Eastern Michigan University

2024 Hazard Mitigation Plan

Section 1 – Introduction

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Background

Natural, man-made, and technological hazards are a part of the world around us. Natural hazards, such as floods, winter storms, and tornadoes, are inevitable, and there is little we can do to control their force and intensity. Further, given the changing climate, many areas are experiencing greater frequency and intensity of hazards. The possibility of man-made and technological disasters, such as hazardous materials incidents, terrorism, civil disturbances, and disease outbreak are also present and must be planned for. While the requirement of a FEMA hazard mitigation plan is natural hazards, the University must consider all hazards as legitimate and significant threats to human life, public safety, and property.

While the threat from hazard events may never be fully eliminated, there is much we can do to lessen their potential impact upon our campus and the population we serve. By minimizing the impact of hazards upon our built environment, we can prevent such events from resulting in disasters in our communities. The concept and practice of reducing risks to people and property from known hazards is generally referred to as hazard mitigation.

FEMA Definition of Hazard Mitigation:

"Any Sustained action taken to reduce or eliminate the long-term risk to human life and property from hazards."

Hazard mitigation techniques include structural measures (such as strengthening or protecting buildings and infrastructure from destructive forces of potential hazards) and non-structural measures (such as the adoption of sound land use policies, regulations, and creation of public awareness programs). **Mitigation has a strong return on investment, estimated at $6 return for every $1 invested according to a 2017 National Institute of Building Science study.** It is widely accepted that the most effective mitigation measures are implemented at the local level, where decisions on the regulation and control of development are ultimately made. A comprehensive mitigation approach addresses hazard vulnerabilities that exist today and in the foreseeable future. Therefore, it is essential that projected patterns of future development and population change are evaluated and considered in terms of how that growth will affect a campus's overall hazard vulnerability.

A key component in the formulation of a comprehensive approach to hazard mitigation is to develop, adopt, and update a local hazard mitigation plan. A hazard mitigation plan establishes the broad campus vision and guiding principles for reducing hazard risk and proposes specific mitigation actions to eliminate or reduce identified vulnerabilities. It also presents an opportunity to integrate hazard mitigation and risk reduction principles into other university plans and procedures.

The *2024 Eastern Michigan University Hazard Mitigation Plan* represents the second iteration of a campus-wide hazard mitigation plan for the University's campus in Ypsilanti. The 2024 Plan Update draws from the existing policies, data, and plans (such as 2013 EMU Multi Hazard Mitigation Plan, 2023 EMU Emergency Response Procedures Guide, and the 2023 Flood Response Plan that currently incorporate hazard mitigation principles into routine campus activities. At its core, this plan recommends specific actions to minimize hazard vulnerability, reduce the risk profile of the campus, and protect the population. Further, this document is intended to serve as a single source to compile university concerns to all hazards. The plan remains a living document with implementation and evaluation procedures established to help achieve meaningful objectives and successful outcomes over time.

Disaster Mitigation Act of 2000

In an effort to reduce the Nation's mounting natural disaster losses, the U.S. Congress passed the Disaster Mitigation Act of 2000 (DMA 2000) to amend the Robert T. Stafford Disaster Relief and Emergency Assistance Act. Section 322 of DMA 2000 emphasizes the need for state and local government entities (including universities) to closely coordinate on mitigation planning activities and requires a hazard mitigation plan for any local government applying for federal mitigation grant funds. These funds primary fall under the Federal Emergency Management Agency (FEMA) Hazard Mitigation Assistance (HMA) program. Grant programs under HMA include the Hazard Mitigation Grant Program (HMGP), the Building Resilient Infrastructure and Cities (BRIC) program, and the Flood Mitigation Administration (FMA) program. Entities with an adopted and federally approved hazard mitigation plan are pre-positioned to receive available mitigation funds before and after the next disaster strikes.

Purpose

The purpose of the *2024 Eastern Michigan University Hazard Mitigation Plan Update* is to:

- Update the existing EMU Multi Hazard Mitigation Plan to demonstrate progress and changing priorities;
- Develop a supporting source documenting University needs related to emergency management;
- Increase public (i.e., university population, staff, and stakeholder) awareness and education of hazards and hazard mitigation;
- Maintain grant eligibility for FEMA funding;
- Maintain compliance with state and federal legislative requirements for local hazard mitigation plans.

