher elevations of Western and Central Massachusetts. From 1971 to 2009 there have been about 40 ice storm events which impacted at least one or more counties in the Commonwealth.

How Susceptibility Was Determined	Susceptibility Criteria
• Campus Emergency Management Assessment Report – University of Massachusetts, Boston Campus (February 2009)	• The CEMAR for UMass Boston evaluated natural hazards including winter storms. Potential consequences included snow loading that may lead to roof damage/collapse and winds that may cause roof damage and related water infiltration to upper floors of buildings. In addition, there may be an inability of students, faculty and staff to evacuate the campus due to limited egress routes and a large commuter population. Traffic congestion could lead to the need for overnight sheltering for limited individuals. • It was reported anecdotally that UMass Boston has concerns about access off campus, student shuttling from Bayside (lot of movement back and forth) and weight of snow on roofs.

3.1.9.4 Risk Assessment Methodology, Limitations and Results

After consideration of the data available for a winter storm hazard event and its impact to the UMass Boston campus, the risk assessment for this natural hazard has been developed as a qualitative analysis. A qualitative assessment of the frequency, duration, severity, intensity, probability and consequence of a winter storm hazard utilizing a low, medium, high and severe ranking system was prepared. The ranking given for UMass Boston was based on background research, future development plans, knowledge of the campus, infrastructure and past occurrences and is shown in **Table 3-46**.

Table 3-46: Risk Assessment – Winter Storm

	Frequency 0-5	Duration 0-5	Severity 0-5	Intensity 0-5	Probability (F,D,I) 40%	Consequence (S) 60%	Total	Risk Ranking L,M,H,S
Winter Storm	4	3	3	2	3.00	3.00	3.00	H

After reviewing the initial ranking of **high** and conducting further research, specific consideration was given to how an event would impact students, faculty and staff, existing buildings, future buildings, operations and critical infrastructure **Table 3-47**.

Table 3-47: Qualitative Risk Assessment – Winter Storm Hazard

	Winter Storm - Qualitative Ranking
Risk Ranking	High
Students, Faculty & Staff	High
Existing Buildings	Medium
Future Buildings	Medium
Operations	High
Critical Infrastructure	High

As a result of considering these additional factors, the overall ranking remained **high**.

3.1.9.5 Future Development Considerations

UMass Boston will continue to give consideration to winter storm events during future development and redevelopment endeavors and continue to mitigate the impact of winter storm occurrences. This includes the following mitigation measures:

- Coordinate weather and emergency information with City of Boston officials.
- Coordinate outreach to public with consistent messaging, information, and instructions via public broadcast, websites, email, and social media for watches and warnings issued by the National Weather Service.
- Coordinate outreach to the campus population for winter storm guidance preparation.

3.1.10 Thunderstorm & Lightning

3.1.10.1 Previous Occurrences of the Hazard and Impact

Table 3-48 summarizes lightning occurrences provided by NOAA's National Climatic Data Center (NCDC) for Suffolk County.

Table 3-48: Lightning Event Data for Suffolk County (January 1, 2000 – February 28, 2013)

Location	Date	Death	Injury	Property Damage
DORCHESTER	7/18/2012	0	0	50.00K
BOSTON	7/4/2012	0	2	0.00K
WINTHROP	8/21/2011	0	1	0.00K
(BOS)LOGAN INTL ARPT	8/19/2011	0	0	15.00K
DORCHESTER CENTER	5/7/2011	0	0	250.00K
SOUTH BOSTON	8/5/2010	1	0	0.00K
BOSTON	8/2/2008	0	2	0.00K
GROVE HALL	7/20/2008	0	10	0.00K
BACK BAY ANNEX	6/27/2008	0	0	5.000M
BOSTON LOGAN INTL AR	12/9/2005	0	0	100.00K
SOUTH BOSTON	7/2/2004	0	1	0.00K
WINTHROP	6/27/2002	0	0	100.00K
BOSTON	8/3/2001	0	0	1.500M
REVERE	7/10/2001	1	0	0.00K
MATTAPAN	5/10/2000	0	0	0.00K
Totals:		**2**	**16**	**7.015M**

Source: NCDC Storm Events Database http://www.ncdc.noaa.gov/stormevents/

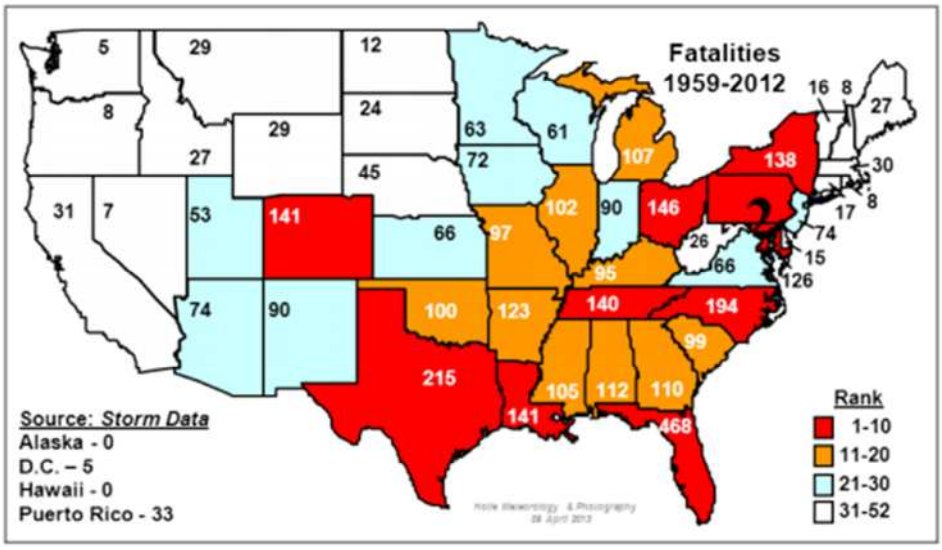
Specific details from the more significant events noted in the figure above that have occurred in the City of Boston include:

- **July 4, 2012** - Hot and humid conditions resulted in diurnal showers and thunderstorms. One of these storms became severe, resulting in some wind damage.
- **August 19, 2011** - Southwest flow kept a cold front over Southern New England for a prolonged period of time. Coupled with an approaching shortwave, this created enough lift, instability, and moisture to produce strong to severe thunderstorms. These storms produced both large hail and damaging winds with hail up to quarter size and numerous downed trees.
- **August 5, 2010** - A cold front moved through the area producing thunderstorms and heavy rain across Southern New England. A 50 year old man was struck by lightning while walking in an area known as the Sugar Bowl in South Boston.
- **July 2, 2004** – A substantial storm brought many reports of large hail, downed trees, and power lines throughout much of central and eastern Massachusetts. Lightning from the storms caused two injuries. A man in South Boston was struck by part of a bolt of lightning that struck a nearby tree.
- **August 3, 2001** - Thunderstorms with frequent lightning knocked out power to about 50,000 electric customers, primarily in Franklin, Hampshire, and Suffolk Counties. Lightning sparked a fire that destroyed the Boston Tea Party gift shop, resulting in an estimated 1.5 million dollars in damage.

3.1.10.2 Probability of Future Occurrence of the Hazard

The probability of a future lightning occurrence in Massachusetts and the City of Boston is likely. Boston is in an area of Massachusetts that typically experiences 3 to 6 lightning flashes per square mile per year. Future lightning events will continue to cause minor property damage throughout the City and threaten human life as well (see **Figure 13**).

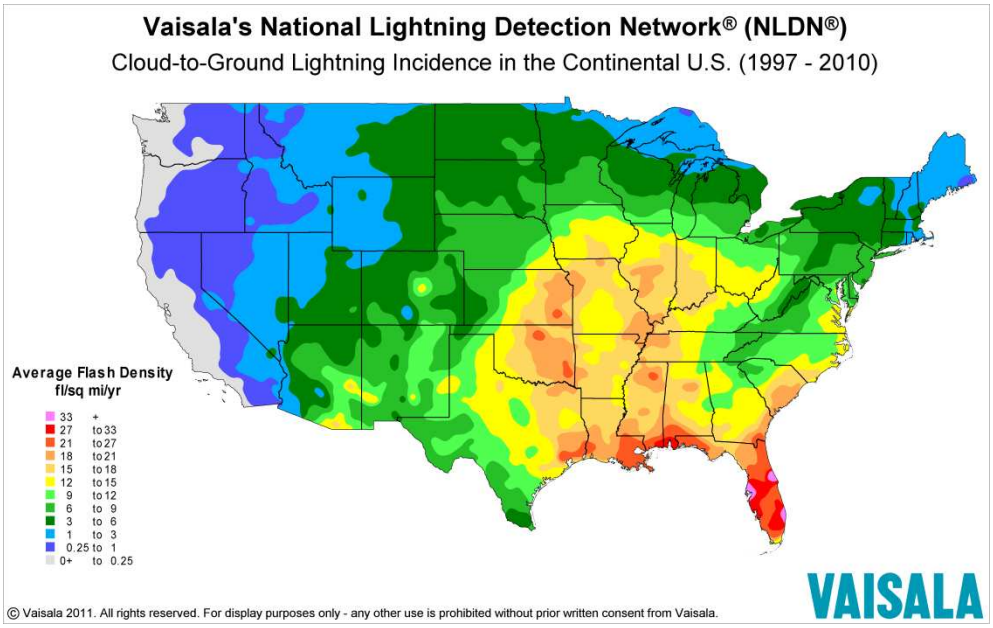
Figure 13: Lightning Fatalities by State, 1959-2012



3.1.10.3 Vulnerability to the Hazard

The UMass Boston campus is located in a region that is vulnerable to thunderstorm and lightning events, however they are not as susceptible as other areas of the United States. **Figure 14** indicates Vaisala's National Lightning Detection Network display data representing Cloud to Ground Lightning Incidences between 1997 – 2010.

Figure 14: Cloud to Ground Lightning Incidents in the U.S. – Vaisala NLDN



In addition, UMass Boston vulnerability to thunderstorm and lightning events was also determined by evaluating state and local planning documents as well as gathering anecdotal information from campus staff (see **Table 3-49**).

Table 3-49: UMass Boston Campus Thunderstorm & Lightning Susceptibility

How Susceptibility Was Determined	Susceptibility Criteria
• State of Massachusetts (2010) and City of Boston (2008) Hazard Mitigation Plans • Review of FEMA's Multi-Hazard Identification and Risk Assessment • Anecdotal Information from UMass Boston Task Force	• Thunderstorms are discussed in the state plan which notes that the entire state is susceptible. It notes that one of the more damaging storms was in 1998 and impacted Suffolk, Worcester, Bristol and Middlesex County among others. • There is some concern on campus about fields with aluminum stands.

3.1.10.4 Risk Assessment Methodology, Limitations and Results

After consideration of the data available for a thunderstorm/lightning hazard event and its impact to the UMass Boston campus, the risk assessment for this natural hazard has been developed as a qualitative analysis. A qualitative assessment of the frequency, duration, severity, intensity, probability and consequence of a thunderstorm/lightning hazard utilizing a low, medium, high and severe ranking system was prepared. The ranking given for UMass Boston was based on background research, future development plans, knowledge of the campus, infrastructure and past occurrences and is shown in **Table 3-50.**

Table 3-50: Risk Assessment – Thunderstorm/Lightning

	Frequency 0-5	Duration 0-5	Severity 0-5	Intensity 0-5	Probability (F,D,I) 40%	Consequence (S) 60%	Total	Risk Ranking L,M,H,S
Thunderstorm Lightning	3	2	2	2	2.33	2.00	2.13	M

After reviewing the initial ranking of **medium** and conducting further research, specific consideration was given to how an event would impact students, faculty and staff, existing buildings, future buildings, operations and critical infrastructure (see **Table 3-51**).

Table 3-51: Qualitative Risk Assessment – Thunderstorm/Lightning Hazard

	Thunderstorm/Lightning - Qualitative Ranking
Risk Ranking	Medium
Students, Faculty & Staff	Medium
Existing Buildings	Medium
Future Buildings	Medium
Operations	Medium
Critical Infrastructure	Low

As a result of considering these additional factors, the overall ranking remained **medium**.

3.1.10.5 Future Development Considerations

UMass Boston will consider thunderstorm/ lightning hazard scenario planning during future development and redevelopment of the campus to mitigate the impact of thunderstorm/ lightning occurrences. This includes the following mitigation measures:

- Coordinate weather and emergency information with City of Boston officials.
- Coordinate outreach to public with consistent messaging, information, and instructions via public broadcast, websites, email, and social media for watches and warnings issued by the National Weather Service.

- Coordinate outreach to the campus population for the dangers of thunderstorm and lightning.

3.1.11 Tsunami

3.1.11.1 Occurrences of the Hazard

According to FEMA, there have been no Presidential Disaster Declarations made for tsunamis in the State of Massachusetts since 1954. At UMass Boston, there have been no tsunami instances impacting campus.

3.1.11.2 Probability of Future Occurrence of the Hazard

Tsunamis are extremely rare but not unprecedented in the Atlantic Ocean. In order for a tsunami to cause major damage, there needs to be an earthquake of a magnitude of at least 7 which are rare on the East Coast. The earthquake would also have to occur in the ocean.

3.1.11.3 Vulnerability to the Hazard

UMass Boston is located in a region that is not as vulnerable to tsunamis as the West Coast. However, tsunamis are possible in the Atlantic Ocean, with one most recently believed to have occurred in June 2013 (see **Table 3-52**).

Table 3-52: UMass Boston Campus Tsunami Susceptibility

How Susceptibility Was Determined	Susceptibility Criteria
• State of Massachusetts (2010) and City of Boston (2008) Hazard Mitigation Plans • Review of FEMA's Multi-Hazard Identification and Risk Assessment • Anecdotal Information from UMass Boston	• The state plan indicates that all of the coastal areas of Massachusetts are exposed to the threat of tsunamis. It is unknown what the probability is of a damaging tsunami along the MA coast. • The state plan refers to the fact that history suggests that there is some tsunami hazard to Massachusetts, both from a strong, local offshore earthquake and from a major earthquake across the Atlantic Ocean. • The campus is at the intersection of two faults.

3.1.11.4 Risk Assessment Methodology, Limitations and Results

After consideration of the data available for a tsunami hazard event and its impact to the UMass Boston campus, the risk assessment for this natural hazard has been developed as a qualitative analysis. A qualitative assessment of the frequency, duration, severity, intensity, probability and consequence of a tsunami hazard utilizing a low, medium, high and severe ranking system was prepared. The ranking given for UMass Boston was based on background research, future development plans, knowledge of the campus, infrastructure and past occurrences and is shown in **Table 3-53.**

Table 3-53: Risk Assessment – Tsunami

	Frequency 0-5	Duration 0-5	Severity 0-5	Intensity 0-5	Probability (F,D,I) 40%	Consequence (S) 60%	Total	Risk Ranking L,M,H,S
Tsunami	0	1	4	3	1.33	4.00	2.93	M

After reviewing the initial ranking of **medium** and conducting further research, specific consideration was given to how an event would impact students, faculty and staff, existing buildings, future buildings, operations and critical infrastructure (see **Table 3-54**).

Table 3-54: Qualitative Risk Assessment – Tsunami Hazard

	Tsunami - Qualitative Ranking
Risk Ranking	Medium
Students, Faculty & Staff	Medium
Existing Buildings	Medium
Future Buildings	Medium
Operations	Medium
Critical Infrastructure	Low

As a result of considering these additional factors, the overall ranking remained **medium**.

3.1.11.5 Future Development Considerations

UMass Boston may consider tsunami hazard scenario planning during future development and redevelopment efforts. Mitigation measures may include:

- Coordinate weather and emergency information with City of Boston and State officials. Due to a potential wide spread effect on the East Coast, State and local resources may need to be involved.
- Coordinate outreach to the campus population with consistent messaging, information, and instructions via public broadcast, websites, email, and social media for watches and warnings issued by the National Weather Service.

3.1.12 Urban Fire

3.1.12.1 Occurrences of the Hazard

UMass Boston has not had any notable fires in recent years. **Table 3-55** indicates susceptibility criteria related to selecting Urban Fire as a hazard of concern for the campus.

Table 3-55: UMass Boston Campus Urban Fire Susceptibility

How Susceptibility Was Determined	Susceptibility Criteria
• State of Massachusetts (2010) and City of Boston (2008) Hazard Mitigation Plans • Review of FEMA's Multi-Hazard Identification and Risk Assessment • Anecdotal Information from UMass Boston Task Force	• The state Hazard Mitigation Plan notes that there are a number of areas of the state vulnerable to urban fires, particularly those areas where there are larger concentrations of wood frame construction homes or businesses which are more likely to experience large destructive fire. • A fire in Healey Library is of concern due to evacuation issues, change in building use over time to include classrooms, computer labs, and a lack of sprinkler system. Other buildings on campus are also unsprinklered.

3.1.12.2 Probability of Future Occurrence of the Hazard

The probability of a future occurrence of an urban fire at UMass Boston is possible. However, due to the campuses' isolated location on the peninsula, it is expected that the extent of this type of event would be localized.

3.1.12.3 Vulnerability to the Hazard

According to City of Boston records, in 1975, there were 417 major fires and in 2012, there were 40 throughout the City. While better building codes and automatic sprinkler systems are regularly utilized, the UMass Boston campus is still vulnerable to fire. Each UMass Boston building was given a high, medium or low vulnerability to fire ranking based on the age of the building and anecdotal information regarding any past instances or insufficient building sprinklers (see **Figure 15**).

Figure 15: Fire Vulnerability Assessment by Building

3.1.12.4 Risk Assessment Methodology, Limitations and Results

After consideration of the data available for an urban fire hazard event and its impact to the UMass Boston campus, the risk assessment for this natural hazard has been developed as a qualitative analysis. A qualitative assessment of the frequency, duration, severity, intensity, probability and consequence of an urban fire hazard utilizing a low, medium, high and severe ranking system was prepared. The ranking given for UMass Boston was based on background research, future development plans, knowledge of the campus, infrastructure and past occurrences and is shown in **Table 3-56.**

Table 3-56: Risk Assessment – Urban Fire

	Frequency 0-5	Duration 0-5	Severity 0-5	Intensity 0-5	Probability (F,D,I) 40%	Consequence (S) 60%	Total	Risk Ranking L,M,H,S
Urban Fire	1	2	4	3	2.00	4.00	3.20	H

After reviewing the initial ranking of **high** and conducting further research, specific consideration was given to how an event would impact students, faculty and staff, existing buildings, future buildings, operations and critical infrastructure **Table 3-57.**

Table 3-57: Qualitative Risk Assessment – Urban Fire Hazard

	Urban Fire Qualitative Ranking
Risk Ranking	High
Students, Faculty & Staff	Medium
Existing Buildings	High
Future Buildings	High
Operations	Medium
Critical Infrastructure	Low

As a result of considering these additional factors, the overall ranking remained **high.**

3.1.12.5 Future Development Considerations

Future development at UMass Boston should be constructed, updated and redeveloped with regard to the most up to date building and fire codes.

3.1.13 Wind Storm

3.1.13.1 Occurrences of the Hazard

Wind Storm events will remain a regular occurrence in the City of Boston and on the UMass Boston campus. The probability of future occurrences is certain. The entire State of Massachusetts is susceptible to both extreme wind events such as hurricanes and tornadoes but also just wind storms that do not have any other associated characteristics other than the movement of air (i.e. no precipitation).

3.1.13.2 Probability of Future Occurrence of the Hazard

The probability of a future occurrence of a wind storm at UMass Boston is certain due to the nature of the campus location and its susceptibility to other natural hazards that typically have a wind associated characteristic.

3.1.13.3 Vulnerability to the Hazard

UMass Boston has experienced minor windstorm events in recent years. **Table 3-58** indicates susceptibility criteria reviewed as related to the selection of a wind storm as a hazard of concern for the campus.

Table 3-58: UMass Boston Campus Wind Storm Susceptibility

How Susceptibility Was Determined	Susceptibility Criteria
• State of Massachusetts (2010) and City of Boston (2008) Hazard Mitigation Plans • Review of FEMA's Multi-Hazard Identification and Risk Assessment • Anecdotal Information from UMass Boston Task Force	• The state plan notes that Massachusetts is susceptible to high wind from several types of weather events: before and after frontal systems, hurricanes and tropical storms, severe thunderstorms, Tornados, and Nor'easters. • The state plan also notes that the entire Commonwealth is vulnerable to high winds that can cause a wide range of damage, with the coast typically seeing the most damage impacts. • There has been previous roof damage due to winds at Healey Library from Hurricane Sandy. Wheatley, Quinn and Clark were also impacted. There is no protection or barrier to high winds. • There is concern at UMass Boston over any event that would have high winds.

3.1.13.4 Risk Assessment Methodology, Limitations and Results

After consideration of the data available for a wind storm hazard event and its impact to the UMass Boston campus, the risk assessment for this natural hazard has been developed as a qualitative analysis. A qualitative assessment of the frequency, duration, severity, intensity, probability and consequence of a wind storm hazard utilizing a low, medium, high and severe ranking system was prepared. The ranking given for UMass Boston was based on background research, future development plans, knowledge of the campus, infrastructure and past occurrences and is shown in **Table 3-59.**

Table 3-59: Risk Assessment – Wind Storm

	Frequency 0-5	Duration 0-5	Severity 0-5	Intensity 0-5	Probability (F,D,I) 40%	Consequence (S) 60%	Total	Risk Ranking L,M,H,S
Wind Storm	4	2	3	3	3.00	3.00	3.00	H

After reviewing the initial ranking of **high** and conducting further research, specific consideration was given to how an event would impact students, faculty and staff, existing buildings, future buildings, operations and critical infrastructure **Table 3-60.**

Table 3-60: Qualitative Risk Assessment – Wind Storm Hazard

	Wind Storm Qualitative Ranking
Risk Ranking	High
Students, Faculty & Staff	Medium
Existing Buildings	High
Future Buildings	High
Operations	Medium
Critical Infrastructure	High

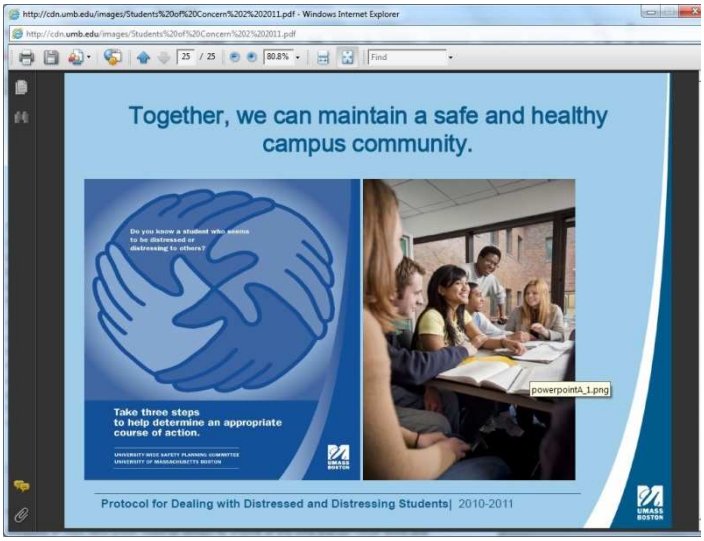
As a result of considering these additional factors, the overall ranking remained **high.**

3.1.13.5 Future Development Considerations

Future development at UMass Boston should be constructed, updated and redeveloped with regard to the most up to date building codes and materials to minimize wind damage.

3.2 HUMAN HAZARDS

The hazard assessment process for human hazards takes on a different aspect than natural hazards due to the inherent unpredictability of these events. Although natural hazard events are also unpredictable, they are related to weather patterns and seasonal changes and often correspond to specific times of the year. Alternatively, human hazards tend to be related to human behaviors that can be difficult to predict and can be either accidental or intentional in nature.



UMass Boston is proactive in monitoring and addressing questionable behaviors and has many programs in place to mitigate any negative outcomes. One such program is the Distressed and Distressing Individuals program led by the Distressed and Distressing Individuals Committee that provides protocols on how to identify and support distressed and/or distressing students or employees. Support resources are available once individuals have been identified.

The human hazards that have been identified and included in this section received their initial consideration from FEMA Guidance documentation, but were then expanded and customized to meet the campus' intent to have an inclusive assessment of the human hazards that could impact the campus. While there are some anecdotal data points regarding human hazard occurrences,

much of the assessment was based on what could happen and how it could impact UMass Boston's campus population, facilities and operations. Each of the human hazards was analyzed to develop a final list of human hazards that could impact UMass Boston. Each of the human hazards the campus is potentially susceptible to that were considered by the stakeholders is listed in **Table 3-61** and further discussed in the specific human hazard assessment sections.

Table 3-61: Human Hazard Qualitative Risk Ranking Summary

	UMass Boston Boston, MA Suffolk County	Qualitative Campus Hazard Risk Ranking
Weapons of Mass Destruction	X	Low
Civil Disturbance	X	Low
SCADA Failure	X	Low
HazMat Release	X	Low
Bomb Threat	X	Low
Vandalism	X	Low
Methane Emissions	X	Medium
Proximity to Flight Path	X	Medium
Arson	X	Medium
Violent Criminal Incident	X	Medium
Robbery/Burglary	X	Medium
Pandemic	X	Medium
Explosion	X	Medium
Cyberattack/Cyberterrorism	X	Medium
Proximity to Gas Tank at Commercial Point	X	Medium
Armed Attack/Active Shooter	X	High
Industrial Accident (Fixed/Transport) - Construction	X	High
Failure of Building Materials / Building Deterioration	X	High
Critical Infrastructure Failure	X	Severe

3.2.1 Vulnerability to Weapons of Mass Destruction

Weapons of mass destruction could be utilized by anyone at any time and can cause death and significant loss of life, damage to property and to the environment. While the use of these weapons on campus is not highly likely to occur, the potential damage resulting from an event involving weapons of mass destruction on the UMass Boston campus could be devastating and threaten the entire function of the campus and surrounding areas. An event of this type could result in the need for full campus evacuation or large scale and/or long term sheltering in place. While each of these presents its own challenges, performing evacuation at UMass Boston with ongoing construction projects and a single main point of ingress and egress adds additional complexities. To date there have been no incidents of the use of weapons of mass destruction at UMass Boston.

A qualitative assessment of the frequency, duration, severity, intensity, probability and consequence of weapons of mass destruction utilizing a low, medium, high and severe ranking system was prepared. The ranking given for UMass Boston was low (see **Table 3-62**) based on the unlikelihood of this type of event.

Table 3-62: Risk Assessment – Weapons of Mass Destruction

	Frequency 0-5	Duration 0-5	Severity 0-5	Intensity 0-5	Probability (F,D,I) 40%	Consequence (S) 60%	Total	Risk Ranking L,M,H,S
Weapons of Mass Destruction	0	1	1	1	0.67	1.00	0.83	L

3.2.2 Civil Disturbance

University students across the country have participated in civil disturbance events associated with a variety of political or socioeconomic issues. The damages resulting from these events if they were to occur at UMass Boston could vary from small scale damages to property or persons to larger scale impacts to each. Disruptions to operations could occur if facilities are inaccessible or workers feel threatened to access certain areas. These events could also cause a deployment of campus and community public safety resources to ensure a safe campus environment.

There have been small scale civil disturbance events experienced on the UMass Boston campus but these have been short in duration and have not resulted in significant impacts. Since UMass Boston does not have any residence halls and students come to campus primarily for class and study, the likelihood of a major civil disturbance event is further reduced. When UMass Boston completes the construction of the residence halls identified in the Master Plan, the risk of this type of event will need to be re-evaluated.

Most recently, in January 2012 UMass Boston students organized an Occupy Boston event at the campus center to protest increases in tuition coupled with cuts in public education funding. Tents were set up in the campus center which student occupied for a period of approximately 2 months.

The susceptibility criteria considered in the risk assessment associate with a civil disturbance is presented in **Table 3-63**.

Table 3-63: Civil Disturbance Susceptibility

How Susceptibility Was Determined	Susceptibility Criteria
• Anecdotal Information	Occupy Boston was a civil disturbance that occurred in January 2012 to protest increases in tuition coupled with cuts in public education funding. Students occupied the campus center for a period of 2 months.

A qualitative assessment of the frequency, duration, severity, intensity, probability and consequence of a civil disturbance utilizing a low, medium, high and severe ranking system was prepared. The ranking given for UMass Boston was low due to the minimal impacts experienced on campus from these types of events in the past (see **Table 3-64**).

Table 3-64: Assessment – Civil Disturbances

	Frequency 0-5	Duration 0-5	Severity 0-5	Intensity 0-5	Probability (F,D,I) 40%	Consequence (S) 60%	Total	Risk Ranking L,M,H,S
Civil Disturbances	1	1	2	1	1.00	2.00	1.50	L

3.2.3 SCADA Failure

UMass Boston has supervisory control and data acquisition (SCADA) systems on campus as a means to electronically monitor and control its industrial systems.

Historically there have been no widespread data failures on UMass campuses that have significantly disturbed the campus or resulted in extended continuity of operations.

A qualitative assessment of the frequency, duration, severity, intensity, probability and consequence of a SCADA failure utilizing a low, medium, high and severe ranking system was prepared. The ranking given for UMass Boston was low given there have been no significant events of this sort previously and the impacts could affect campus operations but not the health and safety of the campus community (see **Table 3-65**).