Scope

The 2024 Eastern Michigan University Hazard Mitigation Plan Update focuses on hazards determined to be high or moderate risks to the campus, as determined through a detailed hazard risk assessment. In addition to FEMA requirements for natural hazards, the University included non-natural hazards, which could have grave consequences on population, reputation, and operations. A detailed, FEMA-compliant risk assessment was undertaken for all natural hazards. Non-natural hazards are also assessed.

Authority

The *2024 Eastern Michigan University Hazard Mitigation Plan Update* has been developed in accordance with current state and federal rules and regulations governing local hazard mitigation plans and has been adopted in accordance with campus procedures. A copy of the adoption resolution is provided in Appendix A. The plan shall be routinely monitored and revised to maintain compliance with the following provisions, rules, and legislation:

- Section 322, Mitigation Planning, of the Robert T. Stafford Disaster Relief and Emergency Assistance Act, as enacted by Section 104 of the Disaster Mitigation Act of 2000 (P.L. 106-390); and
- FEMA's Mitigation Planning Final Rule published in the Federal Register on September 16, 2009, at 44 CFR Part 201.

Summary of Plan Contents

This plan is designed to be as reader-friendly and functional as possible. While significant background information is included on the process undertaken and information used (i.e., risk assessment, capability assessment), this information is separated from the more meaningful planning outcomes or actions (i.e., Mitigation Action Plan). The following text defines each section in greater detail.

This section, *Section 1, **Introduction***, provides a general background on the need for the plan and the included areas.

Section 2, ***Planning Process***, describes the process used to prepare the plan, including the involvement of campus stakeholders. It identifies members of the Mitigation Planning Committee and how the public and other stakeholders were involved. It also includes a summary for each of the key meetings along with any associated outcomes.

The ***Campus Profile***, located in *Section 3*, provides a general overview of the university campus, including geographic, demographic, and economic characteristics. In addition, this section discusses building characteristics and land use patterns on campus. This baseline information provides a snapshot of the planning area.

The ***Risk Assessment*** is presented in *Section 4*. This section serves to identify, analyze, and assess hazards that threaten EMU. The risk assessment also attempts to define hazard risks that may uniquely or exclusively affect specific areas of the campus.

The *Risk Assessment* begins by identifying hazards to which the campus is potentially at risk. Next, it establishes detailed profiles for each hazard, building on available historical data, spatial extent, and probability of future occurrence. This section culminates in a hazard risk ranking based on conclusions regarding the frequency of occurrence, spatial extent, and potential impact, with input from the Mitigation Planning Committee and public survey results. The vulnerability assessment uses available hazard data to evaluate vulnerability. In essence, the information generated through the risk assessment serves a critical function as the university seeks to determine the most appropriate mitigation actions to pursue and implement. The risk assessment enables the university to prioritize and focus its efforts on those hazards of greatest concern.