Table 3-65: Risk Assessment – SCADA Failure

	Frequency 0-5	Duration 0-5	Severity 0-5	Intensity 0-5	Probability (F,D,I) 40%	Consequence (S) 60%	Total	Risk Ranking L,M,H,S
SCADA Failure	1	1	2	2	1.33	2.00	1.67	L

3.2.4 Hazardous Materials Incident

Hazardous materials incidents have occurred at UMass Boston as a result of the common use of these materials in research, course/laboratory work, cleaning, and as fuel and to support other operational functions. Hazardous materials, particularly petroleum products, are transported to campus often in large quantities involving associated potential transportation hazards. Releases of these materials can be accidental or intentional and involve varying degrees of damage depending upon the properties of the material itself, the quantity of material and use of the material. Accidental, small scale releases are a common occurrence on campus and have typically caused minimal damage.

The UMass Boston chemical inventory is relatively small for a University campus and consists of approximately 17,000 containers. The materials used for research also have very low radiation levels, with only a small number of users involved with these materials. There are less than 100 laboratories on campus; most of these are teaching laboratories (only 7 of these laboratories are biosafety level 2 labs).

UMass Boston is well prepared to deal with small scale spills and has emergency response partners in place to support larger scale issues. Procedures are documented in the UMass Boston Contingency Plan & Emergency Response Procedures for the Control of Chemical Spills and Releases and the Oil Spill Prevention Control and Countermeasure Plan. The damages resulting from these incidents at UMass Boston have generally been small and localized and consist of minor injuries, such as burns, and minor, short term operational disruptions. Depending on the type of spill, evacuation of a portion or all of campus could be necessary, but it is generally thought that any type of incident could be handled in 4-6 hours.

In addition to potential for incidents involving hazardous materials used/stored on campus, there is also concern over off campus incidents that could affect the campus. For example, the potential for a diesel oil spill at Columbia point could result in a required shut down of the salt water pump house causing a major disruption to campus operations as it would impact all of the campus chillers. The information associated with factors incorporated into the risk assessment for hazardous materials incidents is provided in **Table 3-66**.

Table 3-66: Hazardous Materials Incident Susceptibility

How Susceptibility Was Determined	Susceptibility Criteria
• Anecdotal information • State Hazard Mitigation Plan, 2010	• There have been isolated incidents of students removing chemicals from laboratories. • Hazardous Materials incidents have the potential to occur in every corner of the Commonwealth. A release may occur at a fixed facility or in transit. Entities with a large industrial base may be more inclined to experience a hazardous materials release due 101 to the number of facilities such materials in their manufacturing process. Entities with several major roadways may be at a greater risk due to the number and frequency of trucks transporting hazardous materials passing through.

A qualitative assessment of the frequency, duration, severity, intensity, probability and consequence of weapons of a hazardous materials release utilizing a low, medium, high and severe ranking system was prepared. The ranking given for UMass Boston was low (**Table 3-67**) given the typically localized nature of these events and generally small scale impacts.

Table 3-67: Risk Assessment – Hazardous Materials Release

	Frequency 0-5	Duration 0-5	Severity 0-5	Intensity 0-5	Probability (F,D,I) 40%	Consequence (S) 60%	Total	Risk Ranking L,M,H,S
Hazardous Materials Release	1	1	2	2	1.33	2.00	1.67	L

3.2.5 Bomb Threat

According to the FEMA, there has been one Presidential Disaster Declaration made for a bombing event in the State of Massachusetts as shown in **Table 3-68**.

Table 3-68: Massachusetts Bombing Related Major Disaster Declarations

	Disaster No.	Incident Period	Date Disaster Declared	Suffolk County a Designated Area?
Boston Marathon Bombing	EM 3662	4/15/13	4/17/13	Yes
Source: FEMA Disaster Declarations 1954 – Present				

On April 15, 2013 during the Boston Marathon two bombs were intentionally detonated near the finish line for the race on Boylston Street in Boston. A total of five deaths and 280 injuries resulted from the bombings. Students from UMass Boston were involved in the race in many capacities including a group of student volunteering to support the runners as part of a class exercise. One of the victims killed was a former UMass Boston student.

Due to the proximity of the event, campus operations were impacted with resources on alert to support the City and campus as needed. Coinciding closely with the timing of the Boston Marathon events was an explosion at the JFK Library. While this event was later determined to be an unrelated incident, the campus was closed on April 15th and 16th so that campus officials could provide assistance to federal, state, and local law enforcement agencies in their investigation.

In addition to the Boston Marathon Bombing, there has been a recent bomb threat on campus (10/18/2012), but no actual detonations. Bomb threats on campus impact campus resources and can result in building evacuations and deployment of personnel, potentially working with local officials, to determine the existence of an actual explosive device. Bomb threats can result in temporary building evacuations and disruptions to campus operations. Impacts from an actual detonation could certainly result in impacts to campus assets and cause injury or loss of life. The

susceptibility factors that were incorporated into the bomb threat risk assessment are provided in **Table 3-69**.

Table 3-69: Bomb Threat Susceptibility

How Susceptibility Was Determined	Susceptibility Criteria
• Anecdotal information	• There have been bomb threats on campus in the past.

A qualitative assessment of the frequency, duration, severity, intensity, probability and consequence of weapons of bomb threats utilizing a low, medium, high and severe ranking system was prepared. The ranking given for UMass Boston was low (see **Table 3-70**).

Table 3-70: Risk Assessment – Bomb Threat

	Frequency 0-5	Duration 0-5	Severity 0-5	Intensity 0-5	Probability (F,D,I) 40%	Consequence (S) 60%	Total	Risk Ranking L,M,H,S
Bomb Threat	1	1	2	2	1.33	2.00	1.67	L

3.2.6 Vandalism

Acts of vandalism have occurred at UMass Boston but on a small scale with minimal damages. These events have caused destruction of personal property and specific, minor damages to campus assets. While these acts are a nuisance, they have not been known to disrupt campus operations or threaten the safety of the campus population. The susceptibility criteria factoring into the risk assessment are provided in **Table 3-71**.

Table 3-71: Vandalism Susceptibility

How Susceptibility Was Determined	Susceptibility Criteria
• UMass Boston 2012 Annual Security Report	• There have been recorded criminal mischief/vandalism offenses on campus.

A qualitative assessment of the frequency, duration, severity, intensity, probability and consequence of vandalism utilizing a low, medium, high and severe ranking system was prepared. The ranking given for UMass Boston was low (see **Table 3-72**) given the minimal impacts typically resulting from these types of events.

Table 3-72: Risk Assessment – Vandalism

	Frequency 0-5	Duration 0-5	Severity 0-5	Intensity 0-5	Probability (F,D,I) 40%	Consequence (S) 60%	Total	Risk Ranking L,M,H,S
Vandalism	2	1	2	1	1.33	2.00	1.67	L

3.2.7 Methane Emissions

Since the UMass Boston campus is constructed on a former landfill, methane emissions are a potential concern. Select existing buildings are equipped with methane monitoring systems, and these systems will be incorporated into new building construction as necessary. The functionality of the existing systems has been in question over time raising potential doubt about their reliability. DCAM has examined the methane monitoring systems in five campus buildings and found no issues.

Inhalation of low concentrations of methane is not harmful. When larger concentrations are present that can displace the available quantities of oxygen, with effects ranging from impacts to breathing and disorientation to vomiting and even death. Due to the ventilation present in the buildings themselves, having a large displacement of oxygen is not feasible unless these systems were not operational. The other risk from the presence of methane emissions is explosion. Based on current data the likelihood of explosion is low, again due to the existing building ventilation systems.

A qualitative assessment of the frequency, duration, severity, intensity, probability and consequence of methane emissions utilizing a low, medium, high and severe ranking system was prepared. The ranking given for UMass Boston was medium due to the potential minor health effects that could be experienced and possible explosion risk (see **Table 3-73**).

Table 3-73: Risk Assessment – Methane Emissions

	Frequency 0-5	Duration 0-5	Severity 0-5	Intensity 0-5	Probability (F,D,I) 40%	Consequence (S) 60%	Total	Risk Ranking L,M,H,S
Methane Emissions	1	2	3	3	2.00	3.00	2.30	M

3.2.8 Proximity to Flight Path

Since UMass Boston is located on the flight path of the Logan Airport, air traffic represents a potential threat. While the likelihood of an air crash in the proximity of the campus is very low, it is feasible and could represent huge impacts to operations, campus assets and injury/death of portions of the campus population.

A qualitative assessment of the frequency, duration, severity, intensity, probability and consequence of being in the proximity of the flight path utilizing a low, medium, high and severe ranking system was prepared. The ranking given for UMass Boston was medium due to the potential, while unlikely; impacts that could be experienced (see **Table 3-74**).

Table 3-74: Risk Assessment – Proximity to Flight Path

	Frequency 0-5	Duration 0-5	Severity 0-5	Intensity 0-5	Probability (F,D,I) 40%	Consequence (S) 60%	Total	Risk Ranking L,M,H,S
Proximity to Flight Path	0	2	3	3	1.67	3.00	2.33	M

3.2.9 Violent Criminal Incident

A violent crime is defined as one or more of the following four offenses: murder and non-negligent manslaughter, forcible rape, robbery, and aggravated assault. In the past three years, there have been reported injuries impacting UMass Boston students. Crimes of this nature can be extremely severe and can result in extreme physical harm or death to the victim, as well as lingering impacts to the overall sense of security and well-being of the campus community. The susceptibility criteria factoring into the risk assessment is presented in **Table 3-75**.

Table 3-75: Violent Criminal Incident Susceptibility

How Susceptibility Was Determined	Susceptibility Criteria
• UMass Boston 2012 Annual Security Report	• There have been forcible and non-forcible sex offenses at UMass Boston. • There have been recorded offenses of aggravated assault on campus and on public property. There have also been cases of simple assault.

A qualitative assessment of the frequency, duration, severity, intensity, probability and consequence of a violent criminal incident utilizing a low, medium, high and severe ranking system was prepared. The ranking given for UMass Boston was medium due to the past occurrences and potential impacts to the safety and health of the victims of these events (see **Table 3-76**).

Table 3-76: Risk Assessment – Violent Criminal Incident

	Frequency 0-5	Duration 0-5	Severity 0-5	Intensity 0-5	Probability (F,D,I) 40%	Consequence (S) 60%	Total	Risk Ranking L,M,H,S
Violent Criminal Incident	1	2	3	3	2.00	3.00	2.50	M

3.2.10 Robbery/Burglary

Acts of theft have occurred on the UMass Boston campus and have involved both personal property and University property. Most of these events have also been on a small scale and have involved student and University property such as bicycles, computers and other personal property. Many of these instances have involved technology such as cell phones and other electronic devices. To date impacts from these events have been minor, however injuries and even death could result from a severe incident or a robbery or burglary gone wrong. The criteria that were considered in the risk assessment for a robbery/burglary incident are provided in **Table 3-77**.

Table 3-77: Robbery/Burglary Incident Susceptibility

How Susceptibility Was Determined	Susceptibility Criteria
• UMass Boston 2012 Annual Security Report	• There have been campus robberies and recorded offenses on public property. There have also been campus burglaries and burglary offenses at non-campus buildings or property and public property.

A qualitative assessment of the frequency, duration, severity, intensity, probability and consequence of a robbery/burglary utilizing a low, medium, high and severe ranking system was prepared. The ranking given for UMass Boston was medium due to the known previous occurrences of these events on campus (see **Table 3-78**).

Table 3-78: Risk Assessment – Robbery/Burglary

	Frequency 0-5	Duration 0-5	Severity 0-5	Intensity 0-5	Probability (F,D,I) 40%	Consequence (S) 60%	Total	Risk Ranking L,M,H,S
Robbery or Burglary	2	2	3	2	2.00	3.00	2.50	M

3.2.11 Pandemic Health Issue

A pandemic health issue is the worldwide spread of an infectious disease across large populations of human beings. This could be any infectious disease but in recent times has been most associated with influenza. To date there have been no pandemic diseases that have impacted UMass Boston. UMass Boston has planned for this type of event as documented in the UMass Boston University Health Services Epidemic/Pandemic Response Plan .

Depending on the nature and severity of the pandemic illness (e.g., flu and other diseases), the impacts from a pandemic health issue could involve quarantine, campus evacuation, and health impacts including death. A severe, widespread event could greatly disrupt campus operations and even result in campus closures due to increased and extended faculty and staff absences or to slow the spread of disease on campus. While currently there are no student residence halls on campus, having students living on campus in the future will result in additional complexities should a pandemic heath issue occur (see **Table 3-79**).

Table 3-79: Pandemic Health Issue Susceptibility

How Susceptibility Was Determined	Susceptibility Criteria
• State of Massachusetts Hazard Mitigation Plan, 2010	• Public health emergencies can occur in any community in the Commonwealth. Depending on the level of contagiousness or method or infectivity, urban environments may be more susceptible for faster spread of certain disease.

A qualitative assessment of the frequency, duration, severity, intensity, probability and consequence of a pandemic health issue utilizing a low, medium, high and severe ranking system was prepared. The ranking given for UMass Boston was medium given the health impacts and viability of this type of event (see **Table 3-80**).

Table 3-80: Risk Assessment – Pandemic Health Issue

	Frequency 0-5	Duration 0-5	Severity 0-5	Intensity 0-5	Probability (F,D,I) 40%	Consequence (S) 60%	Total	Risk Ranking L,M,H,S
Pandemic Health Issue	1	2	3	3	2.00	3.00	2.50	M

3.2.12 Explosion

Explosions can be caused by bombs as discussed above or via other means specifically associated with a campus setting such as the improper use and handling of chemicals or other dangerous substances. Due to the heavy teaching and research component at UMass Boston, there is an opportunity for explosion associated with chemical uses. Explosions associated with

chemical uses have occurred in the past resulting in minor injuries. Safety protocols and procedures and training are provided to all laboratory occupants to try to minimize these events.

Explosions are also possible due to the utility plant operations as well due to the use of natural gas and other fuels. A large scale explosion could result in impacts to campus assets, injuries or loss of life. Campus operations could also be impacted and the need for small or large scale campus evacuations could result. Susceptibility criteria that factored into the risk assessment are presented in **Table 3-81.**

Table 3-81: Explosion Susceptibility

How Susceptibility Was Determined	Susceptibility Criteria
• Anecdotal information	• There was a lab explosion 9 yrs. ago and an explosion in utility plant in 1999 which resulted in PCB impacts and a shutdown of portions of the plan for several years.

A qualitative assessment of the frequency, duration, severity, intensity, probability and consequence of an explosion utilizing a low, medium, high and severe ranking system was prepared. The ranking given for UMass Boston was medium due to the past occurrences and potential impacts (see **Table 3-82**).

Table 3-82: Risk Assessment – Explosion

	Frequency 0-5	Duration 0-5	Severity 0-5	Intensity 0-5	Probability (F,D,I) 40%	Consequence (S) 60%	Total	Risk Ranking L,M,H,S
Explosion	2	2	3	3	2.33	3.00	2.67	M

3.2.13 Cyberattacks/Cyberterrorism

At UMass Boston, cyber related events are common and can occur on a daily basis with the campus population typically being unaware and unimpacted. The campus has protocols in place to minimize the impacts of these events, which involve information storage, redundancy and security of critical systems. To date there has been no event at UMass Boston that has resulted in significant impacts.

Over time it is expected that cyber events will continue to be a major concern. A successful cyber event could result in the loss of sensitive information and impact the operations of essential campus computer systems. A qualitative assessment of the frequency, duration, severity, intensity, probability and consequence of a cyber-event utilizing a low, medium, high and severe ranking system was prepared. The ranking given for UMass Boston was medium due to the high frequency of these events and potential impacts to campus operations (see **Table 3-83**).

Table 3-83: Risk Assessment – Cyberattack/Cyberterrorism

	Frequency 0-5	Duration 0-5	Severity 0-5	Intensity 0-5	Probability (F,D,I) 40%	Consequence (S) 60%	Total	Risk Ranking L,M,H,S
Cyberattack or Cyberterrorism	5	1	3	2	2.67	3.00	2.83	M

3.2.14 Proximity to Gas Tank at Commercial Point

A liquefied natural gas (LNG) facility is located across the harbor on Commercial Point. Due to the nature of this type of facility, the opportunity for explosion does exist although this type of event is unlikely. The risks are presented both at the facility itself and within the harbor where the LNG is transported to the facility. An explosion at this facility could impact the UMass Boston campus from flying debris, impacts to transportation routes, resulting vapors and the potential need for campus evacuation. The hazard ranking was medium since the likelihood of this type of event are low, however the impacts could be significant (see **Table 3-84**).

Table 3-84: Risk Assessment – Proximity to Gas Tank at Commercial Point

	Frequency 0-5	Duration 0-5	Severity 0-5	Intensity 0-5	Probability (F,D,I) 40%	Consequence (S) 60%	Total	Risk Ranking L,M,H,S
Proximity to Gas Tank at Commercial Point	0	2	4	3	1.67	4.00	2.83	M

3.2.15 Active Shooter

UMass Boston takes the threat of an active shooter very seriously and routinely completes training on this type of scenario. To date there have been no active shooter events at UMass Boston. While this type of event is unlikely, it has occurred on other college and university campuses, making it worth serious consideration and planning. The direct impacts of an active shooter situation could be serious injury or death on a large scale. Also, the negative press associated with this type of event could greatly impact the reputation of the University. The aftermath of such an incident to the mental health state and feeling of safety to the campus population would need to be careful managed and could require counseling and increased security presence. The susceptibility criteria included in the risk assessment are provided in **Table 3-85**.

Table 3-85: Active Shooter Susceptibility

How Susceptibility Was Determined	Susceptibility Criteria
• UMass Boston 2012 Annual Security Report	• There have been recorded cases of illegal weapons possessions on campus and at non-campus building or property and public property.

A qualitative assessment of the frequency, duration, severity, intensity, probability and consequence of an active shooter utilizing a low, medium, high and severe ranking system was prepared. The ranking given for UMass Boston was high given the serious impacts to human life that could result and the past incidents on other college and university campuses (see **Table 3-86**).

Table 3-86: Risk Assessment – Armed Attack/Active Shooter

	Frequency 0-5	Duration 0-5	Severity 0-5	Intensity 0-5	Probability (F,D,I) 40%	Consequence (S) 60%	Total	Risk Ranking L,M,H,S
Armed Attack/Active Shooter	1	2	4	4	2.33	4.00	3.17	H

3.2.16 Industrial Accident

Due to the large construction actively taking place on campus now and in the future, the possibility of an industrial accident is present on a daily basis. UMass Boston has taken every precaution to minimize the likelihood of this type of event by hiring qualified contractors, increasing its presence of campus personnel in traffic directing, and using clear signage. Depending on the type of accident that could occur the impacts could result in disruptions to campus operations, campus evacuation, and injuries or loss of life.

A qualitative assessment of the frequency, duration, severity, intensity, probability and consequence of an industrial accident utilizing a low, medium, high and severe ranking system was prepared. The ranking given for UMass Boston was high considering the volume of construction activities and campus transformation ongoing (see **Table 3-87**).

Table 3-87: Risk Assessment – Industrial Accident

	Frequency 0-5	Duration 0-5	Severity 0-5	Intensity 0-5	Probability (F,D,I) 40%	Consequence (S) 60%	Total	Risk Ranking L,M,H,S
Industrial Accident	3	2	4	3	2.67	4.00	3.33	H

3.2.17 Critical Infrastructure Failure

Critical infrastructure failure is an extremely serious consideration for UMass Boston as it strives to minimize any extended impacts to operations. Loss of power or communications is one of the most disruptive events that can occur as it can result in the need to close the campus and evacuate. The financial implications in terms of loss of building operations and the inability to continue classes could be significant. Also impacts to sensitive, irreplaceable research that requires refrigeration, cooling and heating, such as particular experiments or animal research could be devastating.

Infrastructure impacts could be caused from a variety of natural events, but also could result from the failure of aged infrastructure that is known to exist on campus, and construction activities. A qualitative assessment of the frequency, duration, severity, intensity, probability and consequence of weapons of mass destruction utilizing a low, medium, high and severe ranking system was prepared. The ranking given for UMass Boston was severe (see **Table 3-88**) due to potential severity of impacts to the campus operations.

Table 3-88: Infrastructure Failure Susceptibility

How Susceptibility Was Determined	Susceptibility Criteria
• State Hazard Mitigation Plan, 2010	• Technological emergencies have the potential to occur in every corner of the Commonwealth. Entities with limited technological infrastructure are more vulnerable to experiencing an incident because of the lack of redundant systems. Entities should consider mitigation measures such as emergency generators, buried cable, and preventative pruning to help reduce the risk of this type of emergency. • Electricity problems in neighboring power pools to New England may deplete available electricity reserves, leading to supply problems if conditions in New England deteriorate. Disruptions in the supply of natural gas or petroleum to New England may impact generating capacity in the region. Disruptions to generation plants or key transmission lines due to natural disasters, mechanical failure, or deliberate action may reduce the supply of electricity to the region.

A qualitative assessment of the frequency, duration, severity, intensity, probability and consequence of weapons of mass destruction utilizing a low, medium, high and severe ranking system was prepared. The ranking given for UMass Boston was severe (see **Table 3-89**) due to potential severity of impacts to the campus operations.

Table 3-89: Risk Assessment – Critical Infrastructure Failure

	Frequency 0-5	Duration 0-5	Severity 0-5	Intensity 0-5	Probability (F,D,I) 40%	Consequence (S) 60%	Total	Risk Ranking L,M,H,S
Critical Infrastructure Failure	1	2	5	3	2.00	5.00	3.50	S

3.2.18 Failure of Building Materials

Failure of building materials on campus have been experienced in the past related to aged infrastructure and impacts from salt due to the campuses' location on the harbor. There have been previous incidents experienced at UMass Boston in the past. The factors incorporated into the risk assessment are provided in **Table 3-90**.

Table 3-90: Failure of Building Materials Susceptibility

How Susceptibility Was Determined	Susceptibility Criteria
• Anecdotal Information	• Death from structural integrity collapse in garage

Based on this unfortunate event, UMass Boston knows firsthand that a failure of building materials can impact human safety and health as well as campus assets. While these systems are being addressed as part of the 25-year Master Plan improvements currently underway, risks of failure of building materials will remain in some areas for a period of time. A qualitative assessment of the frequency, duration, severity, intensity, probability and consequence of failure of building materials utilizing a low, medium, high and severe ranking system was prepared. The ranking given for UMass Boston was high (see **Table 3-91**) due to potential severity of impacts to the campus operations and human life.

Table 3-91: Risk Assessment – Failure of Building Materials/Building Deterioration

	Frequency 0-5	Duration 0-5	Severity 0-5	Intensity 0-5	Probability (F,D,I) 40%	Consequence (S) 60%	Total	Risk Ranking L,M,H,S
Failure of Building Materials / Building Deterioration	1	3	4	4	2.67	4.00	3.33	H

3.2.19 Arson

UMass Boston has experienced arson incidents by students in the past on a very small scale. While many buildings across the campuses are sprinklered, others are not which puts them at greater risk from an arson event. For these areas, the impacts could be a complete loss of a building, destruction to campus operations, injuries and even loss of life. Some of the susceptibility factors contributing to the risk assessment are provided in **Table 3-92.**

Table 3-92: Arson Susceptibility

How Susceptibility Was Determined	Susceptibility Criteria
• UMass Boston 2012 Annual Security Report	• There have not been recent arson offenses on campus or in the non-campus buildings or property or public property.

A qualitative assessment of the frequency, duration, severity, intensity, probability and consequence of an arson event utilizing a low, medium, high and severe ranking system was prepared. The ranking given for UMass Boston was medium mainly due to the presence of unsprinklered buildings on campus (see **Table 3-93**).

Table 3-93: Risk Assessment – Arson

	Frequency 0-5	Duration 0-5	Severity 0-5	Intensity 0-5	Probability (F,D,I) 40%	Consequence (S) 60%	Total	Risk Ranking L,M,H,S
Arson	1	2	3	3	2.00	3.00	2.50	M

4. VULNERABILITY & IMPACT ASSESSMENT

The purpose of assessing risks, determining vulnerability and estimating losses is to determine how UMass Boston assets may be affected by various hazard events. Each UMass campus evaluated building vulnerability based on a loss of function and total damage calculation using the FEMA methodology which was detailed in the Hazard Mitigation Plan. The information included in the following sections provides the specific calculations for the UMass Boston campus.

4.1 ASSET INVENTORY

Table 4-1 summarizes the assets that were evaluated during the mitigation planning process for the UMass Boston campus.

Table 4-1: UMass Boston Assets Evaluated During Mitigation Planning Process

Existing Buildings	Date Construction Completed	Gross Square Feet
Campus Center	2004	330,000
Calf Pasture Pumping Station	1883	Unknown
Phillis Wheatley Hall	1973	268,551
Salt Water Pump House	1974	4,314
McCormack Hall	1975	266,060
Science Center	1974	297,952
Utility Plant	1974	27,886
Healey Library	1978	337,446
Quinn Administration	1973	96,897
Clark Athletic Center	1979	126,427
Service & Supply	1972	74,295
Bayside Exposition	1968**	275,000
Total		**2,104,828**
Future Buildings		
Integrated Sciences Complex	Fall 2014	220,000
General Academic Building No. 1	Mid 2015	180,000
McCormack Hall Renovation	2014 - 2015	No Change
Wheatley Hall Renovation	2014 - 2015	No Change

4.1.1 Loss of Function

The methodology for discussing the Loss of Function Calculation can be found in **Section 3.6** of the Hazard Mitigation Plan. Data specific for UMass Boston is presented in **Table 4-2**. The data in this table and supporting graphic are for a non-hazard specific loss of function cost to the buildings associated with UMass Boston.

Table 4-2: UMass Boston Loss of Function Cost

	Date Construction	Gross Square Feet	Building Criticality Value	Factored Square Footage	Building/Total Campus Square Footage	Per Day Loss of Function Cost	Estimated Hazard Specific Loss of Function Days	Loss of Function
Existing Buildings								
Campus Center	2004	330,000	3	990,000	0.470347221	$746,788	7	$5,227,514
Calf Pasture Pumping Station	1883	Unknown	1	N/A	N/A	N/A	7	N/A
Phillis Wheatley Hall	1973	268,551	3	805,653	0.382764292	$607,729	7	$4,254,103
Salt Water Pump House	1974	4,314	5	21,570	0.010247868	$16,271	7	$113,896
McCormack Hall	1975	266,060	3	798,180	0.379213884	$602,092	7	$4,214,643
Science Center	1974	297,952	5	1,489,760	0.707782299	$1,123,772	7	$7,866,405
Utility Plant	1974	27,886	5	139,430	0.066242942	$105,176	7	$736,235
Healey Library	1978	337,446	4	1,349,784	0.641279953	$1,018,184	7	$7,127,287
Quinn Administration	1973	96,897	4	387,588	0.184142362	$292,370	7	$2,046,587
Clark Athletic Center	1979	126,427	5	632,135	0.300326202	$476,839	7	$3,337,873
Service & Supply	1972	74,295	4	297,180	0.141189684	$224,172	7	$1,569,205
UMass Bayside	1968**	275,000	3	825,000	0.391956017	$622,323	7	$4,356,261
Future Buildings								
Integrated Sciences Complex	Fall 2014	220,000	5	1,100,000	0.522608023	$829,764	7	$5,808,348.61
General Academic Building No. 1	Mid 2015	180,000	4	720,000	0.342070706	$543,118	7	$3,801,828.18
McCormack Hall Renovation	2014 - 2015	No Change	3	798,180	0.379213884	$602,092	7	$4,214,643.36
Wheatley Hall Renovation	2014 - 2015	No Change	3	805,653	0.382764292	$607,729	7	$4,254,103.17
Total		**2,104,828**						

4.1.2 Building Vulnerability Assessment

Using the Loss of Function cost per hazard, a Building Vulnerability Assessment was conducted that included utilizing additional information such as Insurable Replacement Value and Insurable Contents Value for buildings. A Total Damage amount was calculated and then building vulnerability rankings were assigned based on the dollar amount (see **Table 4-3** and **Figure 16**).

Table 4-3: UMass Boston Campus Buildings - Vulnerability Assessment

Existing Buildings	Insurable Replacement Value	Insurable Contents Value	Loss of Function Per Hazard	Total Damage	Building Vulnerability Ranking
Campus Center	$123,199,871	$184,799,807	$5,227,514	$313,227,191	High
Calf Pasture Pumping Station	Unknown	Unknown	Unknown	Unknown	Low
Phillis Wheatley Hall	$92,382,713	$138,574,070	$4,254,103	$235,210,886	Med
Salt Water Pump House	$727,371	$1,091,057	$113,896	$1,932,324	Med
McCormack Hall	$97,035,922	$145,553,883	$4,214,643	$246,804,448	Med
Science Center	$102,512,053	$153,768,080	$7,866,405	$264,146,537	High
Utility Plant	$6,621,302	$9,931,953	$736,235	$17,289,490	Low
Healey Library	$108,128,176	$162,192,264	$7,127,287	$277,447,727	High
Quinn Administration	$31,620,278	$47,430,417	$2,046,587	$81,097,282	Med
Clark Athletic Center	$38,821,751	$58,232,627	$3,337,873	$100,392,251	Med
Service & Supply	$24,060,563	$36,090,845	$1,569,205	$61,720,612	Low
UMass Bayside Expo Center	$41,250,000	$61,875,000	$4,356,261	$107,481,261	Med
Note: *Building Vulnerability Ranking is based on Replacement Value + Insurable Contents Value + Loss of Function Value*					

Figure 16: UMass Boston Building Vulnerability Assessment – Non-Hazard Specific

5. GOALS & OBJECTIVES

UMass Boston used the identification, profiling and vulnerability assessment of natural and human hazards that have or may impact them in the future to establish planning goals and objectives that provide the basis for the development of the proposed hazard mitigation projects. The establishment of goals and objectives was based upon a clear understanding of the hazards that have a potential to impact the University community, what the risks associated with each hazard are and where vulnerabilities exist, as well as the University's commitment to reducing future vulnerability and mitigating risks where possible.

According to the FEMA guidance documentation, a goal serves as a general guideline that explains what a community would like to achieve and an objective defines a specific strategy or implementation step that will help reach a specific goal. A mitigation action is a specific task that UMass Boston can tie back to its goals and objectives and measure what has been achieved. The goals and objectives identified for UMass Boston are presented in **Table 5-1**.

Table 5-1: UMass Boston Goals & Objectives

Goal/Objective	Explanation
Goal 1	**Protect existing and future assets from known hazards by implementing mitigation projects to minimize potential losses and ensure public health and safety.**
Objective 1-A	Use appropriate techniques to mitigate against impacts from flooding in the Bayside, Morrissey Blvd and Mount Vernon areas.
Objective 1-B	Use appropriate techniques to minimize coastal erosion on the outskirts of campus.
Objective 1-C	Use appropriate techniques to mitigate against impacts from fires.
Objective 1-D	Use appropriate techniques to mitigate against impacts from high wind events such as windstorms, hurricanes and tornadoes.
Goal 2	**Maintain a continuity of campus business operations during and after a hazard event.**
Objective 2-A	Build redundancy in essential systems.
Objective 2-B	Protect critical infrastructure.
Objective 2-C	Evaluate and enhance communication and education during hazard events to increase the understanding of impacts to campus.
Goal 3	**Create and maintain a safe, secure environment for the campus population before, during and after a hazard event.**
Objective 3-A	Focus on the safety and mental health of the campus community.
Objective 3-B	Proactively conduct scenario planning activities.

Goal/Objective	Explanation
Goal 4	**Communicate natural and human hazard information to the campus community and improve education and outreach efforts regarding their potential impact.**
Objective 4-A	Advise the community on health and safety precautions against potential hazards.
Objective 4-B	Work collaboratively with the JFK Library, Archives and other external campus stakeholders on hazard mitigation.
Objective 4-C	Consider and obtain feedback from the campus population on hazard planning communications.
Goal 5	**Proactively protect existing and future campus assets from known hazards by incorporating mitigation activities into capital improvement and infrastructure planning.**
Objective 5-A	Monitor and track asset conditions.
Objective 5-B	Maintain and retrofit campus assets to facilitate resilience during hazard events.
Objective 5-C	Use appropriate measures to ensure new development will not increase hazard threats.
Objective 5-D	Consider natural and human hazard risks as new buildings and infrastructure is developed and redeveloped.

6. MITIGATION ACTIVITIES & ACTION PLAN

6.1 MITIGATION ACTIVITIES & ACTION PLAN

The mitigation actions and projects noted in this section were identified based on the goals and objectives prepared during the planning process, past occurrences and UMass Boston's commitment to work closely with faculty, staff, students, residents and City officials to ensure public safety. Most of the action items focus on mitigating flooding, coastal storms, coastal erosion and hurricane impacts. **Table 6-1** summarizes a list of mitigation projects for UMass Boston.

Table 6-1: UMass Boston Mitigation Projects

Project No.	Hazard Addressed	Description	Objectives Addressed	Estimated Cost
1	Flooding/Stormwater Improvements	Improve stormwater removal and drainage lines on the University's Bayside site including modifying stormwater outfalls as required. Improve stormwater removal and drainage lines in the Mount Vernon area. Modify storm water outfalls as needed.	1A	$25M
2	Coastal Erosion	Harborwalk Shoreline Stabilization project (seawallseawall installation and extension).	1B	$3.8M
3	Coastal Erosion	Beach nourishment, vegetation enhancements and tidal control structures in the Morrissey Boulevard area.	1B	Unknown
4	Coastal Erosion	Complete dredging in area near the salt water pump house.	1B	$7.5M
5	Fire	Install sprinkler system in Healey Library, Quinn, Clark, Service & Supply buildings.	1C	$15M
6	Windstorm, Hurricane, Tornadoes	Prepare a formal plan for sheltering in place.	1D	$15,000
7	Windstorm, Hurricane, Tornadoes	Complete an assessment of campus roofs and water infiltration and mitigate high risk areas with roof replacements and water proofing.	1D	$250,000
8	Windstorm, Hurricane, Tornadoes	Address Healey roof impacts from Hurricane Sandy.	1D	$5M
9	Windstorm, Hurricane, Tornadoes	Improve McCormack roof.	1D	$5M
10	Windstorm, Hurricane, Tornadoes	Repair Clark East Curtain wall façade.	1D	$2M
11	Windstorm, Hurricane, Tornadoes	Address water intrusion in buildings.	1D	$10M
12	Windstorm, Hurricane, Tornadoes	Examine building structural integrity and repair impacted areas (specifically assess building facades).	1D	$10M
13	All	Evaluate and expand emergency generator capacity.	2A	$10M

Project No.	Hazard Addressed	Description	Objectives Addressed	Estimated Cost
14	All	Relocate generators to higher elevations as appropriate.	2A	$5M
15	All	Evaluate and implement trigeneration on campus.	2A	$30M
16	All	Improve generator room in Healey library to make the room less porous or install supplemental piping.	2A	$1M
17	All	Replace and seal older emergency generators.	2A	$5M
18	All	Purchase a large, portable emergency generator.	2A	$500,000
21	All	Evaluate and upgrade the methane monitoring systems for buildings and other enclosed structures.	2B	$20,000
22	All	Conduct a vulnerability assessment of campus catwalks from operational and/or structural failure and implement a solution to improve or remedy any failing components.	2B	$1M
23	All	Consolidate and eliminate hard copy storage of critical information (much of it is personnel related) that is on paper and easily accessible and convert to electronic.	2B	Unknown
24	All	Develop a utility interruption plan.	2B	$30,000
25	All	Conduct training on UMass Ready business continuity software.	2C	$10,000
26	All	Increase campus signage related to safety and emergencies.	3A	Unknown
27	All	Increase building security presence, equipment and protocols.	3A	Unknown
28	All	Evaluate mental health on campus and create an outreach program.	3A	$30,000
29	All	Evaluate and purchase technology to allow for a campus lockdown.	3A	Unknown
30	All	Expand the employee ID system.	3A	Unknown
31	All	Assess visibility and movability throughout Healey Library and implement upgrades as necessary.	3A	Unknown
32	All	Conduct annual training and drills to include active shooter, sheltering in place and campus evacuation.	3B	$30,000
33	All	Develop and implement a hazards public education and outreach program.	4A	$15,000
34	All	Incorporate hazard awareness into the web site and other social media.	4A	$3,000
35	All	Increase notification protocols for threatening employees.	4A	$3,000

Project No.	Hazard Addressed	Description	Objectives Addressed	Estimated Cost
36	All	Participate in municipal, regional and state hazard mitigation planning efforts.	4B	$2,000
37	All	Have annual meetings with external campus stakeholders.	4B	$2,000
38	All	Conduct surveys or other outreach soliciting feedback from the community.	4C	$2,000
39	Windstorm, Hurricane, Tornadoes, Winter Storm, Ice Storm, Fire, Earthquake	Map infrastructure assets and implement an asset management system.	5A	$1M
40	Windstorm, Hurricane, Tornadoes, Winter Storm, Ice Storm, Fire, Earthquake	Upgrade the Salt Water Pump House which is used for cooling.	5B	$2M
43	Windstorm, Hurricane, Tornadoes, Winter Storm, Ice Storm, Fire, Earthquake	Complete a hazard assessment on each new project	5C	Unknown
44	Windstorm, Hurricane, Tornadoes, Winter Storm, Ice Storm, Fire, Earthquake	Ensure new buildings incorporate structural integrity and protection issues associated with top hazards	5C	Unknown
45	All	Develop hazard planning around having student residence halls.	5D	Unknown
46	Windstorm, Hurricane, Tornado, Winter Storm, Sea Level Rise	Construct both active and passive wave attenuation measures for docking facilities at Fox Point and John T. Fallon State Pier; retain onsite and offsite storage and marine facilities to move when hazards arrive.	5C	$3M

6.2 MITIGATION PROJECT PRIORITIZATION

The projects and mitigation activities noted in the previous section that have been proposed meet the FEMA STAPLEE criteria. To meet the STAPLEE criteria, projects and activities must be socially acceptable to the community, technically feasible, protective of or beneficial to the environment and are backed by legal authority and consistent with current laws, consider economic benefits and costs and include environmental considerations. **Table 6-2** indicates the project number, responsible party and whether or not the project meets each individual

STAPLEE criteria at a high, medium or low level. After taking this information into consideration, each project is given a qualitative high, medium or low ranking.

Table 6-2: UMass Boston Project Prioritization

Project No.	Project	Responsible Party	Cost Effectiveness of Activity	Socially Acceptable	Technically Feasible	Protect/Benefit Environment	Legal	Economic Benefit	Project Priority
1	Improve stormwater removal and drainage lines on the University's Bayside site including modifying stormwater outfalls as required. Improve stormwater removal and drainage lines in the Mount Vernon area. Modify storm water outfalls as needed.	Facilities	High	High	High	High	Medium	High	High
2	Harborwalk Shoreline Stabilization project (seawall installation and extension).	Facilities	High	High	High	High	High	Medium	High
3	Beach nourishment, vegetation enhancements and tidal control structures in the Morrissey Boulevard area.	EEOS/SFTE	Medium	High	High	High	Medium	Medium	High
4	Complete dredging in area near the salt water pump house.	Facilities	Low	Low	Medium	High	Medium	High	Medium
5	Install sprinkler system in Healey Library, Quinn, Clark, Service & Supply buildings.	Facilities	High	High	High	High	High	High	High
6	Prepare a formal plan for sheltering in place.	EM/BC	High	High	High	High	Medium	Medium	High
7	Complete an assessment of campus roofs and water infiltration and mitigate high risk areas with roof replacements and water proofing.	Facilities	Medium	High	Medium	Medium	Medium	High	Medium
8	Address Healey roof impacts from Hurricane Sandy.	Facilities	Medium	High	High	High	Medium	High	High

Project No.	Project	Responsible Party	Cost Effectiveness of Activity	Socially Acceptable	Technically Feasible	Protect/Benefit Environment	Legal	Economic Benefit	Project Priority
9	Improve McCormack roof.	Facilities	Medium	High	High	High	Medium	Medium	High
10	Repair Clark East Curtain wall façade.	Facilities	Medium	High	High	High	Medium	Medium	High
11	Address water intrusion in buildings.	Facilities	Medium	High	Medium	High	Medium	High	Medium
12	Examine building structural integrity and repair impacted areas (specifically assess building facades).	Facilities	Medium	Medium	High	High	Medium	Medium	Medium
13	Evaluate and expand emergency generator capacity.	Facilities	High	High	High	Medium	High	High	High
14	Relocate generators to higher elevations as appropriate.	Facilities	Medium	Medium	High	High	Medium	High	Medium
15	Evaluate and implement trigeneration on campus.	Facilities	Low	Low	Medium		Medium	Medium	Low
16	Improve generator room in Healey library to make the room less porous or install supplemental piping.	Facilities	Medium	Medium	High	Low	Medium	Low	Medium
17	Replace and seal older emergency generators.	Facilities	High	Medium	High	Low	Medium	High	Medium
18	Purchase a large, portable emergency generator.	Facilities	High	High	High	Low	Medium	High	High
21	Evaluate and upgrade the methane monitoring systems for buildings and other enclosed structures.	Facilities/EHS	High	High	High	High	Medium	High	High

Project No.	Project	Responsible Party	Cost Effectiveness of Activity	Socially Acceptable	Technically Feasible	Protect/Benefit Environment	Legal	Economic Benefit	Project Priority
22	Conduct a vulnerability assessment of campus catwalks from operational and/or structural failure and implement a solution to improve or remedy any failing components.	Facilities	Medium	High	Medium	Medium	Medium	Medium	Medium
23	Consolidate and eliminate hard copy storage of critical information (much of it is personnel related) that is on paper and easily accessible and convert to electronic.	All applicable departments with support from IT	Medium	Low	Medium	Low	Medium	Low	Medium
24	Develop a utility interruption plan.	Facilities	Medium	Low	Medium	Low	Medium	High	Medium
25	Conduct training on UMass Ready business continuity software.	EM/BC	High	Medium	High	Low	Medium	High	High
26	Increase campus signage related to safety and emergencies.	Facilities	High	High	High	Low	Medium	Medium	High
27	Increase building security presence and protocols.	Public Safety	Medium	Medium	Medium	Low	Medium	Low	Medium
28	Evaluate mental health on campus and create an outreach program.	Health Services	Medium	Medium	Medium	Low	Medium	Low	Low
29	Evaluate and purchase technology to allow for a campus lockdown.	Public Safety/IT	Medium	High	Medium	Low	Medium	Low	Medium
30	Expand the employee ID system.	Public Safety/IT	Medium	Low	Medium	Low	Medium	Low	Medium
31	Assess visibility and movability throughout Healey Library and implement upgrades as necessary.	Facilities	Medium	Low	High	Low	Low	Low	Low
32	Conduct annual training and drills to include active shooter, sheltering in place and campus evacuation.	Public Safety	High	High	High	Low	Low	Medium	High

Project No.	Project	Responsible Party	Cost Effectiveness of Activity	Socially Acceptable	Technically Feasible	Protect/Benefit Environment	Legal	Economic Benefit	Project Priority
33	Develop and implement a hazards public education and outreach program.	EM/BC	Medium	Medium	High	Low	Low	Low	Medium
34	Incorporate hazard awareness into the web site and other social media.	EM/BC	High	Medium	High	Low	Low	Low	Medium
35	Increase notification protocols for threatening employees.	Public Safety	High	Medium	Medium	Low	Medium	Low	Medium
36	Participate in municipal, regional and state hazard mitigation planning efforts.	EM/BC	Medium	Low	High	Low	High	Medium	Medium
37	Have annual meetings with external campus stakeholders.	EM/BC	Medium	Low	Medium	Low	Medium	Low	Medium
38	Conduct surveys or other outreach soliciting feedback from the community.	EM/BC	Medium	Medium	High	Low	Low	Low	Medium
39	Map infrastructure assets and implement an asset management system.	Facilities	Medium	Medium	High	Medium	Medium	High	Medium
40	Upgrade the Salt Water Pump House which is used for cooling.	Facilities	High	Medium	Medium	High	Medium	High	High
41	Evaluate and upgrade Healey Library roof which is of concern during wind events.	Facilities	Medium	High	High	Low	Medium	High	High
42	Evaluate the Service & Supply roof, fire alarms, gas suppression system and power/generator requirements to ensure they are appropriately	Facilities	Medium	Medium	High	Low	Medium	Medium	Medium

Project No.	Project	Responsible Party	Cost Effectiveness of Activity	Socially Acceptable	Technically Feasible	Protect/Benefit Environment	Legal	Economic Benefit	Project Priority
	designed for a data center.								
43	Complete a hazard assessment on each new project.	EM/BC	Medium	Low	High	Medium	Medium	Low	Medium
44	Ensure new buildings incorporate structural integrity and protection issues associated with top hazards.	Facilities	High	High	High	Medium	Medium	High	Medium
45	Develop hazard planning around having student residence halls.	EM/BC	High	High	High	High	Medium	Low	High
46	Construct both active and passive wave attenuation measures for docking facilities at Fox Point and John T. Fallon State Pier; retain onsite and offsite storage and marine facilities to move when hazards arrive.	Facilities	Medium	Medium	High	Medium	Medium	High	Medium

6.3 POTENTIAL FUNDING SOURCES

Potential funding sources were listed in the Hazard Mitigation Plan (see **Section 5.3**) and pertain to UMass Boston. Consideration should be given to pursuing these funding opportunities where appropriate as a way to implement action items.

6.4 CAPABILITIES ASSESSMENT

UMass Boston has policies, procedures and action plans in place as well as qualified staff available that can be utilized for implementation of this Hazard Mitigation Plan which addresses both natural and human hazards. The capability assessment focuses on identifying where the campus already has mechanisms and staff in place that can either be used directly or modified to support mitigation activities.

6.4.1 Administrative Capability

The UMass System is governed by a single Board of Trustees which is composed of 19 voting member and 3 non-voting members. The President of the University (office located in Boston) oversees the five campus system. At each campus (UMass Amherst, UMass Boston, UMass Dartmouth, UMass Lowell and UMass Medical School) there is a Chancellor.

The development of the UMass Boston Hazard Mitigation Plan Annex was led by Anne-Marie McLaughlin from the Office of Emergency Management and Business Continuity. Other UMass Boston departments that either have been or may need to be involved with mitigation activities in the future include:

- Campus Services
- Contracts & Compliance
- Controller's Office
- Customer Service
- Facilities
- Human Resources
- Office of Budget and Financial Planning
- Office of Campus Master Planning
- Environmental Health and Safety
- Information Technology
- Public Safety
- Center for Rebuilding Communities After Disasters
- Community Relations

Within these departments, various levels of staff perform regular job duties as well as special projects when assigned. **Table 6-3** provides more detail about UMass Boston's administrative and technical capabilities to implement hazard mitigation activities.

Table 6-3: Administrative and Technical Capabilities

Department	Campus Offices Within Department	Function	Staff Types Available
Campus Services	• Bookstore • Campus Center • Dining Services • Marine Operations • Parking & Transportation • Quinn Graphics • Recycling & Sustainability	Departments within Campus Services are responsible for delivering many of the day-to-day services that enhance the student experience and benefit the campus community.	Scheduling and Events Staff, Operations and Special Projects Manager, Operations Coordinator,
Contracts & Compliance	• Procurement • Property • Environmental Health & Safety	Provides campus community with information, and assistance that will enable the most cost effective and appropriate acquisition of goods and services in accordance with all applicable laws, regulations, and policies.	Contracts Manager, Bids and Contracts for Design and Construction, Labor and Materials, Maintenance, Repair and Services
Controller's Office	• Bursar's Office	Supports and enhances the academic, research, and public service activities of UMass Boston by providing effective and efficient financial services to the university community while ensuring compliance with applicable laws, regulations and policies.	Senior Leadership for Fiscal Operations, Business Process and Systems Analyst, Financial Analyst, Cost Accounting, Accounts Payable
Customer Service	• Customer Service	Serves as clearing house for scheduling events on campus, creating signs for campus events, organizing campus moves, etc.	Event Systems Coordinator, Analyst, Customer Service Representatives, Maintenance Foreman, Maintainers
Facilities	• Facilities	Ensures that university facilities and grounds support the teaching, research and student success missions.	Directors for Project Management, Administration, Planning & Information, Utilities

Department	Campus Offices Within Department	Function	Staff Types Available
Human Resources	• Human Resources	Focuses on development of existing faculty and staff, and the continued integration of new and talented contributors to ensure that UMass Boston is powered by a motivated, talented, and diverse workforce.	• Business & Operations/Customer Service • Training & Organizational Development • HR Operations • Benefits, Recruitment • HRIS • Labor Relations
Office of Budget and Financial Planning	• Office of Budget and Financial Planning	The Office of Budget and Financial Planning provides support to university administrators and its departments in developing and implementing short and long-range financial plans for the Boston campus.	• Director of Finance • Financial Analyst • Budget & Policy Analyst
Office of Campus Master Planning	• Office of Campus Master Planning	Implements the UMass Boston 25-Year Campus Master Plan and works closely with the Office of Facilities Management, and in partnership with the campus community, collaborates with UMass Boston's building partners (the UMass President's Office, the UMass Building Authority, and the Commonwealth's Division of Capital Asset Management), external consultants, advisers, elected officials, statutory authorities, and specialist internal departments on advancing master plan projects.	• Director of Campus Master Planning • Campus Planner
Office of Emergency Management and Business Continuity	• Office of Emergency Management and Business Continuity	This office leads a cross campus, all hazards emergency preparedness effort that includes preparedness, prevention, protection, mitigation, response, and recovery.	• Emergency Management and Business Continuity Coordinator
Information Technology	• Application Services • Client Services • Communications and Infrastructure • Educational Technology	The IT Office has over 100 dedicated staff and over 60 student employees who support a wide variety of services.	• Managers for Databases, Web Services, Operations, Systems and Communication, Telecommunications,

Department	Campus Offices Within Department	Function	Staff Types Available
	• Research & Computing		Customer Service, Technology Operations, Instructional Support, Digital Learning
Public Safety	• Uniformed Police • Bureau of Investigative Services • Institutional Security • Community Services	Focus is to create and maintain a safe and secure environment for the university community	• Director, Major and Captain • Technology & Special Projects • Parking & Operations • Detective • Security Officer • Police Officer • Dispatcher
University Health Services	• University Health Services	Provides onsite healthcare and mental health services to the UMass Boston campus community.	• Nurse Practitioners • Consulting Physicians • Psychologists • Social workers • Registered Nurses • Laboratory Technicians • Health Educators
Center for Rebuilding Communities After Disasters	• Graduate Studies Program	The Center for Rebuilding Sustainable Communities after Disasters is dedicated to raising awareness and possessing the expertise necessary for long-term sustainable reconstruction.	• Director, Assistant Director, Administrative
Community Relations	• Community Relations	Serves as the liaison between the University of Massachusetts Boston and its surrounding communities, representing the university in community organizations and activities whose missions are closely aligned with that of the university.	• Director, Coordinator, Administrative Support

Department	Campus Offices Within Department	Function	Staff Types Available
Contracts & Compliance	• Environmental Health and Safety	Environmental Health & Safety has the overall responsibility and authority to develop policies, programs, and procedures to maintain a healthy and safe campus environment for all faculty, staff, and students.	• Director • Deputy Director

6.4.2 Plan & Program Capability

The following documents were either reviewed as a part of this mitigation planning process or identified as having relevance to implementation of mitigation activities for the UMass Boston campus (see **Table 6-4**).

Table 6-4: Documents Relied Upon

Name of Plan	State, Local, Campus Plan or Program	Relevance to Hazard Mitigation Planning Effort
Campus Emergency Management Assessment Report - 2009	Campus	Campus specific evaluation of existing UMass Boston emergency response plans.
Campus Emergency Management Assessment Report, University of Massachusetts, Boston Campus – 2009	Campus	Overall evaluation of University's five campuses for current emergency management procedures and recommends improvements to the security environment of UMass.
Epidemic/Pandemic Response Plan – 2010	Campus	Identifies departments and levels of action for Epidemic/Pandemic cases including influenza and other public health events.
Emergency Operations Plan – 2012	Campus	Developed this plan to meet needs of UMass Boston community including those with disabilities, health concerns and mental health difficulties. Utilized an all-hazards approach to emergency preparedness and followed the four-part cycle of Preparedness, Response, Recovery and Mitigation.
Emergency Public Information and Media Relations Plan	Campus	The purpose of this plan is to provide accurate, timely information to members of the campus community and to the media during an emergency that affects the campus. This plan does not address internal communications protocols during emergencies.
Chancellor's Office Emergency Information - 2012	Campus	Details UMass Boson Emergency response actions starting with the Chancellor's office through the chain of command. Reviews incident command, alert/Rave system details, procedures and staff contact information.
UMass Boston 2011 Annual Security Report - 2011	Campus	Explains public safety and security policies in effect at UMass Boston, summarizes crime reporting procedures, crime prevention programs and other services available to the campus community. Meets all criteria for compliance with the Clery Act.

Name of Plan	State, Local, Campus Plan or Program	Relevance to Hazard Mitigation Planning Effort
UMass Boston 2012 Annual Security Report - 2012	Campus	Explains public safety and security policies in effect at UMass Boston, summarizes crime reporting procedures, crime prevention programs and other services available to the campus community. Meets all criteria for compliance with the Clery Act.
Spill Prevention Control and Countermeasure (SPCC) Plan - 2008	Campus	Includes contact information, site specific information, spill prevention control and counter measures, emergency procedures and spill response and notification procedures.
NPDES Phase II, Municipal Separate Storm Sewer System (MS4) Permit, Stormwater Management Plan, University of Massachusetts Boston - 2011	Campus	Stormwater Management Plan (SWMP) was prepared to achieve compliance with the Environmental Protection Agency's (EPA) National Pollutant Discharge Elimination System (NDPES) Stormwater Phase II regulations.
Preparing for the Rising Tide (Douglas, Kirshen, Li, Watson, Wormser), 2013	Local	Report was written for policy makers, planners and property owners that included site specific examples (one of which was UMass Boston) of how to address vulnerability and increase resilience to coastal flooding over time.
Multi-Hazard Mitigation Plan – Boston Annex, 2008	Local	Expired local Hazard Mitigation Plan for Boston region that included specific Boston Annex.
City of Boston Natural Hazard Mitigation Plan – 2013	Local	Update to 2008 Hazard Mitigation Plan that discusses natural and some human hazards.
Commonwealth of Massachusetts – State Hazard Mitigation Plan, 2010	State	Current Hazard Mitigation Plan for Massachusetts that discusses vulnerabilities throughout the state to natural (and some human) hazards and associated mitigation activities.
Campus Master Plan for University of Massachusetts Boston, 2009	Campus	Current 25-year Campus Master Plan that conducted an extensive planning effort and included technical studies by the campus planning team documenting existing conditions and programs and amount, quality, and use of space; evaluating building systems, such as: heating, cooling, plumbing, electricity, fire protection, and utilities; conducting traffic and parking studies; surveying property, buildings, open spaces, topographical features, and property boundaries. The new Campus Master Plan helped to focus/address several events such as deterioration from salt infiltration to substantial portions of the steel reinforcement bars within the concrete floor slabs and col-

Name of Plan	State, Local, Campus Plan or Program	Relevance to Hazard Mitigation Planning Effort
		umns of the two-level above ground garage upon which most campus buildings sit; acquisition of the historic Calf Pasture Pumping Station building and 9.5 acres of grounds from the Boston Water and Sewer Commission; rapid growth in student population; and a call for a new campus master plan to study and suggest solutions to address these and other issues.
Energy and Utility Master Plan – University of Massachusetts Boston, 2010	Campus	Energy and Utility Master Plan was completed after and complementary to the 25-Year Campus Master Plan. Provides recommendations and guidelines to transform the campus to meet its strategic goals. An assessment of energy and infrastructure was performed to determine heating, cooling, and electrical needs based on the first 10 years of the campus master plan and a projection of needs for the implementation of the 25 year master plan.
Marine Safety Plan, 2007	Campus	Includes a Storm Plan and discusses various safety, insurance and operational information with regard to the marine operations and assets associated with UMass Boston.
Emergency Preparedness	UMass Boston Program	UMass Boston offers two certificate programs in emergency management. Provides educational opportunity for students who are interested in this type of work/career.
Fiscal Year 2012 – 2016 Capital Plan Update	Campus	Details the University's capital planning process that focuses on a five-year planning period, but incorporates planning assumptions, needs assessments, and funding projections for the next decade.

6.4.3 Fiscal Capability

Annually, an operating budget is prepared for the University System and approved by the Board of Trustees. The operating budget presents projected revenue and expenditures for all five campuses as well as the President's Office. The UMass Boston fiscal year runs from July 1st to June 30th of the next calendar year.

The UMass System is in the middle of implementing its 2012 – 2016 Five Year Capital Plan update. In general, due to the age of the facilities that make up the UMass System, it is a challenge to maintain and upgrade all of the capital assets including infrastructure, buildings and grounds. According to the Capital Pan, there is no single source of funding that has the capacity to address all of the work that needs to be done, so the University relies on a combination of

revenue sources to fund future capital improvement investment. The four main revenue sources are:

- State support either through general obligation bond funds or economic stimulus and supplemental legislative appropriations,
- Financing through the University of Massachusetts Building Authority,
- Financing through the Massachusetts Health and Educational Facilities Authority, and
- Other legally available sources, operating funds and external funding such as private giving and grants.

The Capital Plan also notes that between 2008 – 2010, a number of developments occurred that will continue to help the University and its five campuses improve and invest in infrastructure. The events that directly and indirectly relate to UMass Boston include:

- The Commonwealth passed a $2 billion Higher Education Bond Bill that included over $1 billion for University projects,
- The Commonwealth passed a $1 billion Life Sciences Investment Bill that could provide up to $240 million of capital support to the University,
- The UMASS Building Authority borrowed $550 million in October 2009 to initiate projects at all of the University's campuses, and
- The UMASS Building Authority borrowed $547 million in November 2010 to initiate a third round of projects across the University.

The UMass Boston FY12-FY21 Capital Plan details over $1.1 billion in spending over the next ten fiscal years in four major areas (see **Table 6-5**).

Table 6-5: UMass Boston FY12-FY21 Capital Plan Details

Program Type	Amount Allocated	% of Total Funds
Basic Infrastructure/Deferred Maintenance/Compliance Projects	$63,600,000	5.7%
Master Plan Related Projects	$1,019,400,000	89.6%
Substructure Related Projects	$8,300,000	.7%
Teaching/Learning/Research	$44,000,000	4.0%

In general, larger capital projects for the entire UMass System such as buildings and athletic facilities are funded through the UMass Building Authority. DCAM generally may fund smaller projects that tend to be more operational in nature such as building maintenance, energy projects, emergency generators and other energy related/efficiency projects. Depending on the nature of the project, utilizing staff time and assigning specific people may be another way to advance certain mitigation projects.