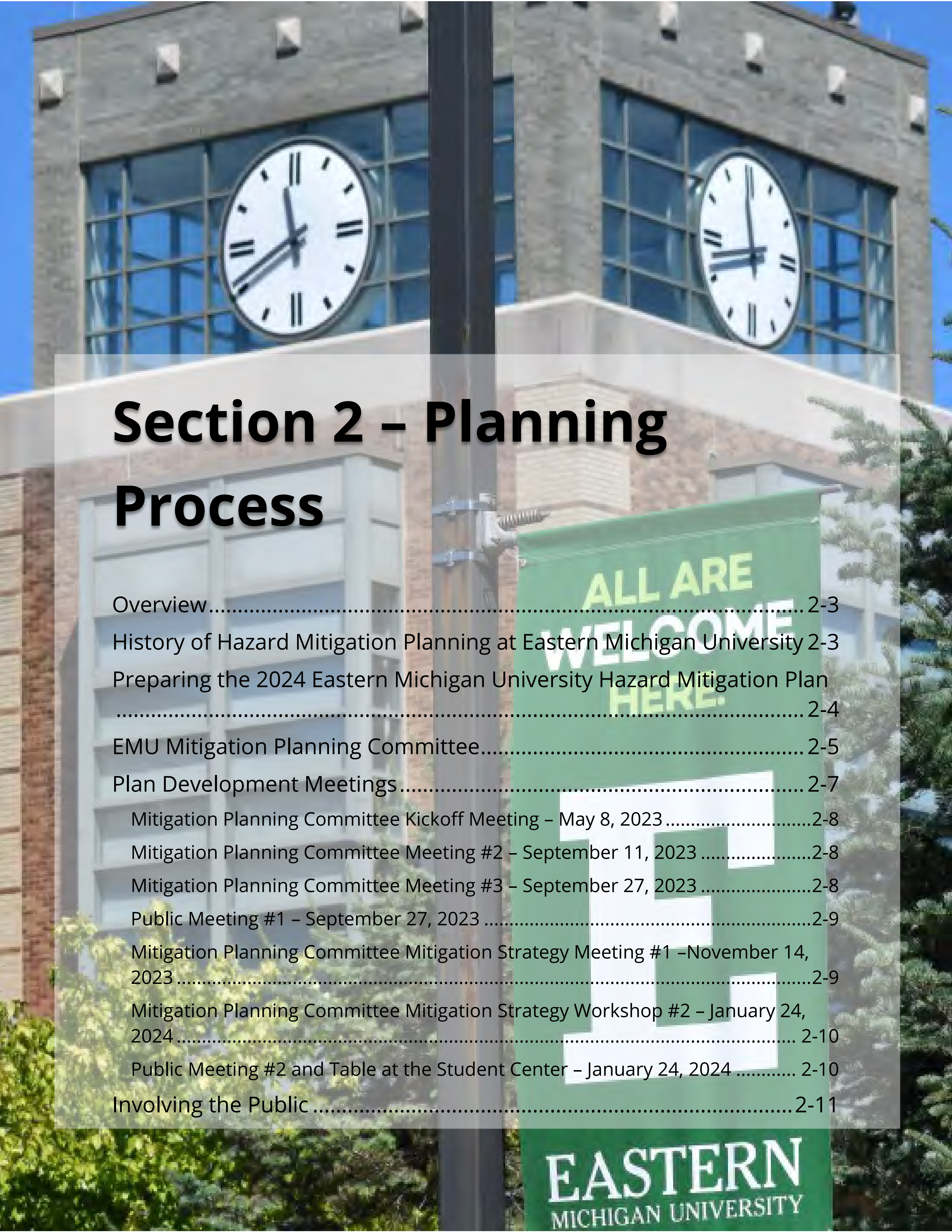
The ***Capability Assessment***, found in *Section 5*, provides an inventory and analysis of existing University plans, policies, and relevant documents. The purpose of this assessment is to identify any existing gaps, opportunities, or conflicts in programs or activities that may hinder hazard mitigation efforts and to identify those activities that should be built upon in establishing a successful and sustainable local hazard mitigation program. Specific capabilities addressed in this section include planning and regulatory capability, fiscal capability, and political capability.

The *Campus Profile, Risk Assessment*, and *Capability Assessment* collectively serve as a basis for finalizing the goals for the University's *Mitigation Strategy*, each contributing to the development, adoption, and implementation of a meaningful and manageable *Mitigation Strategy* that is based on accurate background information.