6.4.4 Regulatory Environment

Additional legal and regulatory policies are in place that pertain to UMass Boston and have an impact on the implementation of mitigation activities. These policies are listed in **Table 6-6.**

Table 6-6: Legal and Regulatory Policies

Regulation/Policy	Purpose
Article 80	Regulates large project review, small project review, planned development area review and institutional master plan review. Hospital or college projects that add more than 20,000 square feet of gross floor area or that involve interior alterations for more than 50,000 square feet of gross floor area require Institutional Master Plan Review according to Article 80. Once an Institutional Master Plan is approved, any project fully described in the plan may be completed (built) by the institution. Currently, UMass Boston is not subject to this regulation.
MEPA – Special Review Procedure (SRP)	In June 2010, a Special Review Procedure was established for UMass Boston in coordination with DCAM regarding the 25-Year Master Plan. The SRP will allow UMass Boston to seek authorization for early implementation of Master Plan elements.

7. PLAN IMPLEMENTATION, MAINTENANCE & ADOPTION

The implementation of the Hazard Mitigation Plan at UMass Boston will be overseen by the Emergency Management and Business Continuity Coordinator, Anne-Marie McLaughlin. The Emergency Management and Business Continuity Coordinator will be responsible for:

- Participating on the Multi-campus Hazard Mitigation Steering Committee as requested by the UMass Emergency Planning and Business Continuity Manager;
- Convening the campus Hazard Mitigation Planning Team on a regular basis to discuss how various action items might be implemented, to ensure mitigation projects are prioritized in the highest order of importance, and to discuss action items that have been completed or are underway, and
- Ongoing stakeholder engagement, both on and off campus, and participation in other local and regional Hazard Mitigation Planning efforts (e.g. City of Boston).

All meetings will be documented and summarized including the status of any mitigation project actions, risk assessments or needed plan revisions.

7.1 PLAN MAINTENANCE & REVISION

Informal Hazard Mitigation Plan monitoring activities will be ongoing on a regular basis. UMass Boston will formally review the Hazard Mitigation Plan annually, or upon the occurrence of a substantial hazard event at any of the campuses. First, an annual plan review meeting with the Hazard Mitigation Steering Committee will be held by the Emergency Planning and Business Continuity Manager. Following that meeting, the campus Emergency Management and Business Continuity Coordinator will assemble the UMass Boston Hazard Mitigation Planning Team to discuss the outcome of the Hazard Mitigation Steering Committee meeting and any recommended or needed changes to the Plan. Then, the Hazard Mitigation Planning Team will evaluate the progress of the Boston campus Plan and document any mitigation activities that have taken place on campus since the last review.

In preparation for the annual meetings of the Hazard Mitigation Steering Committee and Hazard Mitigation Planning Team, the Emergency Management and Business Continuity Coordinator will prepare a status report to document the campus' progress in implementing the Mitigation Plan. Status reports should describe:

- Projects that have been scoped for FEMA grant applications;
- Projects that have been submitted for FEMA funding programs;
- Grant applications that have been either approved or denied FEMA funding;
- Projects funded internally or by other grant programs;
- Projects that have been initiated or are under construction; and/or
- Completed projects.

The public will be informed about the annual review of the plan by the UMass Boston Public Relations Office in accordance with the campus' public relations protocols. The public will be offered the opportunity to provide input and comment through the Emergency Management and

Business Continuity Coordinator. The public will also have an opportunity to comment on the plan during the 5-year plan update meeting. After the annual review meeting, UMass will issue a progress report and post it on the UMass Boston website.

UMass Boston recognizes the importance of continued public outreach and public participation in this planning effort. Once the plan is finalized, a link to the Hazard Mitigation Plan and UMass Boston Annex will be posted to the campus' website (www.umb.edu); and the complete plan will be posted to the UMass system website (www.massachusetts.edu). A press release will be issued by the Public Relations Office, and the effort may be discussed at various meetings where the Emergency Management and Business Continuity Coordinator and Hazard Mitigation Planning Team members can promote the Plan and continue to make the campus and neighboring community aware and encourage participation. Hard copies of the plan will be made available on campus through the Emergency Management and Business Continuity Coordinator and with the Emergency Planning and Business Continuity Manager.

7.2 REVISING THE PLAN

UMass Boston will review and update this plan annex every five years in coordination with the review and update of the entire multi-campus plan. Following a meeting of the Hazard Mitigation Planning Steering Committee in January 2019, the UMass Boston Emergency Management and Business Continuity Coordinator will convene the campus Hazard Mitigation Planning Team and set forth a schedule for reviewing the plan. The review and update will include:

- Updating the plan to reflect any changes in development or in the campus communities;
- A discussion on new/changed regulatory requirements;
- A discussion of recent hazard events;
- A re-evaluation of the hazard ranking and any changes in campus priorities;
- An update of any loss estimates,
- A discussion of any new studies and technologies;
- Revisiting potential projects; and
- A discussion of projects that have been completed.

The campus Hazard Mitigation Planning Team will review any State or Federal changes made to UMass Boston plans, funding, and policies, and will also utilize any updated Census Data that is available. The Hazard Mitigation Planning Team will also review existing goals and objectives and update them along with newer action items as needed. The findings of this research and analysis will be compiled into an updated UMass Boston plan annex and submitted to the Emergency Planning and Business Continuity Manager for inclusion in the Multi-Campus Hazard Mitigation Plan. Ultimately, the entire revised Multi-Campus Hazard Mitigation Plan will be issued to MEMA and FEMA for review.

7.3 INTEGRATION INTO OTHER PLANNING MECHANISMS

UMass Boston has a number of local plans that were previously discussed in Section 6.4.2 that are related either directly or indirectly to this Hazard Mitigation Plan. To the extent possible, requirements, actions or principles of these documents have been integrated into the Hazard Mitigation Plan and UMass Boston Hazard Mitigation Plan Annex. Mitigation planning can be integrated conversely into those documents by making it a regular topic that is discussed through any new or updated document and during the associated planning effort. The Emergency Management and Business Continuity Coordinator will work with other appropriate members of the campus community to advocate for hazard mitigation. Specific activities may include:

- Integrate the Hazard Mitigation Plan goals and objectives into any new, amended or updated planning/policy document to the extent possible,
- Formalize and publicize a recognition of hazard mitigation planning and mitigation activities as a part of local and joint emergency management plans, efforts and operations,
- Address sea level rise, climate change and hazard mitigation planning in any future versions of the campus emergency response and disaster recovery plans, etc.,
- Seek out opportunities to participate in other local Hazard Mitigation planning efforts, projects or initiatives to share local knowledge and also learn about other activities occurring in the region,
- Further integrate mitigation planning into the Capital Improvement/Master Planning process by actively and regularly seeking alternative funding sources that have been highlighted in this plan.

7.4 ADOPTION

In order to be approved by MEMA and FEMA, this Plan must be formally adopted by UMass. Documentation that the Hazard Mitigation Plan has been formally adopted by the University and each campus is provided below.

The UMass Hazard Mitigation Plan and UMass Boston Annex were thoroughly reviewed by the Hazard Mitigation Planning Committee. The UMass Boston Hazard Mitigation Planning Committee formally endorsed the Hazard Mitigation Plan and UMass Boston Annex on ____ and recommended it for adoption by UMass Boston senior campus officials. The UMass Boston Plan was formally adopted by _____ on _____. UMass Boston issued a press release announcing plan endorsement on ____ and posted the plan on the UMass Boston web site.

7.5 APPROVAL

A copy of the formal approval letter for this Plan is provided in **Appendix I**.

[To be included once the Plan has been approved by MEMA and FEMA]

APPENDIX A: BIBLIOGRAPHY OF DOCUMENTS PROVIDED BY UMASS BOSTON

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APPENDIX B: CAMPUS KICKOFF MEETING MATERIALS

MEETING SIGN-IN SHEET – CAMPUS KICK-OFF MEETING

Project:	UMass – Multi-Campus Hazard Mitigation Plan	**Meeting Date:**	November 13, 2012
Facilitator:	Woodard & Curran	**Campus:**	UMass Boston

Name	Department or Organization	Title	Phone	E-Mail
Anne Marie McLaughlin	EM/BC	Emgr	617-287-6821	a.mclaughlin@umb.edu
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Debra Gursha	UMB - EMTS	Staff	7-5467	debra.gursha@umb.edu
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Steve Martinson	UMB - Transportation	Director	617-287-5043	steve.martinson@umb.edu
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KEVIN B. MURPHY	INSTITUTIONAL RESEARCH	ASSOC. DIRECTOR	7-5425	KEVIN.MURPHY@UMB.EDU
DeWayne Lehman	Communications	Director	7-5302	dewayne.lehman@umb.edu

MEETING SIGN-IN SHEET – CAMPUS KICK-OFF MEETING

Project:	UMass – Multi-Campus Hazard Mitigation Plan	**Meeting Date:**	November 13, 2012
Facilitator:	Woodard & Curran	**Campus:**	UMass Boston

Name	Department or Organization	Title	Phone	E-Mail
Zehra Schneider Graham	EH&S	Act. Dir	7-5445	zehra@umb.edu

UMASS MULTI-CAMPUS HAZARD MITIGATION PLAN
CAMPUS KICK-OFF MEETING AGENDA

UMASS BOSTON
NOVEMBER 13, 2012

I. Introductions of Meeting Attendees

II. Project Overview

a. Background Information
b. Goals and Objectives
c. What this Means for UMass
d. Roles and Responsibilities
e. Examples of Hazard Events

III. Requirements of FEMA

a. Focus on Mitigation Strategy
b. Importance of the Planning Process
c. Customize Requirements
d. Engage the Community
e. Documentation

IV. Multi-Hazard Mitigation Planning Process

a. Hazard Identification and Risk Assessment
    i. Description of Hazard
    ii. Previous Occurrences and Probability
    iii. Hazard Vulnerability
    iv. Critical Assets in Hazard Areas
    v. Hazard Impacts
b. Mitigation Strategy
    i. Description of Mitigation Goals
    ii. Mitigation Actions and Projects

V. Project Implementation

a. Schedule
b. Communications
    i. Web Site
    ii. Scheduled Meetings
c. Plan Review Process

VI. Open Discussion/Questions and Comments

Introductions

MARY HOUSE
PROJECT MANAGER

MARYKRISTIN IVANOVICH
TECHNICAL LEAD

About Woodard & Curran

- 680 Person engineering, environmental consulting and contract operations firm
- Experience working with UMass stakeholders for over ten years
- Worked at five of the six campuses
- Completed 50 UMass projects in 5 years
- Completed ICPs at two campuses
- FEMA trained staff and have authored hundreds of emergency management plans
- Secured Millions of Dollars in FEMA Funding – City of Salem/Salem State University $3M FEMA grant
- Teamed with Prism Security
- Offices in Dedham, Andover, and Plymouth

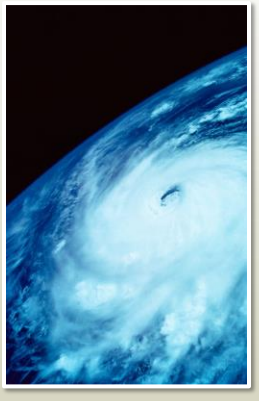
Meeting Agenda

- Project Overview
  - Background and Goals
  - Roles and Responsibilities
- Requirements of FEMA
  - Strategy, process, engagements
  - Documentation
- Multi-Hazard Mitigation Planning Process
  - Hazard identification and risk assessment
  - Mitigation strategy
- Project Implementation
  - Schedule and communications
  - Review process
- Open Discussion/Questions and Comments

Project Overview

Project Background

- The Disaster Mitigation Act was signed by the President in October 2000.
  - Incentive for states and local governments to undertake natural hazard mitigation planning.
  - Promotes sustainability as a strategy for disaster resistance.
  - Encourages state and local governments to work together, and facilitates cooperation between state and local authorities.
  - Results in faster allocation of funding and more effective risk reduction projects.
  - Colleges and Universities can plan in concert with similar planning efforts in their community.



COMMITMENT & INTEGRITY DRIVE RESULTS

Project Background

- The University of Massachusetts campuses (Boston, Dartmouth, Lowell and System Office) received a grant of $350K from FEMA/MEMA to develop hazard mitigation plans
- Plans will help identify cost effective mitigation measures to reduce or eliminate long-term risk to life and property from hazards
- Allow the University to be eligible to receive non-emergency disaster assistance, including state and federal funding for mitigation and recovery projects
- Projects must be pre-identified in the hazard mitigation plans to receive future funding

FEMA Funding

- Existing funding secured is for the hazard mitigation planning process
- Eligible for pre-disaster funding - "FEMA's Hazard Mitigation Assistance (HMA) grant programs provide funding for eligible mitigation activities that reduce disaster losses and protect life and property from future disaster damages including the Hazard Mitigation Grant Program (HMGP), Pre-Disaster Mitigation (PDM), Flood Mitigation Assistance (FMA), Repetitive Flood Claims (RFC), and Severe Repetitive Loss (SRL). Guidance for HMA applications submitted during the FY 2012 grant cycle and for disasters occurring on or after June 1, 2010"
- "Hazard Mitigation Grant Program (HMGP) funds may be used to fund projects that will reduce or eliminate the losses from future disasters. Projects must provide a long-term solution to a problem… Funds may be used to protect either public or private property or to purchase property that has been subjected to, or is in danger of, repetitive damage. Examples of projects include, but are not limited to: Acquisition of real property for willing sellers and demolition or relocation of buildings to convert the property to open space use, Retrofitting structures and facilities to minimize damages from high winds, earthquake, flood, wildfire, or other natural hazards, Elevation of flood prone structures, Development and initial implementation of vegetative management programs, Minor flood control projects that do not duplicate the flood prevention activities of other federal agencies Localized flood control projects, such as certain ring levees and floodwall systems, that are designed specifically to protect critical facilities, and Post-disaster building code related activities that support building code officials during the reconstruction process.

Phases of Emergency Management

- **Mitigation** – long-term reduction of vulnerability
- **Preparedness** – plans and preparations to save lives and property and facilitate response operations
- **Response** – actions taken to provide emergency assistance, save lives and minimize property damage
- **Recovery** – actions taken to return to normal conditions.

Hazard Mitigation Overview

- Hazard mitigation is defined as "any action taken to reduce or eliminate the long-term risk to human life and property from natural [and/or manmade] hazards."
- Hazard mitigation activities may be implemented prior to, during, or after an event; however, it is most effective when based on an inclusive, comprehensive, long-term plan that is developed before a disaster occurs.
- Hazard mitigation is often focused on reducing repetitive loss, as many damaging events tend to occur in the same locations over time (e.g. flooding).

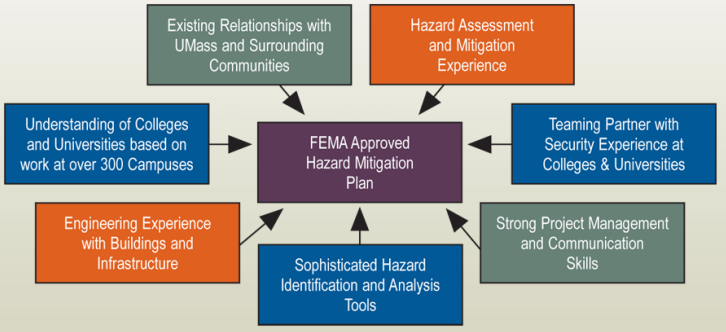
Benefits of Hazard Mitigation Planning

- Campuses benefit from Mitigation Planning by:
  - Identifying cost effective actions for risk reduction that are agreed upon by stakeholders
  - Focusing resources on the greatest risks and vulnerabilities
  - Building partnerships by involving the campus community, organizations, local government and businesses
  - Increasing education and awareness of hazards and risk
  - Communicating priorities to local, state and federal officials
  - Aligning risk reduction with other University objectives

Project Goals

- Fulfill Federal, State, Local and University Hazard Mitigation Planning Requirements
- Promote the Safety of Students, Faculty, Staff and Visitors
- Minimize Hazard Impacts to Physical Assets and Operations
- Reduce or Avoid Long-Term Vulnerabilities from Hazards
- University Eligibility for Future Funding

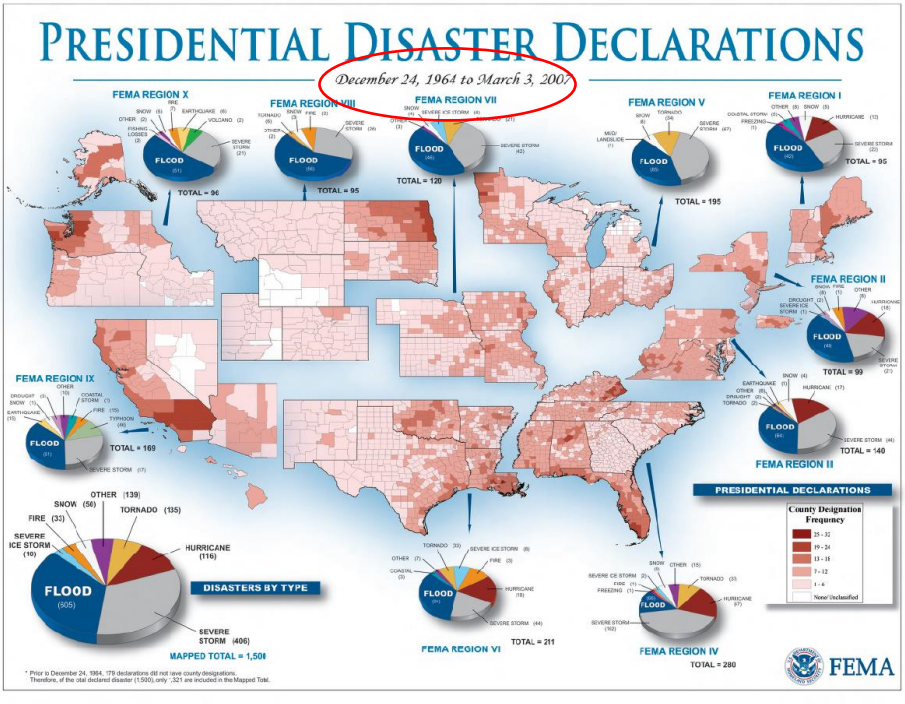
Delivery of a Practical and Implementable Plan

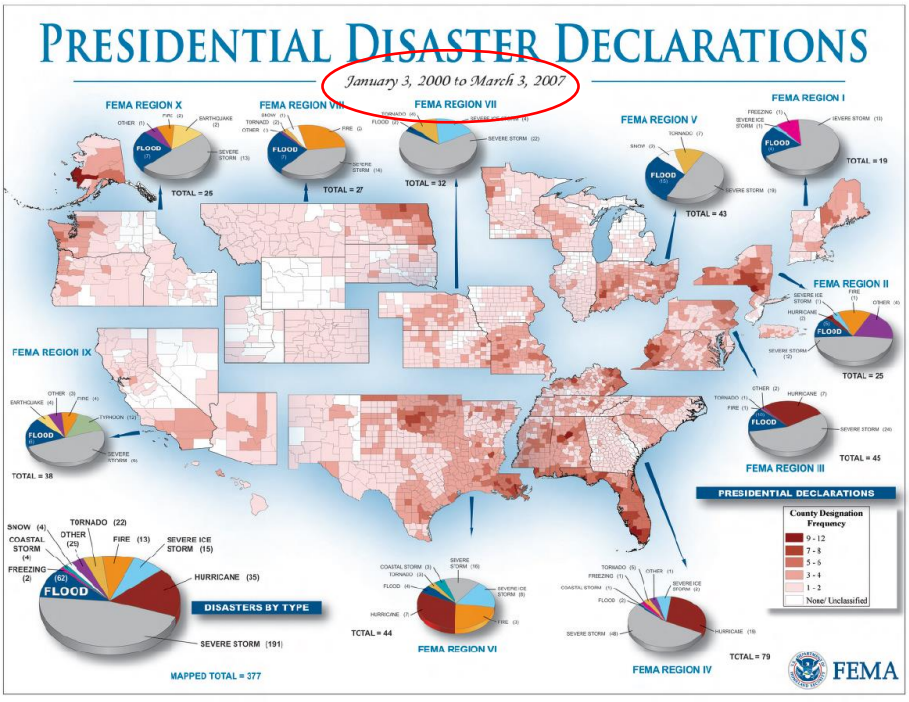


Project Organizational Structure

Roles and Responsibilities of Hazard Mitigation Planning Team

- Participate in at least six meetings/workshops over the course of the two-year project
- Supply information associated with past hazard mitigation planning or related efforts
- Help identify applicable hazards and develop mitigation actions
- Support internal and external outreach activities
- Review and provide comments on the multi-hazard mitigation plan and campus specific appendix
- Support the implementation of the plan when an event occurs and be actively involved in continuous improvements





Examples of Types of Hazards

- Earthquake
- High winds
- Fire
- Floods
- Dam Failure
- Extreme Heat
- Winter storm
- Hailstorm
- Expansive soils
- Terrorism
- Civil Disturbance
- IT Interruption
- All hazards – generators, computer backups, additional contingency planning

UMASS BOSTON

WOODARD & CURRAN

Recent UMass Hazards

- January Blizzard
- Western MA Tornado
- Hurricane Irene
- October 2011 Snowstorm
- UMass Lowell Building Fire
- Superstorm Sandy
- Bombs Threats

Open Discussion
Recent Hazards on Campus

Requirements of FEMA

What is FEMA Interested In?

- **Focus on Mitigation Strategy** – Emphasize Actions and Implementation of the Hazard Mitigation Strategy
- **Review for Intent, as well as Compliance** – Does the Plan Meet the Intent of the law and regulation
- **Process is as Important as the Plan Itself** – Planning Process to be Defined by the University
- **This is Your Plan** – Must be Reflective of your University, Stakeholders and Community
- **Foster Relationships** – The relationships are as Important as the Words in the Plan

COMMITMENT & INTEGRITY DRIVE RESULTS

Documentation is Critically Important

- UMass Labor in Kind
- Meetings
  - Agenda
  - Attendees List
  - Meeting Minutes
- Campus Visits
  - Data Gathered and Data Sources
  - Interview Summaries
- Stakeholder Workshops
  - Agenda
  - Attendees List
  - Workshop Summaries

FEMA Evaluation Criteria (handout)

Hazard Mitigation Planning

Comprehensive Methodology

1. Planning Process
- Community engagement
- Building upon existing information

2. Hazard Identification and Risk Assessment
- Systematically identifying hazards through the use of GIS and other tools to assess/prioritize risk

3. Mitigation Strategy
- Reach across broad skill sets to identify hazard mitigation goals
- Draw upon broad campus experience to develop mitigation strategies

4. Plan Review, Evaluation, and Implementation
- Work collaboratively and proactively with regulators

COMMITMENT & INTEGRITY DRIVE RESULTS

Hazard Mitigation Planning Process

- The UMass planning process will closely follow FEMA's recommended four-stage approach.
- Initial and ongoing community support is critical to the planning process.

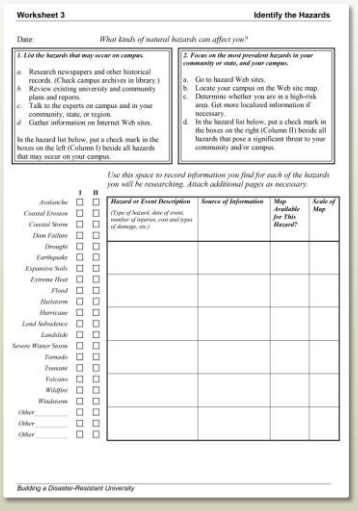
Hazard Mitigation Planning Process

- **Phase 1** – Organize Resources – identifies the resources available and necessary to complete the process:
  - Assess community support
  - Build the planning team
    - Identify and organize interested members of the community (stakeholders – on and off campus)
    - Identify the necessary technical expertise
  - Establish a steering committee
    - Develop a mission statement
    - Hold a project kick-off meeting
    - Establish a meeting schedule and goals
    - Engage the public

Hazard Mitigation Planning Process

- **Phase 2** – Assess risks – identify the hazards that present risks to the campus and the assets that are vulnerable to those hazards.
  - Gather historical information, review existing university plans/reports, communicate with local planning experts, MEMA and FEMA.
  - Determine which hazards present the greatest risk to the campus community
    - Assess vulnerability
    - Create a base map to profile potential hazard events
  - Inventory campus assets
    - Show how hazard events could impact campus (physically and operationally)
    - Estimate losses

Hazard Identification



Worksheet 3 — **Identify the Hazards**

Date: *What kinds of natural hazards can affect you?*

1. List the hazards that may occur on campus.

a. Research newspapers and other historical records. (Check campus archives in library.)
b. Review existing university and community plans and reports.
c. Talk to the experts on campus and in your community, state, or region.
d. Gather information on Internet Web sites.

In the hazard list below, put a check mark in the boxes on the left (Column I) beside all hazards that may occur on your campus.

2. Focus on the most prevalent hazards in your community or state, and your campus.

a. Go to hazard Web sites.
b. Locate your campus on the Web site map.
c. Determine whether you are in a high-risk area. Get more localized information if necessary.
d. In the hazard list below, put a check mark in the boxes on the right (Column II) beside all hazards that pose a significant threat to your community and/or campus.

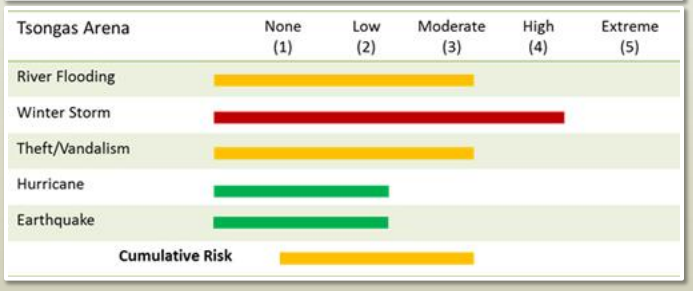
Use this space to record information you find for each of the hazards you will be researching. Attach additional pages as necessary.

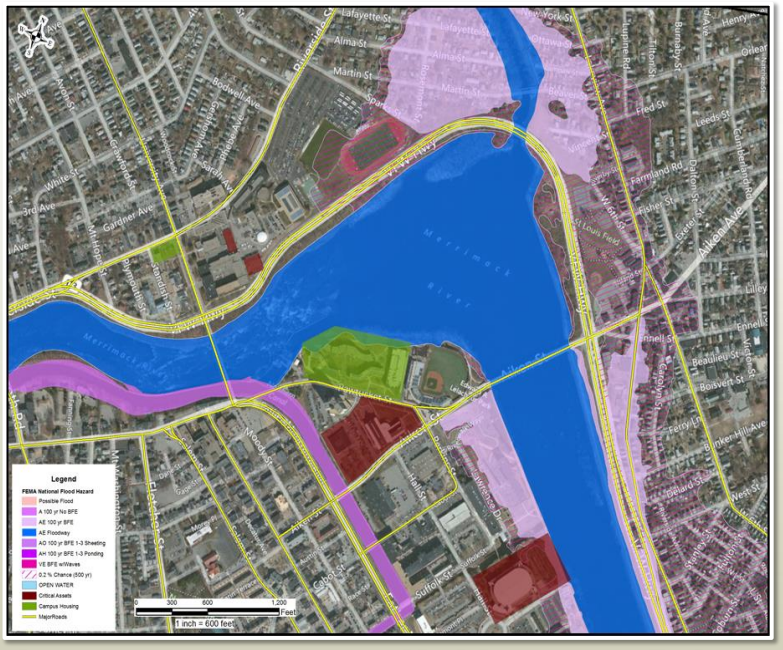
	I	II	Hazard or Event Description (Type of hazard, date of event, number of injuries, cost and types of damage, etc.)	Source of Information	Map Available for This Hazard?	Scale of Map
Avalanche	☐	☐				
Coastal Erosion	☐	☐				
Coastal Storm	☐	☐				
Dam Failure	☐	☐				
Drought	☐	☐				
Earthquake	☐	☐				
Expansive Soils	☐	☐				
Extreme Heat	☐	☐				
Flood	☐	☐				
Hailstorm	☐	☐				
Hurricane	☐	☐				
Land Subsidence	☐	☐				
Landslide	☐	☐				
Severe Winter Storm	☐	☐				
Tornado	☐	☐				
Tsunami	☐	☐				
Volcano	☐	☐				
Wildfire	☐	☐				
Windstorm	☐	☐				
Other _____	☐	☐				
Other _____	☐	☐				
Other _____	☐	☐				

Building a Disaster-Resistant University

Lowell Campus Facilities & Assets	Flooding Risk			Winter Strom Risk			Theft & Vandalism			Hurricane			Cumulative Risk		
	S	M	L	S	M	L	S	M	L	S	M	L	S	M	L
Tsongas Area	1	2	3	1	2	3	1	1	1	1	3	4	1	2	4
Lydon Library	1	2	2	1	1	3	1	2	3	1	2	2	1	2	3
Fox Hall	1	2	2	1	2	3	1	1	2	1	2	2	1	1	2
Costello Gym	1	3	4	3	3	5	1	2	4	2	2	5	1	3	5
Riverview Field	1	2	4	1	1	1	1	3	4	1	3	5	1	3	4
University Crossing	1	2	3	1	1	1	1	2	3	1	3	5	1	3	4
Engineering Building	1	2	3	4	4	5	1	1	1	1	1	1	1	2	4
Cushing Field Complex	1	3	5	1	2	3	2	3	4	1	4	4	1	4	4
Power Plant/ Garage	1	3	3	1	1	3	1	1	1	1	1	1	1	1	3
Campus Center	1	2	1	2	3	3	1	1	1	1	1	2	1	1	2
Aiken Street	1	2	1	3	3	5	1	1	1	1	2	3	1	2	3

L= Immediate Term, M = Mid-Term, H = Long Term Relative Risk is rated 1-5 (5 highest) and color coded





Hazard Mitigation Planning Process

- **Phase 3** – Develop the mitigation plan – lays out in detail the proposed mitigation actions.
  - Establish priorities
    - Compare university mission with the results of the hazard identification and risk assessment
  - Develop hazard mitigation goals
    - Minimize interruption to campus operations and mission
    - Protect research
  - Determine appropriate mitigation actions
  - Prioritize mitigations actions
  - Prepare an implementation strategy

Hazard Mitigation Plan Contents

- Executive Summary
  - Purpose, Process, Major Recommendations
- Goals and Objectives
- Hazard Identification and Risk Assessment
  - Hazard Background, Asset Inventory, Loss Estimation
- Mitigation Strategy
  - Identification of Mitigation Actions, Prioritization of Actions and Methodology, Timeline
- Implementation and Plan Maintenance
  - Responsibilities, Integration with Other Plans, Schedule

Hazard Mitigation Planning Process

- **Phase 4** – Implement the plan and monitor progress
  - Formally adopt the Hazard Mitigation Plan
  - Implement mitigation measures
  - Monitor, evaluate and update the plan as needed
  - Continue to engage stakeholders from the campus and community

Project Implementation

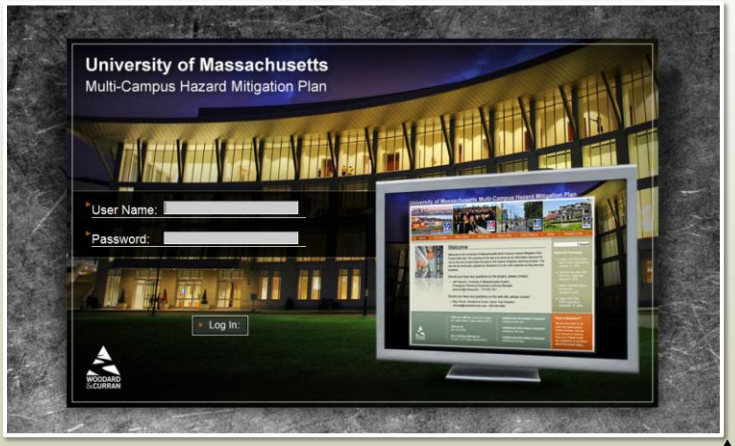
Timeline

- Project Planning - Summer 2012
- Kick off Meetings – Fall 2012
- Hazard Identification and Risk Assessment – Fall 2012/winter 2013
- Campus Workshops
- Submit Draft Plan to UMass – August 2013
- Review and Finalize Plan – Fall 2013 to early 2014
- Submit Draft to State – Feb 2014
- Submit Draft to FEMA – May 2014
- Obtain Approval and Complete Final Presentations – Fall 2014

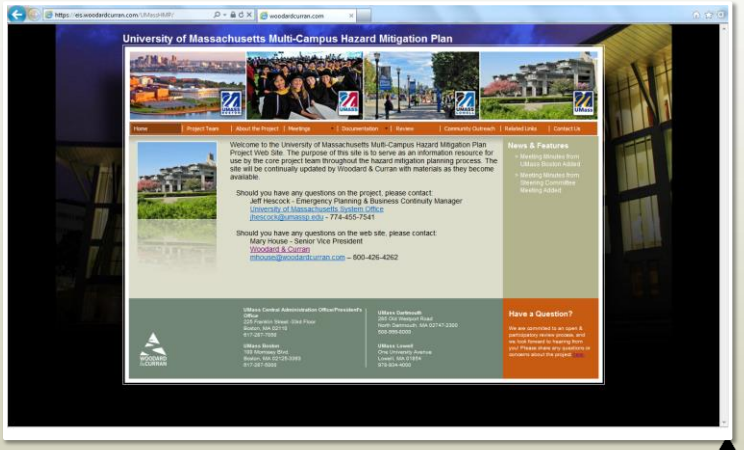
Plan Review Process

- Initial review by Steering Committee
- Distribution of initial draft to Campus Hazard Mitigation Planning Committee for review and comment
  - Steering Committee representative to coordinate electronic comments
  - Look at Schedule – facilitated review meeting
- Distribution of second draft to Campus Hazard Mitigation Planning Committee for review and comment
  - Steering Committee representative to coordinate electronic comments
- Final review and approval by Steering Committee
- Submit draft to agency

Project Web Site



Project Web Site



COMMITMENT & INTEGRITY DRIVE RESULTS

Project Web Site Details

- Unlimited access to all users
- For viewing purposes only

- Link: https://eis.woodardcurran.com/UMassHMP
- User Name: uml
- Password: wc2kuml12

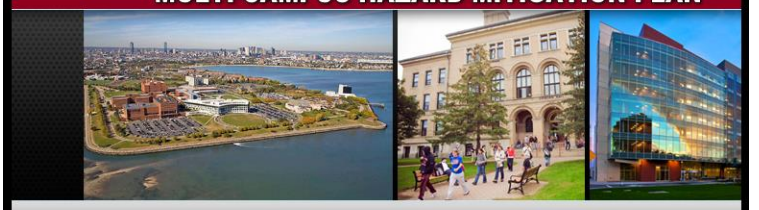
Scheduled Meetings

- Hazard Identification and Risk Assessment – January 2013
- Campus Workshops – January, May, September 2013
- Facilitated Review – September 2013
- Meeting to Discuss Comments, if needed – January 2014
- Final Presentations – November 2014

WOODARD &CURRAN

University of Massachusetts

MULTI-CAMPUS HAZARD MITIGATION PLAN



Thank You

Questions?

UMASS UMASS BOSTON UMASS LOWELL UMASS

APPENDIX C: INTERVIEW QUESTIONNAIRES

COMMITMENT & INTEGRITY
DRIVE RESULTS

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Suite 110
Andover, Massachusetts 01810
www.woodardcurran.com

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T 978.557.8150
F 978.557.7948

UMASS MULTI-CAMPUS HAZARD MITIGATION PLAN

Name:

Job Title/Relationship to the University:
Campus Location:

Address:
Phone:
Email:

Date of Interview:
Interviewer Name:

ON-CAMPUS INTERVIEW QUESTIONS

1) What are the natural hazards that occur/impact this campus?

2) Do you know the frequency and magnitude of possible future hazard events?

3) What is your level of concern regarding how susceptible this UMass Campus is to a natural hazard?

__ No Concern __ Somewhat Concerned __ Very Concerned

Why, or why not?

4) What hazard do you think are of the highest threats to this UMass Campus? Please circle the most serious threat and just check the other hazards that you think have potential.

__ Coastal Storm
__ Coastal Erosion
__ Hurricane
__ Tornado
__ Flood
__ Drought
__ Winter Storm
__ Thunderstorm/Lightning
__ Hailstorm
__ Urban or Wildfire
__ Tsunami
__ Extreme Heat
__ Windstorm

5) In your experience, has hazard mitigation been a part of any discussions at this UMass campus during Master Planning or Strategic Planning?

   Please elaborate:

6) Has any work been done to make this UMass Campus more resistant to natural hazards?

   Please elaborate:

7) What do you think this UMass campus could do to minimize their level of vulnerability to a natural hazard?

8) Using your own institutional knowledge, are you aware of any damages from various hazards that may have occurred to your campus? Can you please provide detail?

9) Are some parts of the campus particularly vulnerable to damages, or is the entire campus?

10) Are some buildings particularly vulnerable to damages? What are the uses and occupancies of the vulnerable buildings?

11) What buildings on campus, in your opinion, are the most critical to protecting the safety of the public and to the continuity of a high functioning campus (where is emergency management, fire/safety, medical facilities, information storage, utilities)?

12) Are your utilities vulnerable to damages? How?

13) What could it cost to repair damages? How long could it take?

14) How will research be impacted?

15) How will students be affected on and off campus?

16) Could the University be closed down for a significant period of time because of possible disaster losses?

MITIGATION ACTIVITIES

Mitigation activities can generally be grouped into several categories including:

- **Public Education and Awareness** (information campaigns about how people can prepare and protect themselves during a natural disaster)
- **Emergency Services** (actions that protect people like emergency alerts, evacuation planning, etc.)
- **Structural Projects** (upgrades that lessen the impact of a hazard such as dams, seawalls, storm sewers, etc.)
- **Natural Resource Protection** (preserve and restore natural habitat areas so that they can function in their natural state during a natural hazard)
- **Protection of Property** (modifying a building/property to protect it from a natural hazard)

Please ask each interviewee:

- How important are each of the above noted Mitigation Activities for your individual campus?

- To what extent has your campus already made strides in any of the above category areas? Please be specific.

Other

Any additional information that you would like to share/have available that would assist the project team during this effort?

COMMITMENT & INTEGRITY
DRIVE RESULTS

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UMASS MULTI-CAMPUS HAZARD MITIGATION PLAN

Name:

Job Title/Relationship to the University:
Campus Location:

Address:
Phone:
Email:

Date of Interview:
Interviewer Name:

ON-CAMPUS INTERVIEW QUESTIONS

1) From your viewpoint, what are the actual and anticipated principal man-made hazards that occur/could occur that could have a significant impact on this campus?

2) Of the following man-made hazards, which hazards do you think are the highest threats to this UMass Campus? Please circle the most serious threat and just check the other hazards that you think have potential to occur.

	Frequency	Magnitude
__ Active Shooter		
__ Bioterrorism		
__ Bomb Threat		
__ Civil Disturbance		
__ Explosion		
__ Violent Criminal Incident		
__ Hostage Situation		
__ Food Shortage		
__ Fuel Shortage		
__ HazMat Incident (on or off campus)		
__ Radiological Incident		
__ Structural Collapse		
__ Terrorism		
__ Transportation Accident		
__ Utility Failure		
__ Cyber Attack/SCADA Attack		

3) Is there any kind of estimation of possible frequency and magnitude of these man-made hazard events? Indicate below or on the previous list in the column provided.

4) What is your level of concern regarding how susceptible this UMass Campus is to specific man-made hazards?

__ No Concern __ Somewhat Concerned __ Very Concerned

Why, or why not?

5) In your experience, has actual or potential hazard mitigation been a part of any discussions at this UMass campus during Master Planning or Strategic Planning?

Please elaborate:

6) Has any work been done either on campus or off campus to make this UMass Campus more resistant or resilient to significant man –made hazards?

Please elaborate:

7) What specific prevention or mitigation strategies do you think this UMass campus could do to minimize your level of vulnerability to man-made hazards?

What strategies have already been implemented?

8) Using your own institutional knowledge, are you aware of any losses or harm that have occurred due to various man-made hazards that may have occurred on your campus? Can you please provide detail?

9) Are some parts or key elements of the campus particularly vulnerable to intentional harms or losses, or is the entire campus?

10) Are some buildings particularly vulnerable to man-made damages? What are the uses and occupancies of the vulnerable buildings?

11) What buildings or areas on campus, in your opinion, are the most critical and potentially vulnerable to protecting the safety and security of the public and to the continuity of a high functioning campus (where is business continuity, emergency management, fire/life safety, medical facilities, information storage, utilities)?

12) Is any part of your critical infrastructure vulnerable to damages in terms of significant losses from any intentional hazards? How?

13) What would be the direct (replacement costs, etc.) and indirect (down time, etc.) impacts of a significant man-made hazard to this campus? How long do you think it would take to return to normal?

14) How will the University's core services and assets be impacted?

15) How will students be affected on and off campus?

16) Could the University be closed down for a significant period of time because of possible man-made disaster losses?

MITIGATION ACTIVITIES

Mitigation activities can generally be grouped into several categories including:

- **Public Education and Awareness** (information campaigns about how people can prepare and protect themselves during a natural disaster or man-made incident)
- **Emergency Services** (actions that protect people like police patrols, emergency communications, emergency notifications & alerts, evacuation planning, crime prevention, etc.)
- **Structural Projects** (upgrades that lessen the impact of a man-made hazards such as blast mitigation, asset compartmentalization, environmental designs (CPTED), etc.)
- **Environmental Protection** (employing natural strategies such as territoriality, access control, surveillance, activity support and maintenance of the built environment to influence human behavior)
- **Protection of Property** (modifying a building/property to protect it from a man-made hazard – site security, perimeter security, entry security, interior security)

Please ask each interviewee:

- How important are each of the above noted Mitigation Activities for your individual campus?

- To what extent has your campus already made strides in any of the above category areas? Please be specific.

Other

Any additional information that you would like to share/have available that would assist the project team during this effort?

APPENDIX D: HAZARD IDENTIFICATION & RISK ASSESSMENT MEETING MATERIALS

MEETING SIGN-IN SHEET – HAZARD IDENTIFICATION & RISK ASSESSMENT STAKEHOLDER MEETING

Project:	UMass – Multi-Campus Hazard Mitigation Plan	**Meeting Date:**	March 12, 2013
Facilitator:	Woodard & Curran	**Campus:**	UMass Boston

Name	Department or Organization	Title	Phone	E-Mail
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Mike McCarthy	Facilities	Deputy Dir Facilities	7-569	michael.mccarthy@umb.edu
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UMASS MULTI-CAMPUS HAZARD MITIGATION PLAN
HAZARD IDENTIFICATION & RISK ASSESSMENT WORKSHOP

UMASS BOSTON
MARCH 11, 2013

I. Overview of Potential Hazards

II. Summary of Interview Discussions

III. Hazard Ranking Methodology

IV. Group Workshop Hazard Ranking

V. Open Discussion/Questions and Comments

University of Massachusetts

MULTI-CAMPUS HAZARD MITIGATION PLAN

University of Massachusetts

Multi-Campus Hazard Mitigation Plan
Hazard Identification & Risk Assessment

March 11, 2013

COMMITMENT & INTEGRITY DRIVE RESULTS

Meeting Agenda

- Overview of Potential Hazards
- Summary of Interview Discussions
- Hazard Ranking Methodology
- Group Workshop Hazard Ranking
- Open Discussion

COMMITMENT & INTEGRITY DRIVE RESULTS

Overview

Project Goals

- Fulfill Federal, State, Local and University Hazard Mitigation Planning Requirements
- Promote the Safety of Students, Faculty, Staff and Visitors
- Minimize Hazard Impacts to Physical Assets and Operations
- Reduce or Avoid Long-Term Vulnerabilities from Hazards
- University Eligibility for Future Funding

Hazard Mitigation Planning Process – Step 2

Meeting Goal

To reach consensus on a ranked list of hazards (natural and human) that could impact UMass Boston

COMMITMENT & INTEGRITY DRIVE RESULTS

Items to Consider

- UMass Boston has been at Columbia Point since 1974 (bordered by Boston Harbor)
- Master Plan implementation involves significant transformative change and construction over the next 5-10 years
  - Future residence halls
  - Active construction on Integrated Sciences Complex
  - General Academic Building No. 1 will begin soon on site of former Bayside Expo Center
- Construction of the Edward Kennedy Institute next to presidential library and museum (not part of campus)
- Morrissey Boulevard experiences frequent, serious flooding that causes ingress/egress problems

Source: UMass Boston Website

Previous Related Study

- According to Campus Emergency Management Assessment **Report** – University of Massachusetts, Boston Campus (February 2009), greatest threats to campus are:
  - Major incident resulting from the deteriorated aging physical infrastructure and utilities
  - Lack of automatic sprinkler protection in the high-rise Healey Library. Such an event could significantly disrupt and potentially suspend the University's operations for an extended period of time
  - The campus supports a number of educational services for K – 12 students, and it also has a significant population of students with various disabilities

Hazard Identification – UMass Boston

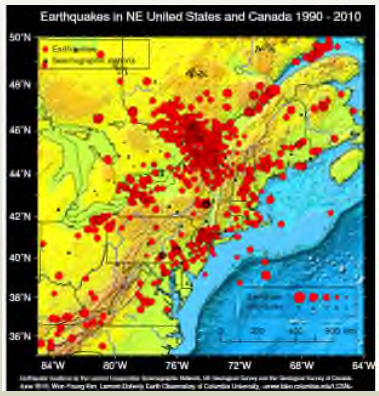
25 Year Master Plan – UMass Boston

25-Year Campus Master Plan

25-Year Campus Master Plan of building parcels and open space network for Urban Boston

Earthquakes

- Between 1924-1989 there have been 8 earthquakes in New England with a magnitude of 4.2 or greater.
- 30-40 earthquakes occur annually in New England – most are not felt
- Northeastern MA, especially along the coastline, has greater vulnerability to potential earthquake than the rest of the state
- UMass Boston CEMAR plan notes that campus could suffer from heavy damage in structurally compromised buildings
  - UMass Boston cancelled classes in 2011 after a small earthquake was felt



Source: USGS, Weston Observatory, Boston Globe

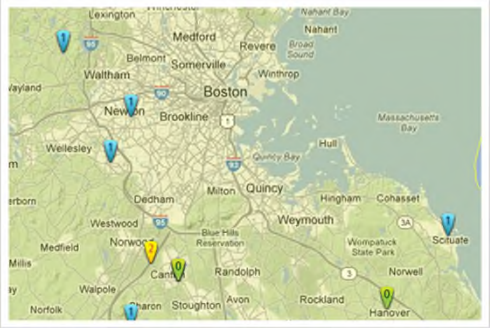
Hurricanes

MAP 2: CATEGORY 1-5 HURRICANES (1851-2010)

- Massachusetts has been impacted by a number of hurricanes of varying strengths
- State HMGP notes that the entire state of MA is susceptible to hurricanes with coastal areas vulnerable to wind damage and storm surge damage
- CEMAR for UMass Boston notes the campus is exposed to high winds and wave action from Boston Harbor. Past winds have produced moderate roof damage and a storm surge of 15-20 feet may be possible

Source: NOAA, CEMAR

Tornadoes – Suffolk County



- Average of 6 tornadoes per year touch down in New England
- No tornadoes in Suffolk County since 1951
- CEMAR noted that a tornado event is unlikely to strike UMass Boston. However, if there was a direct hit, there could be substantial damage to campus buildings and expose staff and students to flying debris

Source: http://www.tornadohistoryproject.com/

UMass Boston – Flood Maps

UMass Boston – Flood Maps

- Flooding is the most common hazard to impact New England
- During heavy rain storms, portions of the outer campus roadway become flooded and incoming utility feeds may be disrupted due to water infiltration
- Major UMass Boston campus flood vulnerabilities are at the campus entrances (Morrissey Boulevard and Mount Vernon Street) and the Bayside Expo property

Source: State HMGP, CEMAR, "Preparing for Rising Tide"

Other Natural Hazards

- **Coastal Erosion**
  - Regardless of the season, coastal storms typically cause erosion.
  - UMass Boston is a waterfront campus, portions of which are in the V Zone. Boston's waterfront areas are subject to repeated wave action and winds. These natural processes not only destabilize coastal structures, but also lead to shoreline change.
- **Winter/Ice Storms**
  - Entire state is at risk
  - From 1971 – 2009 there have been about 40 ice storm events
  - Potential consequences of winter storms include snow loading that may lead to roof damage/collapse and winds that may cause roof damage and related water infiltration to upper floors of buildings. In addition, there may be an inability of students, faculty and staff to evacuate the campus due to limited egress routes and a large commuter population.

Other Natural Hazards

- **Tsunami**
  - The state plan indicates that all of the coastal areas of Massachusetts are exposed to the threat of tsunamis. It is unknown what the probability is of a damaging tsunami along the MA coast.
  - The City of Boston Hazard Mitigation Plan also includes tsunami.
- **Related Area – Climate Change**
  - The City of Boston Hazard Mitigation Plan incorporates climate change not as a hazard, but as a related factor to consider while assessing hazards.

UMass Boston Crime Statistics

- The most frequent crime occurrences relevant to this project **on campus between 2008 - 2011**:
  - Burglary – 37
  - Motor Vehicle Theft – 1
  - Aggravated Assault – 8
  - Robbery -3

Source: UMass Boston Annual Security Reports 2011 and 2012 (covers 2008, 2009, 2010, 2011)

Hazard Identification – UMass Boston

- Coastal Erosion
- Coastal Storm
- Drought
- Earthquake
- Extreme Heat
- Flood
- Hailstorm
- Hurricane
- Winter Storm
- Thunder/Lightning
- Tornado
- Tsunami
- Urban Fire
- Windstorm

Sources: State of Massachusetts Hazard Mitigation Plan (2010); City of Boston Hazard Mitigation Plan (2008)

Summary of Interviews

Common Themes

- Fire – multiple buildings that are not sprinklered
- Significant construction activities on campus
- Hazards that could result in shut down of campus of highest concern; centralized utility plant and limited redundancies
- Dated infrastructure
- Potential challenges with campus evacuation
- Water intrusion common in many areas
- Open nature of campuses
- Urban environment
- Potentially distressed population on campus
- Large population of people with disabilities, K-12 visitors and dignitaries

Specific Events

- Flooding of Morrissey Boulevard and Bayside
- Roof damage from high winds to Healey (Hurricane Sandy), Quinn, Wheatley, Clark
- Two earthquakes in recent past
- Persistent water intrusion issues in specific buildings
- Occupy UMass Boston movement
- Public property crimes
- October 2012 bomb threat
- Historic lab explosion and utility plant explosion
- Access to closed areas on campus

Considerations

- Students occupying future residential dorms
- Potential single point failures – centralized utility plant, transformer room, substation, single water loop
- Potential methane emissions from landfill
- No swipe card system or employee IDs
- Road around campus known as “the Racetrack”
- Vulnerability of catwalks
- JFK Library possible terrorist target

Possible Mitigation Projects

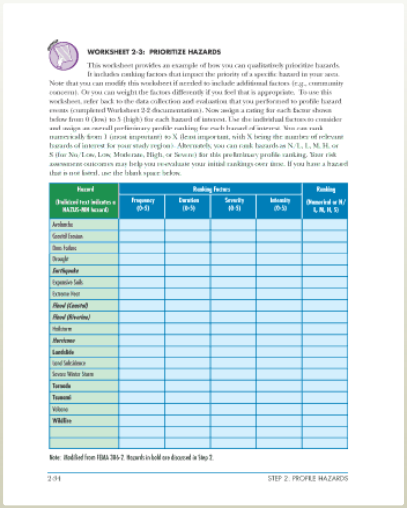
- Plans for sheltering in place
- Harborwalk stabilization
- Improve Healey roof
- Sprinkler system for Healey
- Expand emergency generator capacity
- Trigen
- Locate campus infrastructure on GIS
- Increase signage on campus
- Assessment of campus roofs
- Identify water soluble and water reactive chemicals
- Upgrade methane monitoring systems
- Employee ID system and swipe card system (technology to lock down campus)
- Increase security presence in buildings

Ranking Methodology

Hazard Ranking Methodology

- The primary objective of the upcoming campus meetings is to identify and prioritize risks.
- Hazards will be ranked on a scale of 0 (very low) to 5 (high) in the categories of frequency, severity, duration, and intensity.
- Values will be added for each profile item, so that each hazard will ultimately be given a “rank”.
- Weighting of probability vs. consequence

Hazard Ranking Worksheet



WORKSHEET 2-3: PRIORITIZE HAZARDS

This worksheet provides an example of how you can qualitatively prioritize hazards. It includes ranking factors that impact the priority of a specific hazard in your area. Note that you can modify this worksheet if needed to include additional factors (e.g., community concern). Or you can weight the factors differently if you feel that is appropriate. To use this worksheet, refer back to the data collection and evaluation that you performed to profile hazard events (completed Worksheet 2-2 documentation). Now assign a rating for each factor shown below from 0 (low) to 5 (high) for each hazard of interest. Use the individual factors to consider and assign an overall preliminary profile ranking for each hazard of interest. You can rank numerically from 1 (most important) to X (least important, with X being the number of relevant hazards of interest for your study region). Alternatively, you can rank hazards as N, L, L/M, M, H, or S (for No/Low, Low, Moderate, High, or Severe) for this preliminary profile ranking. Your risk assessment outcomes may help you re-evaluate your initial rankings over time. If you have a hazard that is not listed, use the blank space below.

Hazard (Italicized text indicates a HAZUS-MH hazard)	Ranking Factors				Ranking (Numerical or N, L, L/M, M, H, S)
	Frequency (0-5)	Duration (0-5)	Severity (0-5)	Intensity (0-5)	
Avalanche					
Coastal Erosion					
Dam Failure					
Drought					
Earthquake					
Expansive Soils					
Extreme Heat					
Flood (Coastal)					
Flood (Riverine)					
Hailstorm					
Hurricane					
Landslide					
Land Subsidence					
Severe Winter Storm					
Tornado					
Tsunami					
Volcano					
Wildfire					

Note: Modified from FEMA 386-2. Hazards in bold are discussed in Step 2.

2-34 STEP 2: PROFILE HAZARDS

COMMITMENT & INTEGRITY DRIVE RESULTS

Hazard Ranking Workshop (handout)

COMMITMENT & INTEGRITY DRIVE RESULTS

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MULTI-CAMPUS HAZARD MITIGATION PLAN

Thank You

Questions?

UMASS BOSTON

COMMITMENT & INTEGRITY DRIVE RESULTS

APPENDIX E: HAZARD MITIGATION GOALS, HAZARD PROFILES, LOSS ESTIMATES AND PROJECTS PRESENTATION AND MATERIALS

MEETING SIGN-IN SHEET – ALL-HAZARDS MITIGATION PLANNING TEAM MEETING

Project:	UMass Boston – Multi-Campus Hazard Mitigation Plan	**Meeting Date:**	June 12, 2013
Facilitator:	Woodard & Curran	**Campus:**	UMass Boston

Name	Title	Department or Organization	Phone	Email
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University of Massachusetts

MULTI-CAMPUS HAZARD MITIGATION PLAN

UMass Boston Hazard Mitigation Planning Team

Hazard Mitigation Goals, Hazard Profiles, Loss Estimates and Projects

June 12, 2013

COMMITMENT & INTEGRITY DRIVE RESULTS

Meeting Agenda

- Hazard Mitigation Goals and Objectives
- Hazard Event Profiles
- Building Ratings
- Loss Estimates
- Hazard Mitigation Projects
- Public Workshop
- Open Discussion

COMMITMENT & INTEGRITY DRIVE RESULTS

What Have We Done Thus Far and What are We Doing Now?