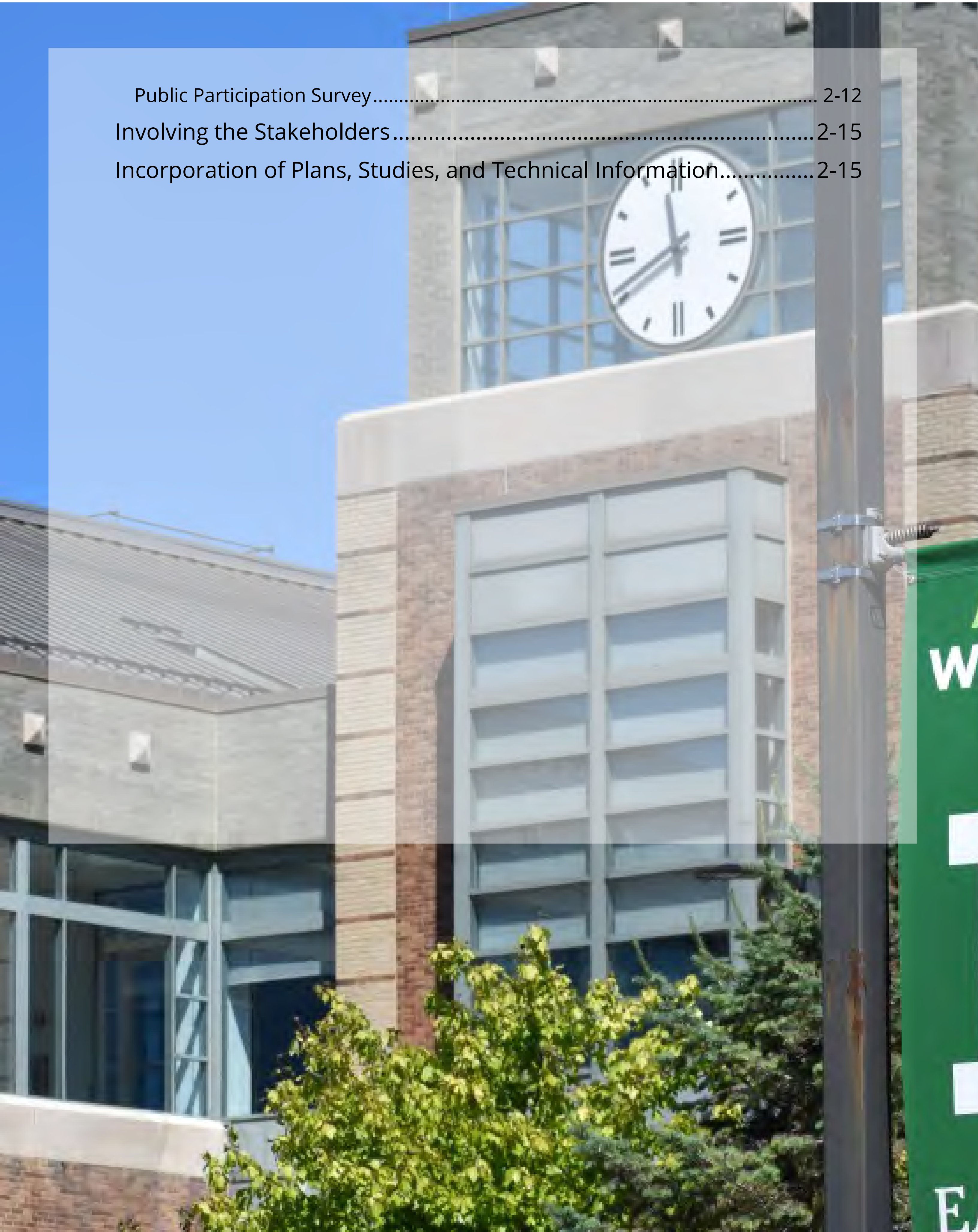
The ***Mitigation Strategy***, found in *Section 6,* consists of broad goal statements and objectives, as well as an analysis of hazard mitigation techniques for the University consider in reducing hazard vulnerabilities. The strategy provides the foundation for a detailed ***Mitigation Action Plan***, which links specific mitigation actions to campus departments. This process assigns local responsibility and target completion dates for implementation. Together, these sections are designed to make the plan both strategic, through the identification of long-term goals, and functional, through the identification of immediate and short-term actions that will guide day-to-day decision-making and project implementation.

Plan Maintenance, found in *Section 7*, includes the measures that the campus will take to ensure the Plan's continuous long-term implementation. The procedures also include the manner in which the Plan will be regularly evaluated and updated to remain a current and meaningful planning document.

The Appendices provide supplemental documentation for the plan including: Appendix A: Adoption Resolution; Appendix B: Planning Tools; Appendix C: Plan Documentation; and Appendix D: Review Tool (Federal Review Tool, State Review Tool).



Section 2 – Planning Process



Overview

Local hazard mitigation planning is the process of organizing campus resources, identifying and assessing hazard risks, and determining how to best minimize or manage those risks. This process culminates in a hazard mitigation plan that identifies specific mitigation actions, each designed to achieve both short-term planning objectives and a long-term campus vision.

Entities that participate in hazard mitigation planning have the potential to accomplish many benefits, including:

- protecting lives and property,
- saving money,
- accelerating recovery following hazard events,
- reducing future vulnerability through strategic development and investment,
- expediting the receipt of pre-disaster and post-disaster grant funding, and
- demonstrating a firm commitment to improving campus health, security, and preparedness.

A core assumption of hazard mitigation is that the investments made before a hazard event (natural or non-natural) will significantly reduce the demand for post-disaster assistance by lessening the need for emergency response, repair, recovery, and reconstruction. Furthermore, mitigation practices and security enhancements get the campus back on track sooner with less interruption.

The benefits of mitigation planning go beyond solely reducing hazard vulnerability. The process serves to bolster relationships and mitigation measures often permit multiple benefits such as increased recreation opportunities through open space conservation. Thus, it is vitally important that any mitigation planning process be integrated with concurrent local planning efforts, and any proposed mitigation strategies must take into account other existing campus goals or initiatives that will help complement or hinder their future implementation.

History of Hazard Mitigation Planning at Eastern Michigan University

This plan is the most recent hazard mitigation plan (HMP) for Eastern Michigan University (EMU). The University's previous version of the HMP was approved in 2013; this plan serves as an update to that plan and supersedes all previous iterations of the HMP.

Preparing the 2024 Eastern Michigan University Hazard Mitigation Plan

The *2024 EMU Hazard Mitigation Plan* was led by the Department of Risk and Emergency Management (REM). EMU funded the project to complete the plan. The planning process was initiated in October 2022 following selection of Stantec Consulting Services Inc. (Stantec) to provide professional mitigation planning services and to prepare the mitigation plan document for submittal to Michigan State Police – Emergency Management and Homeland Security, FEMA and the University leadership.

At the onset of the planning process, the EMU Director of Risk and Emergency Management (Laura Drabczyk) and consultant project manager (Christina Hurley, AICP) reviewed the proposed planning process and schedule.

The *2024 Eastern Michigan University Hazard Mitigation Plan* addresses natural and non-natural hazards. Ultimately, by taking a thorough all-hazards approach, this document is intended to serve as the centralized document for all hazard needs for the campus, as reflected in *Section 6: Mitigation Strategy*.

The consultant team followed the latest mitigation planning process recommended by FEMA: Local Mitigation Planning Handbook (March 2013), Local Mitigation Planning Policy Guide (April 2022), and the Local Mitigation Plan Review Guide (October 2011). Additionally, the Local Mitigation Plan Review Tool, found in Appendix D, provides a detailed summary of FEMA's current minimum standards of acceptability for compliance with DMA 2000 and notes the location where each requirement is met within this plan. These standards are based upon FEMA's Final Rule as published in the Federal Register in Part 201 of the Code of Federal Regulations (CFR). The State of Michigan also has state planning requirements for local hazard mitigation planning. As such, the Michigan State Police Emergency Management and Homeland Security Condensed Local Review Form (June 2015) was referenced during the development of this plan.

The process used to prepare this plan included twelve major steps that were completed over the course of approximately 12 months beginning in May 2023. Each of these planning steps (illustrated in **Figure 2-1**) resulted in critical work products and outcomes that collectively make up the plan. Specific plan sections are further described in *Section 1: Introduction*. The plan was developed with input from a broad planning team and the public, as described below.

Figure 2-1: Hazard Mitigation Planning Process

EMU Mitigation Planning Committee

In order to guide the development of this plan, a Mitigation Planning Committee was created. The Mitigation Planning Committee is made up of representatives from various campus divisions and departments and other key stakeholders identified to serve as critical partners in the planning process. The Mitigation Planning Committee includes University officials engaged in Emergency Management, Facilities, Planning, Construction, and Public Safety, among others. A smaller subset of the Mitigation Planning Committee, called the Steering Committee, met more frequently in order to progress the plan through the steps outlined above.