- Previously the project focus has been two fold:
  - (1) Stakeholder engagement
  - (2) Hazard identification & risk assessment
- This phase of the project builds on the previous and includes:
  - (1) Hazard event profiles
  - (2) Asset inventories and building ranking
  - (3) Hazard event loss estimates
  - (4) Goals and objectives
  - (5) Public meeting

Hazard Mitigation Goals & Objectives

Goals & Objectives

Goal 1	**Protect existing and future assets from known hazards by implementing mitigation projects to minimize potential losses and ensure public health and safety.**
Objective 1A	**Use appropriate techniques to mitigate against impacts from flooding in the Bayside, Morrissey Boulevard and Mount Vernon areas.**
Hazard Addressed:	Flooding
Potential Mitigation Projects	• Bayside Redevelopment project (drainage system installation, increase property elevation) • Improve stormwater removal and drainage lines in the Mount Vernon area. Modify storm water outfalls or add a pump house.
Objective 1B	**Use appropriate techniques to minimize coastal erosion on the outskirts of campus.**
Hazard Addressed:	Coastal Erosion
Potential Mitigation Projects	• Harborwalk Stabilization project (sewall installation and extension) • Beach nourishment, vegetation enhancements and tidal control structures in the Morrissey Blvd. area
Objective 1C	**Use appropriate techniques to mitigate against impacts from fires.**
Hazard Addressed:	Fire
Potential Mitigation Projects	• Install sprinkler system in Healey Library
Objective 1D	**Use appropriate techniques to mitigate against impacts from high wind events such as windstorms, hurricanes and tornadoes.**
Hazard Addressed:	Windstorm, Hurricanes, Tornadoes
Potential Mitigation Projects	• Prepare a formal plan for sheltering in place • Complete an assessment of campus roofs and water infiltration and mitigate high risk areas with roof replacements and water proofing • Examine building structural integrity and repair impacted areas

Goals & Objectives

Goal 2	**Maintain a continuity of campus business operations during and after a hazard event.**
Objective 2A	**Build redundancy in essential systems.**
Hazard Addressed:	All
Potential Mitigation Projects	• Evaluate and expand emergency generator capacity • Evaluate and implement tri-generation on campus
Objective 2B	**Protect critical infrastructure and information.**
Hazard Addressed:	All
Potential Mitigation Projects	• Ensure that all critical facilities have generators and other portable supporting infrastructure • Evaluate and upgrade the methane monitoring systems for buildings and other enclosed structures. • Conduct a vulnerability assessment of campus catwalks from structural failure. • Consolidate and eliminate hard copy storage of critical information (much of it is personnel related) that is on paper and easily accessible and convert to electronic.
Objective 2C	**Evaluate and enhance communication and education during hazard events to increase the understanding of impacts to campus.**
Hazard Addressed:	All
Potential Mitigation Projects	• Conduct training on UMass Ready business continuity software

Goals & Objectives

Goal 3	**Create and maintain a safe, secure environment for the campus population before, during and after a hazard event.**
Objective 3A	**Focus on the safety and mental health of the campus community.**
Hazard Addressed:	All
Potential Mitigation Projects	• Increase campus signage • Increase building security presence and protocols • Evaluate mental health on campus and create an outreach program • Evaluate and purchase technology to allow for a campus lockdown • Expand the employee ID system
Objective 3B	**Proactively conduct scenario planning activities.**
Hazard Addressed:	All
Potential Mitigation Projects	• Conduct annual active shooter training and drills

COMMITMENT & INTEGRITY DRIVE RESULTS

Goals & Objectives

Goal 4	**Communicate natural and human hazard information to the campus community and improve education and outreach efforts regarding their potential impact.**
Objective 4A	**Advise the community on health and safety precautions against potential hazards.**
Hazard Addressed:	All
Potential Mitigation Projects	• Develop and implement a hazards public education and outreach program • Incorporate hazard awareness into the web site and other social media. • Increase notification protocols for threatening employees.
Objective 4B	**Work collaboratively with the JFK Library, Archives and other external campus stakeholders on hazard mitigation.**
Hazard Addressed:	All
Potential Mitigation Projects	• Participate in municipal, regional and state hazard mitigation planning efforts • Have annual meetings with external campus stakeholders
Objective 4C	**Consider and obtain feedback from the campus population on hazard planning communications.**
Hazard Addressed:	All
Potential Mitigation Projects	• Conduct surveys or other outreach soliciting feedback from the community

COMMITMENT & INTEGRITY DRIVE RESULTS

Goals & Objectives

Goal 5	Proactively protect existing and future campus assets from known hazards by incorporating mitigation activities into capital improvement and infrastructure planning.
Objective 5A	**Monitor and track asset conditions.**
Hazard Addressed:	Windstorm, hurricane, tornadoes, winter storm, ice storm, fire, earthquake
Potential Mitigation Projects	• Map infrastructure assets and implement an asset management system
Objective 5B	**Maintain and retrofit campus assets to facilitate resilience during hazard events.**
Hazard Addressed:	Windstorm, hurricane, tornadoes, winter storm, ice storm, fire, earthquake
Potential Mitigation Projects	• Identify areas of water soluble and reactive chemicals • Upgrade the Salt Water Pump House which is used for cooling • Evaluate and upgrade Healey Library roof which is of concern during wind events.
Objective 5C	**Use appropriate measures to ensure new development will not increase hazard threats.**
Hazard Addressed:	Windstorm, hurricane, tornadoes, winter storm, ice storm, fire, earthquake
Potential Mitigation Projects	• Complete a hazard assessment on each new project • Ensure new buildings incorporate structural integrity and protection issues associated with top hazards
Objective 5D	**Consider natural and human hazard risks as new buildings and infrastructure is developed and redeveloped.**
Hazard Addressed:	All hazards
Potential Mitigation Projects	• Develop hazard planning around having student dormitories

Hazard Profiles, Risk Assessment & Loss Estimates

Natural Hazard Identification & Ranking

Natural Hazard	Hazard Ranking for UMass Boston*	Suggested Hazard Ranking Modification**
Hurricane	Severe	Severe
Urban Fire	High	Medium
Coastal Storm	High	High
Windstorm	High	Medium
Flood	High	High
Winter Storm	High	High
Tsunami	Medium	Low
Ice Storm	Medium	Medium
Earthquake	Medium	Medium
Thunderstorm/Lightning	Medium	Low
Coastal Erosion	Medium	Medium
Tornado	Medium	Low
Extreme Heat	Low	Low
Hailstorm	Low	Low
Drought	Low	Low

* Rankings as defined by UMass Team; **Non-Hazard Specific Ranking Based on Qualitative/Quantitative Analysis

Human Hazard Identification & Rankings

Man-Made Hazard	Hazard Ranking for UMass Boston*
Critical Infrastructure Failure	Severe
Failure of Building Materials	High
Civil Disturbance	High
Industrial Accident	High
Armed Attack/Active Shooter	High
Methane	Medium
Proximity to Flight Path	Medium
Arson	Medium
Violent Criminal Incident	Medium
Robbery/Burglary	Medium
Pandemic	Medium
Explosion	Medium
Cyberattack/Cyberterrorism	Medium
Proximity to Gas Tank at Commercial Point	Medium
Vandalism	Low
Bomb Threat	Low
HazMat Release	Low
Weapons of Mass Destruction	Low

COMMITMENT & INTEGRITY DRIVE RESULTS

Quantitative or Qualitative?

Natural Hazard	UMass Boston Susceptible?	Quantitative/Qualitative
Drought	Yes	Qualitative
Hailstorm	Yes	Qualitative
Extreme Heat	Yes	Qualitative
Thunderstorm/Lightning	Yes	Qualitative
Coastal Erosion	Yes	Qualitative
Tornado	Yes	Qualitative
Earthquake	**Yes**	**Quantitative**
Ice Storm	Yes	Qualitative
Tsunami	Yes	Qualitative
Windstorm	Yes	Qualitative
Flood	**Yes**	**Quantitative**
Winter Storm	Yes	Qualitative
Coastal Storm	Yes	Qualitative
Urban Fire	Yes	Qualitative
Hurricane	Yes	Qualitative
Human Hazards	Yes	Qualitative

Inventory of Assets

Existing Buildings	Date Construction Completed	Gross Square Feet
Campus Center	2004	330,000
Calf Pasture Pumping Station	1883	Unknown
Phillis Wheatley Hall	1973	268,551
Salt Water Pump House	1974	4,314
McCormack Hall	1975	266,060
Science Center	1974	297,952
Utility Plant	1974	27,886
Healey Library	1978	337,446
Quinn Administration	1973	96,897
Clark Athletic Center	1979	126,427
Service & Supply	1972	74,295
UMass Bayside	1968**	275,000
Total		**2,104,828**
Future Buildings/Projects		
Integrated Sciences Complex	Fall 2014	220,000
General Academic Building No. 1	Mid 2015	180,000

** Per online article review, UMass Bayside building was constructed in late 1960s – we utilized a date of 1968

COMMITMENT & INTEGRITY DRIVE RESULTS

Non-Hazard Specific Loss of Function Cost

Table: Loss of Function Cost UMass Boston

Existing Buildings	Date Construction Completed	Gross Square Feet	Building Criticality Value	Factored Square Footage	Building/Total Campus Square Footage	Per Day Loss of Function Cost	Estimated Hazard Specific Loss of Function Days	Loss of Function Cost Per Hazard
Campus Center	2004	330,000	3	990,000	0.470347221	$746,788	7	$5,227,514
Calf Pasture Pumping Station	1883	Unknown	1	N/A			7	
Phillis Wheatley Hall	1973	268,551	3	805,653	0.382764292	$607,729	7	$4,254,103
Salt Water Pump House	1974	4,314	4	17,256	0.008198295	$13,017	7	$91,117
McCormack Hall	1975	266,060	3	798,180	0.379213884	$602,092	7	$4,214,643
Science Center	1974	297,952	5	1,489,760	0.707782299	$1,123,772	7	$7,866,405
Utility Plant	1974	27,886	5	139,430	0.066242942	$105,176	7	$736,235
Healey Library	1978	337,446	4	1,349,784	0.641279953	$1,018,184	7	$7,127,287
Quinn Administration	1973	96,897	4	387,588	0.18414236 2	$292,370	7	$2,046,587
Clark Athletic Center	1979	126,427	5	632,135	0.300326202	$476,839	7	$3,337,873
Service & Supply	1972	74,295	4	297,180	0.141189684	$224,172	7	$1,569,205
UMass Bayside	1968**	275,000	3	825,000	0.391956017	$622,323	7	$4,356,261
Total		**2,104,828**						
Future Buildings/Projects								
Integrated Sciences Complex	Fall 2014	220,000	5	1,100,000	0.522608023	$829,764	7	$5,808,348.61
General Academic Building No. 1	Mid 2015	180,000	4	720,000	0.342070706	$543,118	7	$3,801,828.18
McCormack Hall Renovation	2014 - 2015	No Change	3	798,180	0.379213884	$602,092	7	$4,214,643.36
Wheatley Hall Renovation	2014 - 2015	No Change	3	805,653	0.382764292	$607,729	7	$4,254,103.17
Utility Corridor and Roadway Relocation	Spring 2013	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Harbor Walk Improvements and Shoreline Stabilization	In design phase	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Calculations & Assumptions:

- ** Per online article review, UMass Bayside building was constructed in late 1960s – we utilized a date of 1968
- **Building Gross Square Feet** - Information provided by UMass Boston
- **Building Criticality Value** – Buildings given a rank based on May 15, 2013 memorandum defining what characteristics pertain to each number value
- **Factored Square Footage** = Gross Square Feet * Building Criticality Value
- **Building/Total Campus Square Footage** = Factored Square Footage/Total Gross Square Feet
- **Per Day Loss of Function Cost** = Resulting square footage factor/daily operating budget of the college (derived from 2013 operating budget)
- **Estimated Hazard Specific Loss of Function Days** – Assumed to be 30 days for this calculation
- **Loss of Function Cost Per Hazard** - Per Day Loss of Function Cost/Estimated Hazard Loss of Function Days

Non-Hazard Specific Vulnerability Assessment

Table: UMass Boston Campus Buildings - Vulnerability Assessment

Existing Buildings	Insurable Replacement Value	Insurable Contents Value	Loss of Function Per Hazard	Total Damage	Building Vulnerability Ranking
Campus Center	$123,199,871	$184,799,807	$5,227,514	$313,227,191	High
Calf Pasture Pumping Station	Unknown	Unknown		Unknown	Low
Phillis Wheatley Hall	$92,382,713	$138,574,070	$4,254,103	$235,210,886	Med
Salt Water Pump House	$727,371	$1,091,057	$91,117	$1,909,545	Med
McCormack Hall	$97,035,922	$145,553,883	$4,214,643	$246,804,448	Med
Science Center	$102,512,053	$153,768,080	$7,866,405	$264,146,537	High
Utility Plant	$6,621,302	$9,931,953	$736,235	$17,289,490	Low
Healey Library	$108,128,176	$162,192,264	$7,127,287	$277,447,727	High
Quinn Administration	$31,620,278	$47,430,417	$2,046,587	$81,097,282	Med
Clark Athletic Center	$38,821,751	$58,232,627	$3,337,873	$100,392,251	Med
Service & Supply	$24,060,563	$36,090,845	$1,569,205	$61,720,612	Low
UMass Bayside Expo Center	$41,250,000	$61,875,000	$4,356,261	$107,481,261	Med

Note: Building Vulnerability Ranking is based on Replacement Value + Insurable Contents Value + Loss of Function Value

Calculations & Assumptions:

- **Insurable Replacement Value** – Provided by UMass Boston
- **Insurable Contents Value** – Insurable Replacement Value *150% (Contents Value as % of Building Replacement Value – FEMA 386-2)
- **Loss of Function Per Hazard** – See previous slide
- **Total Damage** – Insurable Replacement Value + Insurable Contents Value + Loss of Function Per Hazard
- **Building Vulnerability Ranking** – Anything over $250M got a "high"

Note: This is based on a Loss of Function where the building would be out of use for 7days.

Non-Hazard Specific Building Ranking Map

Non-Hazard Specific Damage Cost Per Square Foot

Table: Damage Cost Per Square Foot

Existing Buildings	Total Damage Cost	Gross Square Feet	Damage Cost Per Sq Ft
Campus Center	$313,227,191	330,000	949
Calf Pasture Pumping Station	Unknown	Unknown	Unknown
Phillis Wheatley Hall	$235,210,886	268,551	876
Salt Water Pump House	$1,909,545	4,314	443
McCormack Hall	$246,804,448	266,060	928
Science Center	$264,146,537	297,952	887
Utility Plant	$17,289,490	27,886	620
Healey Library	$277,447,727	337,446	822
Quinn Administration	$81,097,282	96,897	837
Clark Athletic Center	$100,392,251	126,427	794
Service & Supply	$61,720,612	74,295	831
UMass Bayside Expo Center	$107,481,261	275,000	391

Note: Total Damage/Gross Square Feet

Calculations & Assumptions:
•**Damage Cost Per Square Foot –** Total Damage Cost/Gross Square Feet

Note: This is based on a Loss of Function where the building would be out of use for 7 days.

Wind Hazard Events (Windstorm, Hurricane, Coastal Storm)

Hazard Profile & Risk Assessment
Windstorm

- A storm marked by consistent, high winds with little to no precipitation.
- Massachusetts is located in a Zone II which means it is susceptible to winds of up to 160mph and it is also located in a hurricane susceptible region.
- Massachusetts building regulations and standards require a basic wind speed design factor of 105 mph for the City of Boston.
- UMass Boston is certain to experience future hurricane events

Qualitative Hazard Ranking – HIGH

Suggested Ranking Modification - MEDIUM

COMMITMENT & INTEGRITY DRIVE RESULTS

Hazard Profile
Coastal Storm/Nor'Easter

- Common occurrence in Massachusetts.
- Can cause substantial damage to coastal (and at times, inland) areas due to strong winds (can be hurricane force), storm surge and substantial rainfall or snow amounts.
- Nor'Easter occurs when the wind blows in from the northeast and pushes the storm up the east coast of the United States.
- Repeatedly result in flooding, various degrees of wave and erosion damage to structures, and erosion of natural resources, such as beaches, dunes and coastal bluffs.
- Erosion of coastal features commonly results in greater potential for damage to shoreline development from future storms.

Photo: Morrissey Boulevard - John Hamman, November 2011

Risk Assessment
Coastal Storm

- One or two nor'easters typically impact the Massachusetts coastline per year between October and April.
- There have been two Presidential Disaster Declarations made for "coastal storms" in Massachusetts.
- At UMass Boston, there have been varying degrees of impacts from coastal storms and others felt on campus.
- The current 100-year storm surge is expected to overtop the HarborWalk and protective berm associated with UMass Boston. Sometime after 2050, annual coastal storms will likely overtop the HarborWalk as well.
- Concern over general isolation on campus.

Qualitative Hazard Ranking – HIGH

Suggested Ranking Modification – None

Hazard Profile
Hurricane

- Characterized by a constant speed of 74 mph or greater, wind blowing in spiral motion around an eye and an expansive reach (can be 100s of miles).
- Hurricanes can be short in duration or last for several days impacting numerous states, counties and towns along the coastline.
- Aftermath of a hurricane frequently causes additional damage due to lasting high winds, storm surge and flooding.
- Hurricanes are categorized by class in accordance with the Saffir-Simpson Hurricane Wind Scale and receive a number of 1-5.

Photo: Harbor Walk flooding near JFK building during Hurricane Sandy, Dorchester Reporter

COMMITMENT & INTEGRITY DRIVE RESULTS

Risk Assessment
Hurricane

- Between 1851-2010, there have been 10 direct hurricane hits to the Massachusetts coastline.
- Since 1954, there have been 6 Major Disaster Declarations in Massachusetts due to a hurricane or tropical storm - 4 have resulted in Suffolk County receiving a "designated area" status from FEMA.
- The 2009 Campus Emergency Management Assessment Report (CEMAR) for UMass Boston notes the campus is exposed to high winds and wave action from Boston Harbor. Past winds have produced moderate roof damage and a storm surge of 15-20 feet may be possible.
- Concern over general isolation on campus.
- UMass Boston closed on October 29, 2012 due to Hurricane Sandy.
- Campus is certain to experience future hurricane events.

Qualitative Hazard Ranking – SEVERE

Suggested Ranking Modification - None

COMMITMENT & INTEGRITY DRIVE RESULTS

Winter Storm

Hazard Profile – Winter Storm

- Consist of varying forms of precipitation including snow, sleet, freezing rain or a mix of these wintry conditions
- Blizzards are the most dangerous and severe type of winter storm and are characterized by strong, sustained winds of at least 35 mph that last for a prolonged period of time – typically 3 hours or more
- An ice storm is another form of winter storm that is defined as an event which results in the accumulation of at least .25-inch of ice on exposed surfaces
- Significant winter storm events in the past include:
  - **February 8, 2013** – Historic winter storm deposited almost 25" of snow in Boston between February 8-9, 2013 (the 5th highest total in Boston history). Along the coastline, storm surge reached 3-4 feet.
  - **February 1, 2011** - A series of significant heavy snow events occurred between December 26, 2010 and February 2, 2011. Snow for the winter season totaled 86.4 inches, most of which fell during this period.
  - **January 1, 2011** - Fourteen to nineteen inches of snow fell across Suffolk County. Strong winds combined with the heavy snow resulting in numerous trees and limbs downed in Boston and Chelsea.

COMMITMENT & INTEGRITY DRIVE RESULTS

Risk Assessment – Winter Storm

- Since 1954, there have been 6 Major Disaster Declarations in Massachusetts due to some form of winter storm and 3 of those have resulted in Suffolk County receiving a "designated area" status from FEMA.
- At UMass Boston, there have been several winter storm impacts and there are some general concerns including access off campus due to the student commuter population, student shuttling from Bayside during inclement weather and weight of snow on roofs.
- UMass Boston concerns include access off campus, student shuttling from Bayside (lot of movement back and forth) and weight of snow on roofs.
- UMass Boston is certain to experience future winter storm events.

Qualitative Hazard Ranking – HIGH

Suggested Ranking Modification - NONE

Urban Fire

Hazard Profile & Risk Assessment
Urban Fire

- An uncontrolled fire in an urban area affecting residential or commercial properties, which due to the dense nature of some areas, age of buildings and construction material of the buildings can spread quickly.
- There were no recorded instances of arson on campus between 2008 – 2011
- On campus, a fire in Healey was of concern (lack of sprinkler system, evacuation issues, change in building use over time to include classrooms, computer labs)
- Potential single point failure at Salt Water Pump House
- Special considerations for evacuation include large population of people with disabilities and k-12 populations

Risk Assessment
Urban Fire

- Since 1954, there has been 1 Major Disaster Declarations in Massachusetts for an Urban Fire. The Urban Fire instance was located in Essex County and did not impact Suffolk County (or Boston) directly.
- Fire in Healey of concern due to evacuation issues, rare collections, change in building use over time to include classrooms, computer labs, and a lack of sprinkler system.
- Students will be living on campus in the future with new residential dorms, so fire potential will increase.
- UMass Boston closed campus 4/16/2013 as JFK Library fire was investigated
- UMass Boston is likely to experience future fire events.

Qualitative Hazard Ranking – HIGH

Suggested Ranking Modification - MEDIUM

Fire Hazard
Building Ranking Map

Flood

Hazard Profile - Flood

- A flood is when there is a high flow or inundation of water that submerges land which is normally dry and causes or threatens damage
- Flooding is the most common hazard to affect New England and can result from coastal storms/nor'easters, hurricanes, winter storms, thunder/lightning storms and hailstorms
- Past Flooding Events
  - October 29, 2012 – Sandy, a hybrid storm with tropical and extra-tropical characteristics brought high winds and coastal flooding to southern New England. **In Boston, minor coastal flooding closed the ramp for Morrissey Boulevard off of Interstate 93 and occurred at Columbia Point over the Harborwalk.**
  - December 27, 2010 – Moderate to major coastal flooding affected the eastern Massachusetts coast during early morning high tide. **A portion of Morrissey Boulevard near UMass Boston was closed.**
  - July 10, 2010 – Two to four inches of rain fell within an hour's time and produced significant urban flash flooding in and around the city of Boston.
  - March 14, 2010 – Stacked low pressure system resulted in widespread rainfall totals of three to six inches. Heavy rains resulted in flooding across much of Boston.
  - March 5, 2001 – Major winter storm impacted the Bay state with near blizzard conditions, high winds, and coastal flooding.

Risk Assessment - Flood

- At UMass Boston, there have been a varying degree of impacts from coastal storms and associated flooding felt on campus
  - Vulnerable area is campus entrances on Morrissey Boulevard and Mt. Vernon Street, and flooding of the Bayside Expo property (purchased in 2010)
  - Morrissey Boulevard and Mt. Vernon Street flooding during coastal storm events has caused disruption for ingress and egress to the campus in the past
  - Section of the Harbor Walk around the JFK Library has flooded out
  - Water intrusion in the Healey Library has occurred in the past
- UMass Boston is certain to experience future flooding events

Quantitative & Qualitative Hazard Ranking – HIGH

Suggested Ranking Modification - NONE

Flood Hazard
What Will Be Affected by the Hazard?

COMMITMENT & INTEGRITY DRIVE RESULTS

What Will Be Affected?

What will be affected by the Hazard Event?		FLOOD								
		Number of Structures			Value of Structures			Number of People		
	Gross Square Feet	# on Campus	# in Hazard Area	% in Hazard Area	$ on Campus	$ in Hazard Area	% in Hazard Area	# on Campus	# in Hazard Area	% in Hazard Area
Campus Center	**330,000**	**1**	**1**	**10%**	**$123,199,871**	**$12,319,987**	**10%**	**2,000**	**200**	**10%**
Calf Pasture Pumping Station	N/A	1	0	0%	$0	0	0	0	0	0%
Phillis Wheatley Hall	268,551	1	0	0%	$92,382,713	0	0	2,600	0	0%
Salt Water Pump House	**4,314**	**1**	**1**	**20%**	**$727,371**	**$145,474**	**20%**	**14**	**0**	**0%**
McCormack Hall	266,060	1	0	0%	$97,035,922	0	0	2,000	0	0%
Science Center	297,952	1	0	0%	$102,512,053	0	0	1,000	0	0%
Utility Plant	27,886	1	0	0%	$6,621,302	0	0	93	0	0%
Healey Library	337,446	1	0	0%	$108,128,176	0	0	1,500	0	0%
Quinn Administration	96,897	1	0	0%	$31,620,278	0	0	400	0	0%
Clark Athletic Center	126,427	1	0	0%	$38,821,751	0	0	5,600	0	0%
Service & Supply	74,295	1	0	0%	$24,060,563	0	0	100	0	0%
UMass Bayside Expo Center	**275,000**	**1**	**1**	**100%**	**$41,250,000**	**$41,250,000**	**100%**	**39,286**	**39,286**	**100%**

Source: International Building Code Used to Calculate # of People on Campus Per Building in Accordance with IBC Building Type Categories for the UMass Bayside Expo Center Building. All other capacity #s were provided by UMass Boston.

Calculations & Assumptions:
- **% in the Hazard Area –** Estimated by Project Team Based on Flood Map
- **Number of People on Campus** – International Building Code (IBC) Used to Calculate # of People on Campus Per Building in Accordance with IBC Building Type Categories for the UMass Bayside Expo Center Building. All other capacity #s were provided by UMass Boston.

COMMITMENT & INTEGRITY DRIVE RESULTS

What Will Be Affected?

What will be affected by the Hazard Event?							FLOOD					
Name of Asset	Sources of Information	Critical Facilities	Emergency Operations	Communications Systems	Data Systems	Laboratories	Size of Building (sq. ft.)	Replacement Value ($)	Contents Value ($)	Function or Use Value ($)	Displacement Cost ($ per day)	Occupancy or Capacity (#)
Campus Center		X	X				**330,000**	**$123,199,871**	**$184,799,807**	**$22,403,630**	**$746,788**	**2,000**
Calf Pasture Pumping Station							Unknown	Unknown	Unknown	Unknown	Unknown	0
Phillis Wheatley Hall							268,551	$92,382,713	$138,574,070	$18,231,871	$607,729	2,600
Salt Water Pump House		X					4,314	$727,371	$1,091,057	$390,502	$13,017	14
McCormack Hall						X	266,060	$97,035,922	$145,553,883	$18,062,757	$602,092	2,000
Science Center		X				X	297,952	$102,512,053	$153,768,080	$33,713,164	$1,123,772	1,000
Utility Plant		X					27,886	$6,621,302	$9,931,953	$3,155,291	$105,176	93
Healey Library		X					337,446	$108,128,176	$162,192,264	$30,545,517	$1,018,184	1,500
Quinn Administration			X	X			96,897	$31,620,278	$47,430,417	$6,578,317	$219,277	400
Clark Athletic Center		X					126,427	$38,821,751	$58,232,627	$14,305,171	$476,839	5,600
Service & Supply		X	X				74,295	$24,060,563	$36,090,845	$6,725,162	$224,172	100
UMass Bayside Expo Center							**275,000**	**$41,250,000**	**$61,875,000**	**$18,669,692**	**$622,323**	**39,286**

How Will the Hazard Affect Campus?

Table: Structure Loss - FLOOD

	Insurable Replacement Value $	x	Percent Damage (%)	=	Loss to Structure ($)
Campus Center	**$123,199,871**	x	**10%**	=	**$12,319,987**
Calf Pasture Pumping Station	Unknown	x	0%	=	$0
Phillis Wheatley Hall	$92,382,713	x	0%	=	$0
Salt Water Pump House	**$727,371**	x	**20%**	=	**$145,474**
McCormack Hall	$97,035,922	x	0%	=	$0
Science Center	$102,512,053	x	0%	=	$0
Utility Plant	$6,621,302	x	0%	=	$0
Healey Library	$108,128,176	x	0%	=	$0
Quinn Administration	$31,620,278	x	0%	=	$0
Clark Athletic Center	$38,821,751	x	0%	=	$0
Service & Supply	$24,060,563	x	0%	=	$0
UMass Bayside Expo Center	**$41,250,000**	x	**100%**	=	**$41,250,000**

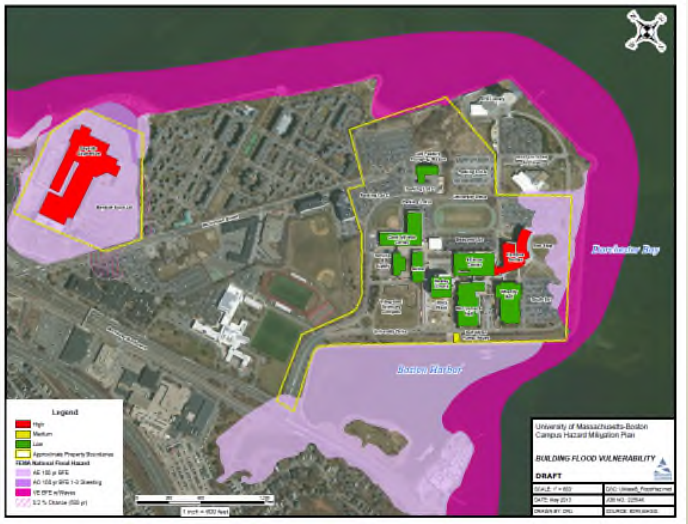
Table: Contents Loss - FLOOD

	Replacement Value of Contents ($)	x	Percent Damage (%)	=	Loss to Contents ($)
Campus Center	**$184,799,807**	x	**10%**	=	**$18,479,981**
Calf Pasture Pumping Station	Unknown	x	0%	=	$0
Phillis Wheatley Hall	$138,574,070	x	0%	=	$0
Salt Water Pump House	**$1,091,057**	x	**20%**	=	**$218,211**
McCormack Hall	$145,553,883	x	0%	=	$0
Science Center	$153,768,080	x	0%	=	$0
Utility Plant	$9,931,953	x	0%	=	$0
Healey Library	$162,192,264	x	0%	=	$0
Quinn Administration	$47,430,417	x	0%	=	$0
Clark Athletic Center	$58,232,627	x	0%	=	$0
Service & Supply	$36,090,845	x	0%	=	$0
UMass Bayside Expo Center	**$61,875,000**	x	**100%**	=	**$18,562,500**

Table: Structure use and Function Loss & Total Loss for Hazard Event

	Average Daily Operating Budget	x	Functional Downtime (# of Days)	+	Displacement Cost Per Day ($)	x	Displacement Time	=	Structure Use and Function Loss		Structure Loss + Content Loss + Function Loss
Campus Center	**$746,788**	x	**7**	+	**$3,287.67**	x	**7**	=	**$5,250,527.45**		**$36,050,495.20**
Calf Pasture Pumping Station	Unknown	x	N/A	+	N/A	x	N/A	=	N/A		N/A
Phillis Wheatley Hall	$607,729	x	N/A	+	N/A	x	N/A	=	N/A		N/A
Salt Water Pump House	**$13,017**	x	**7**	+	**$13,017**	x	**7**	=	**$182,234.30**		**$545,919.80**
McCormack Hall	$602,092	x	N/A	+	N/A	x	N/A	=	N/A		N/A
Science Center	$1,123,772	x	N/A	+	N/A	x	N/A	=	N/A		N/A
Utility Plant	$105,176	x	N/A	+	N/A	x	N/A	=	N/A		N/A
Healey Library	$1,018,184	x	N/A	+	N/A	x	N/A	=	N/A		N/A
Quinn Administration	$292,370	x	N/A	+	N/A	x	N/A	=	N/A		N/A
Clark Athletic Center	$476,839	x	N/A	+	N/A	x	N/A	=	N/A		N/A
Service & Supply	$224,172	x	N/A	+	N/A	x	N/A	=	N/A		N/A
UMass Bayside Expo Center	**$622,323**	x	**7**	+	**$821.92**	x	**7**	=	**$4,362,014.88**		**$64,174,514.88**
											TOTAL LOSS for HAZARD EVENT

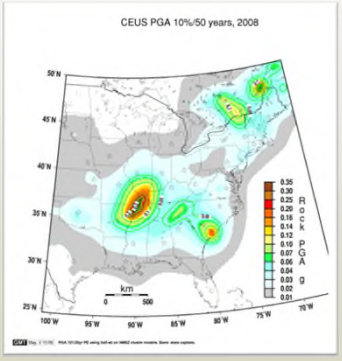
Building Ranking Map



Earthquake

Hazard Profile - Earthquake

- An earthquake is the result of a release of energy (which can be observed by shifting and fracturing of rock materials beneath the surface) in the Earth's crust that creates seismic activity.
- Seismic activity is defined by the frequency, type and size of earthquakes that occur.
- The last major earthquake to affect Massachusetts was more than 200 years ago in 1755 with an estimated magnitude of about 6.0 to 6.25. The epicenter was probably located off the coast of Cape Ann, north of Boston.
- The earthquake hazard possibility is on the lower end of the spectrum in Massachusetts compared to other areas of the country.