Beginning in May 2023, the planning team engaged in local meetings to discuss and complete tasks associated with preparing the plan. This working group coordinated all aspects of plan preparation and provided valuable input to the process. In addition to meetings, planning team members were kept informed and participated through targeted phone calls. Agendas and minutes from the meetings can be found in Appendix C.

Specifically, the tasks assigned to the Mitigation Planning Committee members included:

- participate in committee meetings and stakeholder calls;
- provide best available data as required for the risk assessment portion of the plan;
- provide information that will help complete the capability assessment section of the plan and provide copies of any mitigation or hazard-related documents for review and incorporation into the plan;
- support the development of the *Mitigation Strategy*, including the design and adoption of goal statements;

- help design and propose appropriate mitigation actions for their department/agency for incorporation into the Mitigation Action Plan;
- review and provide timely comments on all study findings and draft plan deliverables; and
- support the adoption of the *2024 Eastern Michigan University Hazard Mitigation Plan*.

Table 2-1 lists the members of the EMU Mitigation Planning Committee who were responsible for participating in the development of the plan.

Table 2-1: Members of the Eastern Michigan University Mitigation Planning Committee

Name	Title	Department
Laura Drabczyk	Director	Risk and Emergency Management
Todd Ohmer	Executive Director Financial Planning and Budgets	Business and Finance
Jordan Phelps	Internal Communications Specialist	Division of Communications
Kathryn Wilhoff	Director	Environmental Health and Safety
Scott Storrar	Executive Director, Facilities Planning, Maintenance and Construction	Physical Plant
Dieter Otto	Executive Director, Custodial, Motor Pool & Grounds Services	Physical Plant
Ron Woody	Chief Information Officer	Information Technology (IT)
Rocky Jenkins	Director	Network and Systems Services, IT
Matthew J Lige	Executive Director of Public Safety & Chief of Police	EMU Police Department
Kevin Lawson	Director	Student Center

Name	Title	Department
Kara Corwin	Director of Special Events	EMU Athletics
Jeanette Zalba	Director	EMU Housing and Residence Life
Gretchen Sanchez	Director of Operations	EMU Dining Services

Plan Development Meetings

The preparation of this plan required a series of meetings and workshops for facilitating discussion, gaining consensus and initiating data collection efforts with university staff and other identified stakeholders (including university officials, the public, greater campus community, and those involved in hazard mitigation activities). More importantly, the meetings prompted continuous input and feedback from relevant participants throughout the drafting stages of the plan. Public meetings were publicized to invite a broad range of stakeholders. The following is a summary of the key meetings held during the development of the plan.

In total, seven primary meetings were conducted:

- Mitigation Planning Committee Kickoff Meetings (2);
- Public Meeting #1;
- Mitigation Planning Committee Risk Assessment Results Meeting;
- Mitigation Planning Committee Mitigation Strategy Workshop #1;
- Mitigation Planning Committee Mitigation Strategy Workshop #2;
- Public Meeting #2

In addition to these meetings, many routine discussions and additional meetings were held by University staff to accomplish planning tasks specific to their division or department. Project management meetings were held weekly, and Steering Committee meetings were held monthly.

Mitigation Planning Committee Kickoff Meeting – May 8, 2023

This meeting was facilitated by John Bucher and Christina Hurley from Stantec, as well as Laura Drabczyk from EMU, who served as the EMU project manager for the plan. The meeting was held virtually May 8, 2023. The purpose of the meeting was to:

- provide an overview of hazard mitigation including possible techniques;
- review proposed project tasks, roles and responsibilities;
- review project schedule with the planning team; and,
- review hazards.

The meeting began with introductions, followed by an overview of hazard mitigation planning. Members of the planning team noted information that may be of interest to the Stantec team. A draft hazards list was reviewed, as was a data collection request spreadsheet. Discussion on whether additional members, such as someone some Communications, should be added to the Mitigation Planning Committee was held.