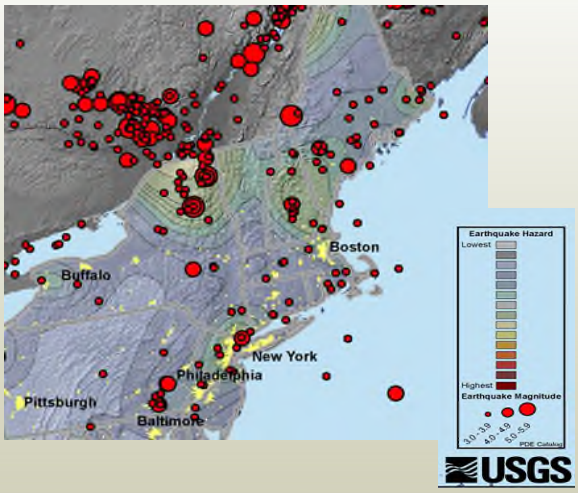
Risk Assessment - Earthquake

- The Massachusetts coastline from the northern portion of Plymouth County through the Boston Metropolitan area to the New Hampshire border, has greater vulnerability to potential earthquake activity than the rest of the state.
- There has never been a Presidential Disaster Declaration made for an earthquake in Massachusetts.
- At UMass Boston, there have been several instances in the recent past where a minor earthquake has impacted the campus.
- In August 2011, UMass Boston cancelled classes and on-campus events after an early afternoon earthquake that caused tremors in Boston. Public safety services on campus evacuated students and faculty as a precaution.
- There is concern about structural integrity in the plaza area – the facilities department has conducted studies with seismographic data and photographic surveys that have shown low potential for impact.

Qualitative Hazard Ranking – MEDIUM

Suggested Ranking Modification - NONE

Earthquake Hazard
What Will Be Affected by the Hazard?



Earthquake Hazard
Building Ranking Map

Earthquake Hazard
What Will Be Affected?

Table: UMass Boston Campus Buildings - Estimated Loss to Structure & Contents Due to Earthquake

Existing Buildings	Year Constructed	Insurable Replacement Value	PGA Zone	Building Damage Ratio (%)	Estimated Building Damage Sustained ($)	Contents Damage Ratio (%)	Estimated Contents Damage Sustained ($)	Loss of Function (Days)
Campus Center	2004	$123,199,871	0.05	0.0%	$0.0	0.00%	$0.00	0
Calf Pasture Pumping Station	1883	Unknown	0.05	0.2%	Unknown	0.10%	Unknown	1
Phillis Wheatley Hall	1973	$92,382,713	0.05	0.1%	$92,382.71	0.05%	$46,191.36	0
Salt Water Pump House	1974	$727,371	0.05	0.1%	$727.37	0.05%	$363.69	0
McCormack Hall	1975	$97,035,922	0.05	0.0%	$0.0	0.00%	$0.00	0
Science Center	1974	$102,512,053	0.05	0.1%	$102,512.05	0.05%	$51,256.03	0
Utility Plant	1974	$6,621,302	0.05	0.1%	$6,621.30	0.05%	$3,310.65	0
Healey Library	1978	$108,128,176	0.05	0.0%	$0.0	0.00%	$0.00	0
Quinn Administration	1973	$31,620,278	0.05	0.1%	$31,620.28	0.05%	$15,810.14	0
Clark Athletic Center	1979	$38,821,751	0.05	0.0%	$0.0	0.00%	$0.00	0
Service & Supply	1972	$24,060,563	0.05	0.1%	$24,060.56	0.05%	$12,030.28	0
UMass Bayside Expo Center	1968**	$41,250,000	0.05	0.2%	$82,500.0	0.10%	$41,250.00	1

Note: Utilized FEMA 386-2. loss estimation tables by category did not include an educational institution, so for the purposes of this analysis, we utilized the Professional Office category. Once the category was selected, we utilized a PGA value of .05 to select the appropriate building damage ratio % and loss of function days.

Calculations & Assumptions:
- **Insurable Replacement Value –** Insurable replacement value provided by UMass Boston
- **PGA Zone –** Determined from 386-2 Loss Estimation Table
- **Building Damage Ratio** - Building Damage Ratio is based on FEMA formula for Repair Cost/Replacement Value
- **Estimated Building Damage Sustained ($)** - Insurable Replacement Value*Building Damage Ratio
- **Contents Damage Ratio** - Percent Contents damage is one half of the percent structural damage.
- **Estimated Contents Damage Sustained ($)** - $$ Contents damage is one half of the percent structural damage.
- **Loss of Function (Days) –** Determined from 386-2 Loss Estimation Table

Human Hazards

Hazard Profiles – Receiving Severe and High Rankings

- Critical Infrastructure Failure - Severe
- Armed Attack/Active Shooter - High
- Industrial Accident - High
- Failure of Building Materials/Building Deterioration – High

Note: Rankings that were "high" or "severe" as defined by UMass Team

Revisit Hazard Mitigation Goals & Objectives

Mitigation Projects…

- If you want to apply for future MEMA/FEMA hazard mitigation project funding, the project **MUST** be identified in the hazard mitigation plan
- Mitigation project must be tied to a goal, objective and hazard

Goals & Objectives

Goal 1	**Protect existing and future assets from known hazards by implementing mitigation projects to minimize potential losses and ensure public health and safety.**
Objective 1A	**Use appropriate techniques to mitigate against impacts from flooding in the Bayside, Morrissey Boulevard and Mount Vernon areas.**
Hazard Addressed:	Flooding
Potential Mitigation Projects	• Bayside Redevelopment project (drainage system installation, increase property elevation) • Improve stormwater removal and drainage lines in the Mount Vernon area. Modify storm water outfalls or add a pump house.
Objective 1B	**Use appropriate techniques to minimize coastal erosion on the outskirts of campus.**
Hazard Addressed:	Coastal Erosion
Potential Mitigation Projects	• Harborwalk Stabilization project (sewall installation and extension) • Beach nourishment, vegetation enhancements and tidal control structures in the Morrissey Blvd. area
Objective 1C	**Use appropriate techniques to mitigate against impacts from fires.**
Hazard Addressed:	Fire
Potential Mitigation Projects	• Install sprinkler system in Healey Library
Objective 1D	**Use appropriate techniques to mitigate against impacts from high wind events such as windstorms, hurricanes and tornadoes.**
Hazard Addressed:	Windstorm, Hurricanes, Tornadoes
Potential Mitigation Projects	• Prepare a formal plan for sheltering in place • Complete an assessment of campus roofs and water infiltration and mitigate high risk areas with roof replacements and water proofing • Examine building structural integrity and repair impacted areas

COMMITMENT & INTEGRITY DRIVE RESULTS

Goals & Objectives

Goal 2	Maintain a continuity of campus business operations during and after a hazard event.
Objective 2A	**Build redundancy in essential systems.**
Hazard Addressed:	All
Potential Mitigation Projects	• Evaluate and expand emergency generator capacity • Evaluate and implement tri-generation on campus
Objective 2B	**Protect critical infrastructure.**
Hazard Addressed:	All
Potential Mitigation Projects	• Ensure that all critical facilities have generators and other portable supporting infrastructure • Upgrade the methane monitoring systems • Conduct a vulnerability assessment of campus catwalks from structural failure.
Objective 2C	**Evaluate and enhance communication and education during hazard events to increase the understanding of impacts to campus.**
Hazard Addressed:	All
Potential Mitigation Projects	• Conduct training on UMass Ready business continuity software

Goals & Objectives

Goal 3	Create and maintain a safe, secure environment for the campus population before, during and after a hazard event.
Objective 3A	**Focus on the safety and mental health of the campus community.**
Hazard Addressed:	All
Potential Mitigation Projects	• Increase campus signage • Increase building security presence and protocols • Evaluate mental health on campus and create an outreach program • Evaluate and purchase technology to allow for a campus lockdown • Expand the employee ID system
Objective 3B	**Proactively conduct scenario planning activities.**
Hazard Addressed:	All
Potential Mitigation Projects	• Conduct annual active shooter training and drills

Goals & Objectives

Goal 4	**Communicate natural and human hazard information to the campus community and improve education and outreach efforts regarding their potential impact.**
Objective 4A	**Advise the community on health and safety precautions against potential hazards.**
Hazard Addressed:	All
Potential Mitigation Projects	• Develop and implement a hazards public education and outreach program • Incorporate hazard awareness into the web site and other social media. • Increase notification protocols for threatening employees.
Objective 4B	**Work collaboratively with the JFK Library, Archives and other external campus stakeholders on hazard mitigation.**
Hazard Addressed:	All
Potential Mitigation Projects	• Participate in municipal, regional and state hazard mitigation planning efforts • Have annual meetings with external campus stakeholders
Objective 4C	**Consider and obtain feedback from the campus population on hazard planning communications.**
Hazard Addressed:	All
Potential Mitigation Projects	• Conduct surveys or other outreach soliciting feedback from the community

Goals & Objectives

Goal 5	**Proactively protect existing and future campus assets from known hazards by incorporating mitigation activities into capital improvement and infrastructure planning.**
Objective 5A	**Monitor and track asset conditions.**
Hazard Addressed:	Windstorm, hurricane, tornadoes, winter storm, ice storm, fire, earthquake
Potential Mitigation Projects	• Map infrastructure assets and implement an asset management system
Objective 5B	**Maintain and retrofit campus assets to facilitate resilience during hazard events.**
Hazard Addressed:	Windstorm, hurricane, tornadoes, winter storm, ice storm, fire, earthquake
Potential Mitigation Projects	• Identify areas of water soluble and reactive chemicals
Objective 5C	**Use appropriate measures to ensure new development will not increase hazard threats.**
Hazard Addressed:	Windstorm, hurricane, tornadoes, winter storm, ice storm, fire, earthquake
Potential Mitigation Projects	• Complete a hazard assessment on each new project • Ensure new buildings incorporate structural integrity and protection issues associated with top hazards
Objective 5D	**Consider natural and human hazard risks as new buildings and infrastructure is developed and redeveloped.**
Hazard Addressed:	All hazards
Potential Mitigation Projects	• Develop hazard planning around having student dormitories

First Public Workshop

Public Workshops

- Need to have two public workshops to meet FEMA & MEMA requirements
  - First Public Workshop:
    - Later today
    - Focus on the process not the details
    - Open house style format
  - Second Public Workshop:
    - Late summer/early fall
    - Focus on the details and mitigation projects
    - Completed during draft report review

COMMITMENT & INTEGRITY DRIVE RESULTS

Next Steps

Hazard Mitigation Plan Next Steps

- Make sure all mitigation projects are identified
  - Have one on one meetings with facilities, emergency management, IT
- Campus to review hazard event profiles, building rankings and loss estimates
- Finish writing the draft plan
- Present draft plan in late summer/early fall
- Grant applications for current MEMA HMGP funding round due in August 2013 – need to identify project to submit

WOODARD &CURRAN

University of Massachusetts

MULTI-CAMPUS HAZARD MITIGATION PLAN

Thank You

Questions?

UMASS BOSTON

COMMITMENT & INTEGRITY DRIVE RESULTS

APPENDIX F: PUBLIC MEETING NO. 1 – MEETING MATERIALS

MEETING SIGN-IN SHEET – ALL-HAZARDS MITIGATION PLAN PUBLIC FORUM

Project:	UMass Boston – Multi-Campus Hazard Mitigation Plan	**Meeting Date:**	June 12, 2013
Facilitator:	Woodard & Curran	**Campus:**	UMass Boston

Name	Address	Phone	Email	Group Represented *(Self or Organization's Name)*
Alex Gill	400 Worcester Rd. Framingham	508-820-1406	Alex.gill@state.ma.us	MEMA
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Shawn Carey	" "	617-287-5680		UMB
Dorothy F. Reardon	" "			UMB

University of Massachusetts

MULTI-CAMPUS HAZARD MITIGATION PLAN

UMass Boston

Hazard Mitigation Planning Process

June 12, 2013

COMMITMENT & INTEGRITY DRIVE RESULTS

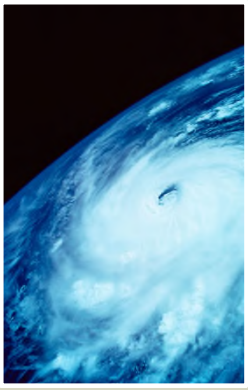
Public Engagement

- Why are We Having this Workshop?
  - Public Engagement of both on and off campus stakeholders is a critical component of hazard mitigation planning
- What do We Want from You?
  - Your questions, thoughts, ideas, suggestions on how to make this the best possible plan to:
    - (1) assist the University in identifying and reducing its risk from natural and human-caused hazards; and
    - (2) identify actions that can be taken to prevent damage to property and loss of life

COMMITMENT & INTEGRITY DRIVE RESULTS

Project Background

- The Disaster Mitigation Act was signed by the President in October 2000.
  - Incentive for states and local governments to undertake natural hazard mitigation planning.
  - Promotes sustainability as a strategy for disaster resistance.
  - Encourages state and local governments to work together, and facilitates cooperation between state and local authorities.
  - Results in faster allocation of funding and more effective risk reduction projects.
  - Colleges and Universities can plan in concert with similar planning efforts in their community.



COMMITMENT & INTEGRITY DRIVE RESULTS

Project Background

- The University of Massachusetts Boston received a grant from FEMA/MEMA to develop hazard mitigation plan
- Plan will help identify cost effective mitigation measures to reduce or eliminate long-term risk to life and property from hazards
- Allow the University to be eligible to receive non-emergency disaster assistance, including state and federal funding for mitigation and recovery projects
- Projects must be pre-identified in the hazard mitigation plans to receive future funding

COMMITMENT & INTEGRITY DRIVE RESULTS

Benefits of Hazard Mitigation Planning

- Campus benefits from Mitigation Planning by:
  - Identifying cost effective actions for risk reduction that are agreed upon by stakeholders
  - Focusing resources on the greatest risks and vulnerabilities
  - Building partnerships by involving the campus community, organizations, local government and businesses
  - Increasing education and awareness of hazards and risk
  - Communicating priorities to local, state and federal officials
  - Aligning risk reduction with other University objectives

Project Goals

- Fulfill Federal, State, Local and University Hazard Mitigation Planning Requirements
- Promote the Safety of Students, Faculty, Staff and Visitors
- Minimize Hazard Impacts to Physical Assets and Operations
- Reduce or Avoid Long-Term Vulnerabilities from Hazards
- University Eligibility for Future Funding

Hazard Mitigation Overview

- Hazard mitigation is defined as "any action taken to reduce or eliminate the long-term risk to human life and property from natural [and/or manmade] hazards."
- Hazard mitigation activities may be implemented prior to, during, or after an event; however, it is most effective when based on an inclusive, comprehensive, long-term plan that is developed before a disaster occurs.
- Hazard mitigation is often focused on reducing repetitive loss, as many damaging events tend to occur in the same locations over time (e.g. flooding).

COMMITMENT & INTEGRITY DRIVE RESULTS

Hazard Mitigation Planning Process

- The UMass planning process closely follows FEMA's recommended four-stage approach.
- Initial and ongoing community support is critical to the planning process.

COMMITMENT & INTEGRITY DRIVE RESULTS

Phase 1 – Organize Resources

- Identify the resources available and necessary to complete the process:
  - Assess community support
  - Build the planning team
    - Identify and organize interested members of the community (stakeholders – on and off campus)
    - Identify the necessary technical expertise
  - Establish a steering committee
    - Develop a mission statement
    - Hold a project kick-off meeting
    - Establish a meeting schedule and goals
    - Engage the public

Phase 2 – Assess Risk

- Identify the hazards that present risks to the campus and the assets that are vulnerable to those hazards.
  - Gather historical information, review existing university plans/reports, communicate with local planning experts, MEMA and FEMA.
  - Determine which hazards present the greatest risk to the campus community
    - Assess vulnerability
    - Create a base map to profile potential hazard events
  - Inventory campus assets
    - Show how hazard events could impact campus (physically and operationally)
    - Estimate losses

Phase 3 – Develop the Mitigation Plan

- Lay out in detail the proposed mitigation actions:
  - Establish priorities
    - Compare university mission with the results of the hazard identification and risk assessment
  - Develop hazard mitigation goals
    - Minimize interruption to campus operations and mission
    - Protect research
  - Determine appropriate mitigation actions
  - Prioritize mitigations actions
  - Prepare an implementation strategy

Phase 4 – Implement the Plan and Monitor Progress

- Formally adopt the Hazard Mitigation Plan
- Implement mitigation measures
- Monitor, evaluate and update the plan as needed
- Continue to engage stakeholders from the campus and community

Massachusetts Disaster Declarations Since 2010

Date	Description
4/19/13	Severe winter storm, snowstorm & flooding
4/17/13	Explosions
12/19/12, 10/28/12	Hurricane Sandy
1/6/12	Severe storm & snowstorm
11/1/11	Severe storm
9/3/11	Tropical storm Irene
8/26/11	Hurricane Irene
6/15/11	Severe storms & tornadoes
3/7/11	Severe winter storm & snowstorm
9/2/10	Hurricane Earl
5/3/10	Water main break
3/29/10	Severe storm & flooding

Examples of Types of Hazards (Natural and Human)

- Earthquake
- High winds
- Hurricane
- Fire
- Floods
- Extreme cold/heat
- Winter storm
- Hailstorm
- Lightning
- Tornado
- Terrorism
- Civil Disturbance
- Robbery, vandalism, theft
- Power or IT Interruption
- All hazards – generators, computer backups, additional contingency planning

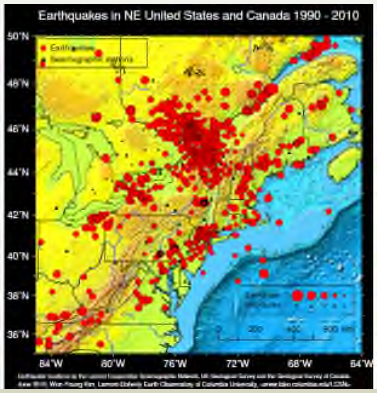



UMass Boston

COMMITMENT & INTEGRITY DRIVE RESULTS

Earthquakes

- Between 1924-1989 there have been 8 earthquakes in New England with a magnitude of 4.2 or greater.
- 30-40 earthquakes occur annually in New England – most are not felt
- Northeastern MA, especially along the coastline, has greater vulnerability to potential earthquake than the rest of the state



Source: USGS, Weston Observatory, Boston Globe

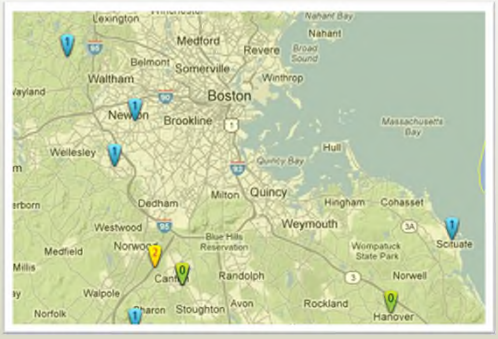
COMMITMENT & INTEGRITY DRIVE RESULTS

Hurricanes

- Massachusetts has been impacted by a number of hurricanes of varying strengths
- State HMGP notes that the entire state of MA is susceptible to hurricanes with coastal areas vulnerable to wind damage and storm surge damage
- The campus is exposed to high winds and wave action from Boston Harbor. A storm surge of 15-20 feet may be possible.

Source: NOAA, CEMAR

Tornadoes – Suffolk County



- Average of 6 tornadoes per year touch down in New England
- No tornadoes in Suffolk County since 1951

Source: http://www.tornadohistoryproject.com/

UMass Boston – Flood Maps

Other Natural Hazards

- **Coastal Erosion**
  - Regardless of the season, coastal storms typically cause erosion.
  - UMass Boston is a waterfront campus, portions of which are in the velocity zone.
- **Winter/Ice Storms**
  - Entire state is at risk
  - There have been about 40 ice storm events in the last 40 years
  - In the past three years there have been annual winter storm disaster declarations.

Hazard Mitigation Plan Contents

- Executive Summary
  - Purpose, Process, Major Recommendations
- Goals and Objectives
- Hazard Identification and Risk Assessment
  - Hazard Background, Asset Inventory, Loss Estimation
- Mitigation Strategy
  - Identification of Mitigation Actions, Prioritization of Actions and Methodology, Timeline
- Implementation and Plan Maintenance
  - Responsibilities, Integration with Other Plans, Schedule

COMMITMENT & INTEGRITY DRIVE RESULTS

APPENDIX G: FACILITATED DRAFT HAZARD MITIGATION PLAN REVIEW MEETING MATERIALS

MEETING SIGN-IN SHEET – STAKEHOLDER PRESENTATION OF DRAFT HAZARD MITIGATION PLAN MEETING

Project:	UMass Boston – Multi-Campus Hazard Mitigation Plan	**Meeting Date:**	December 4, 2013
Facilitator:	Woodard & Curran	**Campus:**	UMass Boston

Name	Address	Phone	Email	Group Represented *(Self or Organization's Name)*
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MEETING SIGN-IN SHEET – STAKEHOLDER PRESENTATION OF DRAFT HAZARD MITIGATION PLAN MEETING

Project:	UMass Boston – Multi-Campus Hazard Mitigation Plan	**Meeting Date:**	December 4, 2013
Facilitator:	Woodard & Curran	**Campus:**	UMass Boston

Name	Address	Phone	Email	Group Represented *(Self or Organization's Name)*
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University of Massachusetts

MULTI-CAMPUS HAZARD MITIGATION PLAN

UMass Boston Hazard Mitigation Plan Review

Hazard Mitigation Planning Team

December 4, 2013

COMMITMENT & INTEGRITY DRIVE RESULTS

Meeting Agenda

- Overall Hazard Mitigation Planning Process
- Overview of Each Plan Section
- Focus on Hazard Susceptibility & Vulnerability
- Hazard Mitigation Goals and Objectives
- Hazard Mitigation Projects
- STAPLEE Criteria
- Final Timeline & Plan Implementation

COMMITMENT & INTEGRITY DRIVE RESULTS

What Have We Done Thus Far and What are We Doing Now?

- Previously the project focus has been:
  - Stakeholder engagement & public participation
  - Hazard identification & risk assessment
  - Hazard event profiles
  - Asset inventories and building rankings
  - Hazard event loss estimates
  - Goals and objectives
  - Hazard mitigation projects
- This phase of the project includes:
  - Review of the draft Hazard Mitigation Plan
  - Focus on hazard susceptibility & vulnerability determinations, hazard mitigation projects and STAPLEE criteria
  - Final timeline & plan implementation

Hazard Mitigation Planning Process

Project Goals

- Fulfill Federal, State, Local and University Hazard Mitigation Planning Requirements
- Promote the Safety of Students, Faculty, Staff and Visitors
- Minimize Hazard Impacts to Physical Assets and Operations
- Reduce or Avoid Long-Term Vulnerabilities from Hazards
- University Eligibility for Future Funding

Hazard Mitigation Planning Process

- The UMass planning process closely follows FEMA's recommended four-stage approach.
- Initial and ongoing community support is critical to the planning process.

Hazard Mitigation Plan Sections

UMass Boston Hazard Mitigation Plan

- Consists of Two Components:
  - (1) Hazard Mitigation Plan – Common to all campuses included in the Multi-Campus Hazard Mitigation Plan (UMass Boston, UMass Dartmouth, UMass Lowell, UMass System Office)
    - Focuses on background and methodology
  - (2) UMass Boston Hazard Mitigation Plan Annex – Specific to UMass Boston only
    - Focuses on UMass Boston specific hazard rankings, assets, goals and mitigation projects

Hazard Mitigation Plan Sections

- Introduction
  - Introduces the plan and campuses
- Planning Process
  - Outlines the team organization, schedule, and resources reviewed
- Hazard Identification & Risk Assessment
  - Presents the project approach, hazard identification and ranking methodology, asset ranking methodology, overview/definitions of applicable hazards
- Goals & Objectives
  - Presents goal identification methodology
- Mitigation Activities & Action Plan
  - Provides STAPLEE methodology and funding sources
- Plan Implementation, Maintenance & Adoption
  - Approach to implementation

UMass Boston Hazard Mitigation Plan Sections

- Introduction
- Planning Process
  - Details the team, process, meetings, participants, stakeholder interviews and overarching themes
- Hazard Profiles & Risk Assessment
  - Profiles human and natural hazards, why the campus is vulnerable, why it is susceptible, risk assessment and future development considerations
- Vulnerability & Impact Assessment
  - Details an asset inventory, loss function calculations and vulnerability assessment by building
- Goals & Objectives
- Mitigation Activities & Action Plan
  - Discusses activities, action plan, potential funding sources and a capabilities assessment
- Plan Implementation, Maintenance & Adoption

Hazard Susceptibility & Vulnerability

Natural Hazard Identification & Ranking

Natural Hazard	Hazard Ranking for UMass Boston*	Suggested Hazard Ranking Modification**
Hurricane	Severe	Severe
Urban Fire	High	Medium
Coastal Storm	High	High
Windstorm	High	Medium
Flood	High	High
Winter Storm	High	High
Tsunami	Medium	Low
Ice Storm	Medium	Medium
Earthquake	Medium	Medium
Thunderstorm/Lightning	Medium	Low
Coastal Erosion	Medium	Medium
Tornado	Medium	Low
Extreme Heat	Low	Low
Hailstorm	Low	Low
Drought	Low	Low

* Rankings as defined by UMass Team; **Non-Hazard Specific Ranking Based on Qualitative/Quantitative Analysis

COMMITMENT & INTEGRITY DRIVE RESULTS

Human Hazard Identification & Rankings

Man-Made Hazard	Hazard Ranking for UMass Boston*
Critical Infrastructure Failure	Severe
Failure of Building Materials	High
Civil Disturbance	High
Industrial Accident	High
Armed Attack/Active Shooter	High
Methane	Medium
Proximity to Flight Path	Medium
Arson	Medium
Violent Criminal Incident	Medium
Robbery/Burglary	Medium
Pandemic	Medium
Explosion	Medium
Cyberattack/Cyberterrorism	Medium
Proximity to Gas Tank at Commercial Point	Medium
Vandalism	Low
Bomb Threat	Low
HazMat Release	Low
Weapons of Mass Destruction	Low

Inventory of Assets

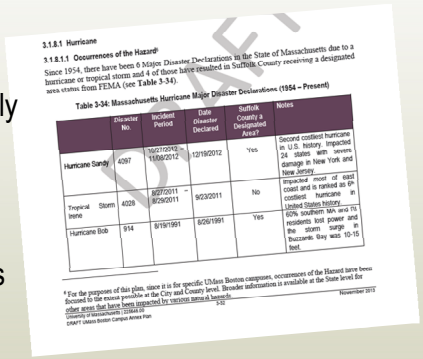
Existing Buildings	Date Construction Completed	Gross Square Feet
Campus Center	2004	330,000
Calf Pasture Pumping Station	1883	Unknown
Phillis Wheatley Hall	1973	268,551
Salt Water Pump House	1974	4,314
McCormack Hall	1975	266,060
Science Center	1974	297,952
Utility Plant	1974	27,886
Healey Library	1978	337,446
Quinn Administration	1973	96,897
Clark Athletic Center	1979	126,427
Service & Supply	1972	74,295
UMass Bayside	1968**	275,000
Total		**2,104,828**
Future Buildings/Projects		
Integrated Sciences Complex	Fall 2014	220,000
General Academic Building No. 1	Mid 2015	180,000

** Per online article review, UMass Bayside building was constructed in late 1960s – we utilized a date of 1968

COMMITMENT & INTEGRITY DRIVE RESULTS

Hazard Spotlight - Hurricane Occurrences of the Hazard

- Discussed Presidential Disaster Declarations and which pertained specifically to Suffolk County
- Direct hurricane hits
- Specific UMass Boston damage due to hurricanes



3.1.8.1 Hurricane

3.1.8.1.1 Occurrences of the Hazard

Since 1954, there have been 6 Major Disaster Declarations in the State of Massachusetts due to a hurricane or tropical storm and 4 of those have resulted in Suffolk County receiving a designated area status from FEMA (see Table 3-34).

Table 3-34: Massachusetts Hurricane Major Disaster Declarations (1954 – Present)

	Disaster No.	Incident Period	Date Disaster Declared	Suffolk County a Designated Area?	Notes
Hurricane Sandy	4097	10/27/2012 – 11/08/2012	12/19/2012	Yes	Second costliest hurricane in U.S. history. Impacted 24 states with severe damage in New York and New Jersey
Tropical Storm Irene	4028	8/27/2011 – 9/29/2011	9/23/2011	No	Impacted most of east coast and is ranked as 6th costliest hurricane in United States history
Hurricane Bob	914	8/19/1991	8/26/1991	Yes	60% southern MA and RI residents lost power and the storm surge in Buzzards Bay was 10-15 feet

* For the purposes of this plan, since it is for specific UMass Boston campuses, occurrences of the Hazard have been focused to the extent possible at the City and County level. Broader information is available at the State level for other areas that have been impacted by various areas of hazards.

Hazard Spotlight – Hurricane Probability of Occurrence & Susceptibility

- UMass Boston proximity to coastline
- NOAA hurricane season forecasting
- Information from State Hazard Mitigation Plan, City Hazard Mitigation Plan, NOAA data, anecdotal UMass Boston information, CEMAR report, etc.