Mitigation Planning Committee Meeting #2 – September 11, 2023

This meeting was facilitated by Christina Hurley from Stantec, along with other team members, and as well as Laura Drabczyk from EMU. The meeting was held virtually September 11, 2023. After staff being out for the summer, this meeting served to re-kick off the planning process. Christina provided an overview of hazard mitigation, and an overview of the project with an updated schedule. She presented progress that had been made over the summer, including collection of data and development of a building's geodatabase. The hazards list was presented, and committee members provided input of hazards of highest concern, such as flooding, extreme cold (e.g., burst pipes), cyber-attacks and active shooter events.

In addition to the hazards list, the draft public survey was reviewed with the committee. Suggestions for revising questions were discussions and changes were made. Lastly, future engagement opportunities and next steps were discussed.

Mitigation Planning Committee Meeting #3 – September 27, 2023

This meeting was facilitated by Christina Hurley from Stantec, along with other team members, and as well as Laura Drabczyk from EMU. The meeting was held virtually September 27, 2023. This meeting served to present risk assessment and capability assessment results to the Mitigation Planning Committee. Christina presented plan progress updates, and provided an overview of upcoming engagement opportunities, including the public survey (noting it was currently open), along with the upcoming public meeting and future mitigation planning committee meetings. She then presented an overview of the Capability and Capacity Assessment results. It was noted that the Comprehensive Emergency Management Plan and the Stormwater Plan had not yet been reviewed. Laura and Scott noted they could provide these plans. provided an overview of hazard mitigation, and an overview of the project with an updated schedule. Attendees had a discussion regarding staffing capacity needs, noting that additional staff and specific skillsets, such as staff well-versed in in applying for and managing competitive mitigation grants, were needed. Danielle Curri then presented results from the risk assessment. Concerns and mitigation actions/redundancies in place regarding power outages, stormwater-related flooding, and hazardous materials releases were discussed.

Lastly, Ben Schattschneider gave an overview of the mitigation strategy. Goals from the 2013 plan were reviewed, discussed, and ultimately unchanged with the intension of revisiting at the first Mitigation Strategy Workshop. future engagement opportunities and next steps were discussed. Ben provided an overview of the types of mitigation actions, including examples of each. A mentimeter poll was utilized to understand how MPC members would prefer to spend mitigation dollars. Actions related to prevention (e.g., planning, capital improvement planning, and maintenance) and emergency services (e.g., warning systems, evacuation planning, exercises) received the highest dollar "votes."

Christina Hurley then went over next steps and concluded the meeting.

Public Meeting #1 – September 27, 2023

This meeting was facilitated by Christina Hurley and Danielle Curri from Stantec, along with Laura Drabczyk from EMU. It was held virtually via the University's Zoom account. The meeting was attended by seven members of the public. The purpose of this meeting was to:

- introduce the public to the hazard mitigation planning process;
- review the project purpose and schedule;
- review progress to date including identified hazards and risk assessment results; and,
- review opportunities for future and continued engagement.

The meeting began with introductions of the Stantec team and the EMU Steering Committee members in attendance. Christina then provided a background on hazard mitigation, why the University engaged in hazard mitigation planning, and provided an overview of the project and schedule. A question was asked about the plan and opportunities for funding, and it was explained that the plan, once approved and adopted, will make EMU eligible for specific types of FEMA hazard mitigation funding to increase overall resilience of the University.

Danielle then presented results of the risk assessment by hazard. Several comments regarding previous hazards and their impacts were discussed. Attendees answered a poll question about which hazards on campus are of most concern on campus. Terrorism and similar criminal activities (including active shooter), extreme cold, and public health emergencies were noted as hazards of concern.

Christina then presented an overview of mitigation strategy types. She then noted opportunities to further participate in the planning process, noting that another public meeting would be held in January in-person, and that the public survey was now open. A link to the survey was provided.

Mitigation Planning Committee Mitigation Strategy Meeting #1 –November 14, 2023

This meeting was facilitated by Christina Hurley and Ben Schattschneider from Stantec, as well as Laura Drabczyk from EMU. The purpose of the meeting was to:

- provide an update on plan progress, including public survey results to date; and
- begin mitigation action plan development through review of plan goals, and previously mitigation actions (2013 plan and those identified to date).