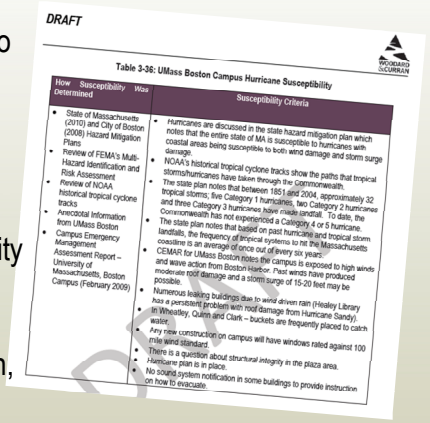


Table 3-36: UMass Boston Campus Hurricane Susceptibility

How Susceptibility Was Determined	Susceptibility Criteria
• State of Massachusetts (2010) and City of Boston (2008) Hazard Mitigation Plans • Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NOAA historical tropical cyclone tracks • Anecdotal information from UMass Boston • Campus Emergency Management Assessment Report – University of Massachusetts, Boston Campus (February 2009)	• Hurricanes are discussed in the state hazard mitigation plan which notes that the entire state of MA is susceptible to hurricanes with coastal areas being susceptible to both wind damage and storm surge damage. • NOAA's historical tropical cyclone tracks show the paths that tropical storms/hurricanes have taken through the Commonwealth. • The state plan notes that between 1851 and 2004, approximately 32 tropical storms; five Category 1 hurricanes, two Category 2 hurricanes and three Category 3 hurricanes have made landfall. To date, the Commonwealth has not experienced a Category 4 or 5 hurricane. • The state plan notes that based on past hurricane and tropical storm landfalls, the frequency of tropical systems to hit the Massachusetts coastline is an average of once out of every six years. • CEMAR for UMass Boston notes the campus is exposed to high winds and wave action from Boston Harbor. Past winds have produced moderate roof damage and a storm surge of 15-20 feet may be possible. • Numerous leaking buildings due to wind driven rain (Healey Library has a persistent problem with roof damage from Hurricane Sandy), in Wheatley, Quinn and Clark – buckets are frequently placed to catch water. • Any new construction on campus will have windows rated against 100 mile wind standard. • There is a question about structural integrity in the plaza area. • Hurricane plan is in place. • No sound system notification in some buildings to provide instruction on how to evacuate.

Hazard Spotlight – Hurricane Risk Assessment Methodology

- Qualitative analysis
  - Frequency, duration, severity, intensity, probability and consequence using a low, medium, high, severe ranking system
- Ranking based on background research, future development plans, knowledge of campus, infrastructure and past occurrences

Table 3-37: Risk Assessment – Hurricane

	Frequency 0-5	Duration 0-5	Severity 0-5	Intensity 0-5	Probability (F,D,I) 40%	Consequence (S) 60%	Total	Risk Ranking L,M,H,S
Hurricane	3	4	5	4	3.67	5.00	4.47	S

Hazard Spotlight – Hurricane Qualitative Risk Assessment

- Considered initial ranking of **severe**
- Consideration then given to impacts on students, faculty, staff, existing buildings, future buildings, operations and critical infrastructure

Table 3-38: Qualitative Risk Assessment - Hurricane

	Hurricane Hazard - Qualitative Ranking
Risk Ranking	Severe
Students, Faculty & Staff	Severe
Existing Buildings	High
Future Buildings	High
Operations	Severe
Critical Infrastructure	High

- Ranking remained **severe**

Mitigation Project Discussion

Goals, Objectives & Projects

Goal 1	**Protect existing and future assets from known hazards by implementing mitigation projects to minimize potential losses and ensure public health and safety.**
Objective 1A	**Use appropriate techniques to mitigate against impacts from flooding in the Bayside, Morrissey Boulevard and Mount Vernon areas.**
Hazard Addressed:	Flooding
Potential Mitigation Projects	• Improve stormwater removal and drainage lines on the University's Bayside site including modifying stormwater outfalls as required. Improve stormwater removal and drainage lines in the Mount Vernon area.
Objective 1B	**Use appropriate techniques to minimize coastal erosion on the outskirts of campus.**
Hazard Addressed:	Coastal Erosion
Potential Mitigation Projects	• Harborwalk Shoreline Stabilization project (sewall installation and extension) • Beach nourishment, vegetation enhancements and tidal control structures in the Morrissey Blvd. area • Complete dredging in area near the salt water pump house
Objective 1C	**Use appropriate techniques to mitigate against impacts from fires.**
Hazard Addressed:	Fire
Potential Mitigation Projects	• Install sprinkler system in Healey Library, Quinn, Clark, Service & Supply Buildings.
Objective 1D	**Use appropriate techniques to mitigate against impacts from high wind events such as windstorms, hurricanes and tornadoes.**
Hazard Addressed:	Windstorm, Hurricanes, Tornadoes
Potential Mitigation Projects	• Prepare a formal plan for sheltering in place • Complete an assessment of campus roofs and water infiltration and mitigate high risk areas with roof replacements and water proofing • Improve McCormick roof • Repair Clark East Curtain wall façade • Address water intrusion in buildings • Examine building structural integrity and repair impacted areas (facades)

COMMITMENT & INTEGRITY DRIVE RESULTS

Goals, Objectives & Projects

Goal 2	Maintain a continuity of campus business operations during and after a hazard event.
Objective 2A	**Build redundancy in essential systems.**
Hazard Addressed:	All
Potential Mitigation Projects	• Evaluate and expand emergency generator capacity • Relocate generators to higher elevations as appropriate • Evaluate and implement tri-generation on campus • Improve generator room in Healy library to make the room less porous or install supplemental piping • Replace and seal older emergency generators • Purchase a large, portable emergency generator • Increase diesel storage capacity or switch generators to natural gas
Objective 2B	**Protect critical infrastructure.**
Hazard Addressed:	All
Potential Mitigation Projects	• Ensure that all critical facilities have generators and other portable supporting infrastructure • Evaluate and upgrade the methane monitoring systems for buildings and other enclosed structures. • Conduct a vulnerability assessment of campus catwalks from operational and/or structural failure and implement a solution to improve or remedy any failing components • Consolidate and eliminate hard copy storage of critical information (much of it is personnel related) that is on paper and easily accessible and convert to electronic • Develop a utility interruption plan
Objective 2C	**Evaluate and enhance communication and education during hazard events to increase the understanding of impacts to campus.**
Hazard Addressed:	All
Potential Mitigation Projects	• Conduct training on UMass Ready business continuity software

Goals, Objectives & Projects

Goal 3	Create and maintain a safe, secure environment for the campus population before, during and after a hazard event.
Objective 3A	**Focus on the safety and mental health of the campus community.**
Hazard Addressed:	All
Potential Mitigation Projects	• Increase campus signage related to safety and emergencies • Increase building security presence and protocols • Evaluate mental health on campus and create an outreach program • Evaluate and purchase technology to allow for a campus lockdown • Expand the employee ID system • Assess visibility and movability throughout Healy Library and implement upgrades as necessary
Objective 3B	**Proactively conduct scenario planning activities.**
Hazard Addressed:	All
Potential Mitigation Projects	• Conduct annual training and drills to include active shooter, sheltering in place and campus evacuation

Goals, Objectives & Projects

Goal 4	**Communicate natural and human hazard information to the campus community and improve education and outreach efforts regarding their potential impact.**
Objective 4A	**Advise the community on health and safety precautions against potential hazards.**
Hazard Addressed:	All
Potential Mitigation Projects	• Develop and implement a hazards public education and outreach program • Incorporate hazard awareness into the web site and other social media. • Increase notification protocols for threatening employees.
Objective 4B	**Work collaboratively with the JFK Library, Archives and other external campus stakeholders on hazard mitigation.**
Hazard Addressed:	All
Potential Mitigation Projects	• Participate in municipal, regional and state hazard mitigation planning efforts • Have annual meetings with external campus stakeholders
Objective 4C	**Consider and obtain feedback from the campus population on hazard planning communications.**
Hazard Addressed:	All
Potential Mitigation Projects	• Conduct surveys or other outreach soliciting feedback from the community

Goals, Objectives & Projects

Goal 5	**Proactively protect existing and future campus assets from known hazards by incorporating mitigation activities into capital improvement and infrastructure planning.**
Objective 5A	**Monitor and track asset conditions.**
Hazard Addressed:	Windstorm, hurricane, tornadoes, winter storm, ice storm, fire, earthquake
Potential Mitigation Projects	• Map infrastructure assets and implement an asset management system
Objective 5B	**Maintain and retrofit campus assets to facilitate resiliency during hazard events.**
Hazard Addressed:	Windstorm, hurricane, tornadoes, winter storm, ice storm, fire, earthquake
Potential Mitigation Projects	• Upgrade the Salt Water Pump House which is used for cooling • Evaluate and upgrade Healey Library roof which is of concern during wind events • Evaluate the Service & Supply roof, fire alarms, gas suppression system and power/generator requirements to ensure they are appropriately designed for a data center
Objective 5C	**Use appropriate measures to ensure new development will not increase hazard threats.**
Hazard Addressed:	Windstorm, hurricane, tornadoes, winter storm, ice storm, fire, earthquake
Potential Mitigation Projects	• Complete a hazard assessment on each new project • Ensure new buildings incorporate structural integrity and protection issues associated with top hazards
Objective 5D	**Consider natural and human hazard risks as new buildings and infrastructure is developed and redeveloped.**
Hazard Addressed:	All hazards
Potential Mitigation Projects	• Develop hazard planning around having student dormitories

Mitigation Project Prioritization

Mitigation Project Prioritization

- Mitigation projects and activities proposed meet FEMA STAPLEE criteria
  - "Projects and activities must be socially acceptable to the community, technically feasible, protective of or beneficial to the environment and are backed by legal authority and consistent with current laws, consider economic benefits and costs and include environmental considerations."
- Each project was assigned a responsible party and evaluated to see if it met the STAPLEE criteria at a high, medium or low level
  - Each project then received a high, medium or low prioritization ranking

Mitigation Project Prioritization

- **See Handout**

Final Steps

Final Steps

- Submit adopted Hazard Mitigation Plan to Massachusetts Emergency Management Agency (MEMA)
- Adopted Hazard Mitigation Plan is reviewed by FEMA Region 1
- Hazard Mitigation Plan is finalized and effective (Fall 2014 anticipated)

Plan Maintenance

Plan Maintenance

- Hazard Mitigation Planning team to meet regularly to review implementation and action items
- Ongoing stakeholder engagement (on and off campus)
- Document progress (grants, projects, actions)
- Review and update the plan every five years to maintain Hazard Mitigation Grant Program eligibility
- Integrate hazard mitigation planning into other campus planning efforts

Summary

Information We Need from You….

- Susceptibility criteria review
- Estimated project costs
- Project responsible parties verification
- Review of project prioritization
- Overall review and comment on the draft plan

COMMITMENT & INTEGRITY DRIVE RESULTS

APPENDIX H: PUBLIC MEETING NO. 2 – MEETING MATERIALS

MEETING SIGN-IN SHEET – HAZARD MITIGATION PLAN PUBLIC MEETING #2

Project:	UMass Boston – Multi-Campus Hazard Mitigation Plan	**Meeting Date:**	December 4, 2013
Facilitator:	Woodard & Curran	**Campus:**	UMass Boston

Name	Address	Phone	Email	Group Represented *(Self or Organization's Name)*
Dorothy Renaghan	UMass Boston Facilities	287-5486	dorothy.renaghan@umb.edu	UMass Boston Facilities
Shaun Curry	UMass Boston Facilities	287-5630	shaun.curry@umb.edu	
[illegible]	UMB Boston Mgt	7-6821	a.mclaughlin@uhs.edu	
Mary Hulse	Woodard & Curran		mhulse@woodardcurran.com	
Mary Kristin Ivanovich	Woodard & Curran		mivanovich@woodardcurran.com	

University of Massachusetts

MULTI-CAMPUS HAZARD MITIGATION PLAN

UMass Boston

Hazard Mitigation Plan

December 4, 2013

COMMITMENT & INTEGRITY DRIVE RESULTS

Public Engagement

- Why Are We Having This Workshop?
  - Public Engagement of both on and off campus stakeholders is a critical component of hazard mitigation planning
- What Do We Want from You?
  - Your questions, thoughts, ideas, suggestions on how to make this the best possible plan to:
    - (1) Assist the University in identifying and reducing its risk from natural and human-caused hazards; and
    - (2) Identify actions that can be taken to prevent damage to property and loss of life

COMMITMENT & INTEGRITY DRIVE RESULTS

Project Background

- The Disaster Mitigation Act was signed by the President in October 2000
  - Incentive for states and local governments to undertake natural hazard mitigation planning.
  - Promotes sustainability as a strategy for disaster resistance.
  - Encourages state and local governments to work together, and facilitates cooperation between state and local authorities.
  - Results in faster allocation of funding and more effective risk reduction projects.
  - Colleges and Universities can plan in concert with similar planning efforts in their community.

COMMITMENT & INTEGRITY DRIVE RESULTS

Project Background

- The University of Massachusetts Boston received a grant from FEMA/MEMA to develop hazard mitigation plan
- Plan will help identify cost effective mitigation measures to reduce or eliminate long-term risk to life and property from hazards
- Allow the University to be eligible to receive non-emergency disaster assistance, including state and federal funding for mitigation and recovery projects
- Projects must be pre-identified in the hazard mitigation plans to receive future funding

COMMITMENT & INTEGRITY DRIVE RESULTS

Benefits of Hazard Mitigation Planning

- Campus benefits from Mitigation Planning by:
  - Identifying cost effective actions for risk reduction that are agreed upon by stakeholders
  - Focusing resources on the greatest risks and vulnerabilities
  - Building partnerships by involving the campus community, organizations, local government and businesses
  - Increasing education and awareness of hazards and risk
  - Communicating priorities to local, state and federal officials
  - Aligning risk reduction with other University objectives

COMMITMENT & INTEGRITY DRIVE RESULTS

Project Goals

- Fulfill Federal, State, Local and University Hazard Mitigation Planning Requirements
- Promote the Safety of Students, Faculty, Staff and Visitors
- Minimize Hazard Impacts to Physical Assets and Operations
- Reduce or Avoid Long-Term Vulnerabilities from Hazards
- University Eligibility for Future Funding

COMMITMENT & INTEGRITY DRIVE RESULTS

Hazard Mitigation Overview

- Hazard mitigation is defined as "any action taken to reduce or eliminate the long-term risk to human life and property from natural [and/or manmade] hazards."
- Hazard mitigation activities may be implemented prior to, during, or after an event; however, it is most effective when based on an inclusive, comprehensive, long-term plan that is developed before a disaster occurs.
- Hazard mitigation is often focused on reducing repetitive loss, as many damaging events tend to occur in the same locations over time (e.g. flooding).

COMMITMENT & INTEGRITY DRIVE RESULTS

Hazard Mitigation Planning Process

- The UMass planning process closely follows FEMA's recommended four-stage approach.
- Initial and ongoing community support is critical to the planning process.

COMMITMENT & INTEGRITY DRIVE RESULTS

Phase 1 – Organize Resources

- Identify the resources available and necessary to complete the process:
  - Assess community support
  - Build the planning team
    - Identify and organize interested members of the community (stakeholders – on and off campus)
    - Identify the necessary technical expertise
  - Establish a steering committee
    - Develop a mission statement
    - Hold a project kick-off meeting
    - Establish a meeting schedule and goals
    - Engage the public

Phase 2 – Assess Risk

- Identify the hazards that present risks to the campus and the assets that are vulnerable to those hazards.
  - Gather historical information, review existing university plans/reports, communicate with local planning experts, MEMA and FEMA.
  - Determine which hazards present the greatest risk to the campus community
    - Assess vulnerability
    - Create a base map to profile potential hazard events
  - Inventory campus assets
    - Show how hazard events could impact campus (physically and operationally)
    - Estimate losses

UMass Boston

COMMITMENT & INTEGRITY DRIVE RESULTS

Massachusetts Disaster Declarations Since 2010

Date	Description
4/19/13	Severe winter storm, snowstorm & flooding
4/17/13	Explosions
12/19/12, 10/28/12	Hurricane Sandy
1/6/12	Severe storm & snowstorm
11/1/11	Severe storm
9/3/11	Tropical storm Irene
8/26/11	Hurricane Irene
6/15/11	Severe storms & tornadoes
3/7/11	Severe winter storm & snowstorm
9/2/10	Hurricane Earl
5/3/10	Water main break
3/29/10	Severe storm & flooding

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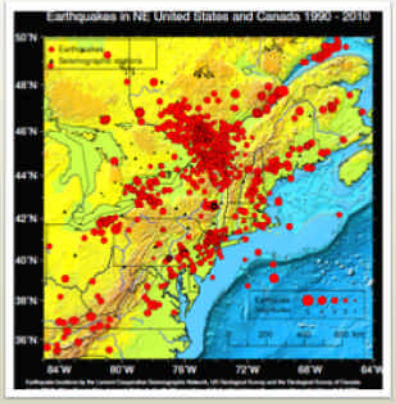
Earthquakes

- Between 1924-1989 there have been 8 earthquakes in New England with a magnitude of 4.2 or greater.
- 30-40 earthquakes occur annually in New England – most are not felt
- Northeastern MA, especially along the coastline, has greater vulnerability to potential earthquake than the rest of the state



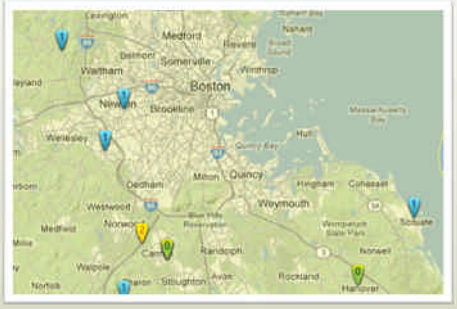
Source: USGS, Weston Observatory, Boston Globe

Hurricanes

Source: NOAA, CEMAR

- Massachusetts has been impacted by a number of hurricanes of varying strengths
- State HMGP notes that the entire state of MA is susceptible to hurricanes with coastal areas vulnerable to wind damage and storm surge damage
- The campus is exposed to high winds and wave action from Boston Harbor. A storm surge of 15-20 feet may be possible.

Tornadoes – Suffolk County



- Average of 6 tornadoes per year touch down in New England
- No tornadoes in Suffolk County since 1951

Source: http://www.tornadohistoryproject.com/

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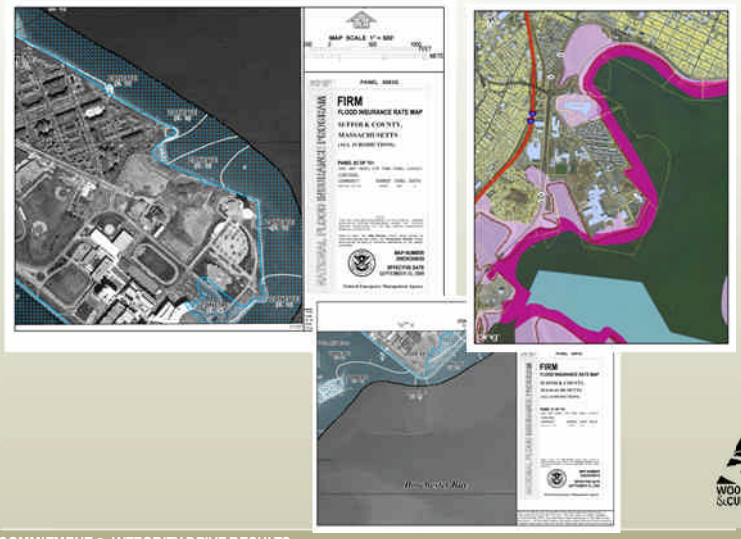
UMass Boston – Flood Maps



COMMITMENT & INTEGRITY DRIVE RESULTS

Flood Hazard
What Will Be Affected by the Hazard?

Other Natural Hazards

- **Coastal Erosion**
  - Regardless of the season, coastal storms typically cause erosion.
  - UMass Boston is a waterfront campus, portions of which are in the velocity zone.
- **Winter/Ice Storms**
  - Entire state is at risk
  - There have been about 40 ice storm events in the last 40 years
  - In the past three years there have been annual winter storm disaster declarations.

Natural Hazard Identification & Rankings

Natural Hazard	Hazard Ranking for UMass Boston*	Suggested Hazard Ranking Modification**
Hurricane	Severe	Severe
Urban Fire	High	Medium
Coastal Storm	High	High
Windstorm	High	Medium
Flood	High	High
Winter Storm	High	High
Tsunami	Medium	Low
Ice Storm	Medium	Medium
Earthquake	Medium	Medium
Thunderstorm/Lightning	Medium	Low
Coastal Erosion	Medium	Medium
Tornado	Medium	Low
Extreme Heat	Low	Low
Hailstorm	Low	Low
Drought	Low	Low

* Rankings as defined by UMass Team; **Non-Hazard Specific Ranking Based on Qualitative/Quantitative Analysis

Human Hazard Identification & Rankings

Man-Made Hazard	Hazard Ranking for UMass Boston*
Critical Infrastructure Failure	Severe
Failure of Building Materials	High
Civil Disturbance	High
Industrial Accident	High
Armed Attack/Active Shooter	High
Methane	Medium
Proximity to Flight Path	Medium
Arson	Medium
Violent Criminal Incident	Medium
Robbery/Burglary	Medium
Pandemic	Medium
Explosion	Medium
Cyberattack/Cyberterrorism	Medium
Proximity to Gas Tank at Commercial Point	Medium
Vandalism	Low
Bomb Threat	Low
HazMat Release	Low
Weapons of Mass Destruction	Low

Inventory of Assets

Existing Buildings	Date Construction Completed	Gross Square Feet
Campus Center	2004	330,000
Calf Pasture Pumping Station	1883	Unknown
Phillis Wheatley Hall	1973	268,551
Salt Water Pump House	1974	4,314
McCormack Hall	1975	266,060
Science Center	1974	297,952
Utility Plant	1974	27,886
Healey Library	1978	337,446
Quinn Administration	1973	96,897
Clark Athletic Center	1979	126,427
Service & Supply	1972	74,295
UMass Bayside	1968**	275,000
Total		**2,104,828**
Future Buildings/Projects		
Integrated Sciences Complex	Fall 2014	220,000
General Academic Building No. 1	Mid 2015	180,000

** Per online article review, UMass Bayside building was constructed in late 1960s – we utilized a date of 1968

COMMITMENT & INTEGRITY DRIVE RESULTS

Non-Hazard Specific Building Ranking Map

COMMITMENT & INTEGRITY DRIVE RESULTS

Phase 3 – Develop the Mitigation Plan

- Lay out in detail the proposed mitigation actions:
  - Establish priorities
    - Compare university mission with the results of the hazard identification and risk assessment
  - Develop hazard mitigation goals
    - Minimize interruption to campus operations and mission
    - Protect research
  - Determine appropriate mitigation actions
  - Prioritize mitigations actions
  - Prepare an implementation strategy

Goals, Objectives & Projects

Goal 1	**Protect existing and future assets from known hazards by implementing mitigation projects to minimize potential losses and ensure public health and safety.**
Objective 1A	**Use appropriate techniques to mitigate against impacts from flooding in the Bayside, Morrissey Boulevard and Mount Vernon areas.**
Hazard Addressed:	Flooding
Potential Mitigation Projects	• Improve stormwater removal and drainage lines on the University's Bayside site including modifying stormwater outfalls as required. Improve stormwater removal and drainage lines in the Mount Vernon area.
Objective 1B	**Use appropriate techniques to minimize coastal erosion on the outskirts of campus.**
Hazard Addressed:	Coastal Erosion
Potential Mitigation Projects	• Harborwalk Shoreline Stabilization project (seawall installation and extension) • Beach nourishment, vegetation enhancements and tidal control structures in the Morrissey Blvd. area • Complete dredging in area near the salt water pump house
Objective 1C	**Use appropriate techniques to mitigate against impacts from fires.**
Hazard Addressed:	Fire
Potential Mitigation Projects	• Install sprinkler system in Healey Library, Quinn, Clark, Service & Supply Buildings.
Objective 1D	**Use appropriate techniques to mitigate against impacts from high wind events such as windstorms, hurricanes and tornadoes.**
Hazard Addressed:	Windstorm, Hurricanes, Tornadoes
Potential Mitigation Projects	• Prepare a formal plan for sheltering in place • Complete an assessment of campus roofs and water infiltration and mitigate high risk areas with roof replacements and water proofing • Improve McCormick roof • Repair Clark East Curtain wall façade • Address water intrusion in buildings • Examine building structural integrity and repair impacted areas (facades)

COMMITMENT & INTEGRITY DRIVE RESULTS

Goals, Objectives & Projects

Goal 2	**Maintain a continuity of campus business operations during and after a hazard event.**
Objective 2A	**Build redundancy in essential systems.**
Hazard Addressed:	All
Potential Mitigation Projects	• Evaluate and expand emergency generator capacity • Relocate generators to higher elevations as appropriate • Evaluate and implement tri-generation on campus • Improve generator room in Healy library to make the room less porous or install supplemental piping • Replace and seal older emergency generators • Purchase a large, portable emergency generator • Increase diesel storage capacity or switch generators to natural gas
Objective 2B	**Protect critical infrastructure.**
Hazard Addressed:	All
Potential Mitigation Projects	• Ensure that all critical facilities have generators and other portable supporting infrastructure • Evaluate and upgrade the methane monitoring systems for buildings and other enclosed structures. • Conduct a vulnerability assessment of campus catwalks from operational and/or structural failure and implement a solution to improve or remedy any failing components • Consolidate and eliminate hard copy storage of critical information (much of it is personnel related) that is on paper and easily accessible and convert to electronic • Develop a utility interruption plan
Objective 2C	**Evaluate and enhance communication and education during hazard events to increase the understanding of impacts to campus.**
Hazard Addressed:	All
Potential Mitigation Projects	• Conduct training on UMass Ready business continuity software

Goals, Objectives & Projects

Goal 3	**Create and maintain a safe, secure environment for the campus population before, during and after a hazard event.**
Objective 3A	**Focus on the safety and mental health of the campus community.**
Hazard Addressed:	All
Potential Mitigation Projects	• Increase campus signage related to safety and emergencies • Increase building security presence and protocols • Evaluate mental health on campus and create an outreach program • Evaluate and purchase technology to allow for a campus lockdown • Expand the employee ID system • Assess visibility and movability throughout Healy Library and implement upgrades as necessary
Objective 3B	**Proactively conduct scenario planning activities.**
Hazard Addressed:	All
Potential Mitigation Projects	• Conduct annual training and drills to include active shooter, sheltering in place and campus evacuation

Goals, Objectives & Projects

Goal 4	Communicate natural and human hazard information to the campus community and improve education and outreach efforts regarding their potential impact.
Objective 4A	**Advise the community on health and safety precautions against potential hazards.**
Hazard Addressed:	All
Potential Mitigation Projects	• Develop and implement a hazards public education and outreach program • Incorporate hazard awareness into the web site and other social media. • Increase notification protocols for threatening employees.
Objective 4B	**Work collaboratively with the JFK Library, Archives and other external campus stakeholders on hazard mitigation.**
Hazard Addressed:	All
Potential Mitigation Projects	• Participate in municipal, regional and state hazard mitigation planning efforts • Have annual meetings with external campus stakeholders
Objective 4C	**Consider and obtain feedback from the campus population on hazard planning communications.**
Hazard Addressed:	All
Potential Mitigation Projects	• Conduct surveys or other outreach soliciting feedback from the community

Goals, Objectives & Projects

Goal 5	Proactively protect existing and future campus assets from known hazards by incorporating mitigation activities into capital improvement and infrastructure planning.
Objective 5A	**Monitor and track asset conditions.**
Hazard Addressed:	Windstorm, hurricane, tornadoes, winter storm, ice storm, fire, earthquake
Potential Mitigation Projects	• Map infrastructure assets and implement an asset management system
Objective 5B	**Maintain and retrofit campus assets to facilitate resiliency during hazard events.**
Hazard Addressed:	Windstorm, hurricane, tornadoes, winter storm, ice storm, fire, earthquake
Potential Mitigation Projects	• Upgrade the Salt Water Pump House which is used for cooling • Evaluate and upgrade Healey Library roof which is of concern during wind events • Evaluate the Service & Supply roof, fire alarms, gas suppression system and power/generator requirements to ensure they are appropriately designed for a data center
Objective 5C	**Use appropriate measures to ensure new development will not increase hazard threats.**
Hazard Addressed:	Windstorm, hurricane, tornadoes, winter storm, ice storm, fire, earthquake
Potential Mitigation Projects	• Complete a hazard assessment on each new project • Ensure new buildings incorporate structural integrity and protection issues associated with top hazards
Objective 5D	**Consider natural and human hazard risks as new buildings and infrastructure is developed and redeveloped.**
Hazard Addressed:	All hazards
Potential Mitigation Projects	• Develop hazard planning around having student dormitories

Phase 4 – Implement the Plan and Monitor Progress

- Formally adopt the Hazard Mitigation Plan (valid for a period of five years)
- Implement mitigation measures
- Monitor, evaluate and update the plan as needed
- Continue to engage stakeholders from the campus and community

Final Steps

- Submit adopted Hazard Mitigation Plan to Massachusetts Emergency Management Agency (MEMA)
- Adopted Hazard Mitigation Plan is reviewed by FEMA Region 1
- Hazard Mitigation Plan is finalized and effective (Fall 2014 anticipated)

WOODARD &CURRAN

APPENDIX I: PLAN APPROVAL LETTER