The meeting began with introductions. Christina then reviewed the project schedule, including key planning process items, meetings, and plan review milestones.

Christina then presented results from the public survey. Ben presented information regarding types of mitigation actions, including providing examples from other University plans. The committee discussed potential actions and several were identified for including in the Mitigation Action Plan. Goals and actions from the 2013 plan were reviewed.

Mitigation Planning Committee Mitigation Strategy Workshop #2 – January 24, 2024

The Mitigation Strategy Workshop #2 was held on January 24, 2024 in-person at the EMU Student Center from 12:30 to 1:30pm. The meeting was facilitated by Christina Hurley and Ben Schattschneider from Stantec and Laura Drabczyk from EMU. The purpose of the meeting was to:

- finalize plan goals and objectives;
- review the mitigation strategy workbook, adding additional actions as necessary and filling in meeting items in the workbook; and,
- review hazard rankings.

Christina presented draft hazard rankings for review. She presented the rankings from the 2013 plan, results regarding hazards of highest concern from the public survey, and then presented draft ranking developed for the 2024 plan. It was noted that hazard rankings intended to help prioritize mitigation actions and implementation, and do not have any bearing on potential funding. It was discussed why Terrorism and Similar Criminal Activities, which includes active shooter, rate so high above other hazards on the survey. It was mentioned that the survey went out around the same time as the anniversary of the Michigan State University shooting. It was also discussed whether public health emergencies should be moved from moderate to high, but ultimately no change was made as several committee members felt better prepared to deal with such events since the development of the pandemic response plan and after going through the COVID-19 pandemic. Several hazard names, including Terrorism and Similar Criminal Activities, and Civil Disturbances, were revised for the public meeting to better indicate their meaning.

Ben then presented the mitigation strategy workbook to date. He noted several actions that were missing schedules or a lead contact. Information was identified for these actions. New actions were also discussed and added to the workbook, including cellular boosters for areas of campus that are “dead zones” so that emergency alerts could be issued.

Public Meeting #2 and Table at the Student Center – January 24, 2024

Public Meeting #2 was held at the Student Center, Room 301 from 2-3:30pm. A zoom link was also provided for those who preferred to join virtually. This meeting was facilitated by Christina

Hurley and Ben Schattschneider from Stantec, as well as Laura Drabczyk from EMU. The purpose of the meeting was to:

- provide an update on plan progress, including public survey results to date, risk assessment findings, and capability assessment findings; and
- continue mitigation action plan development through review of previously suggested mitigation actions and collection of additional mitigation actions.

The meeting began with introductions. Three attendees outside of those on the Mitigation Planning Committee were present, and well as several online participants. Christina began the meeting by describing hazard mitigation and requirements from the Disaster Mitigation Act of 2000, then went on to describe the project and the project schedule, including key planning process items, meetings, and plan review milestones.

Following the overview, an attendee asked several questions about the plan, specifically about engagement of faculty in plan development. Christina noted that faculty, staff, and students would have opportunity to review the draft plan and provide comments, and that faculty participated in the public survey. Christina then presented an overview of risk assessment results and answered questions regarding risk assessment results. Christina also presented plans reviewed and results from the capability assessment.

Ben then presented mitigation action types and examples of actions identified, and asked attendees for feedback or recommendation on mitigation actions. One participant brought up a new building that has many glass walls and windows throughout, making it vulnerable to active shooters. Christina recommended considering a mitigation action to install shatterproof film on the windows to decrease risk.

The meeting was adjourned at 3:15 after all attendee questions were answered.

In addition to the public meeting, Christina Hurley and Ben Schattschneider, along with Laura Drabczyk and Jordan Phelps with EMU, staffed a booth at the EMU Student Center from 9am – 12pm. The area has high student traffic. The team had a poster with mitigation action categories, as well as laptops with risk assessment result maps. The team solicited student feedback on hazards and potential mitigation actions. Of note, all students engaged did not know where to go or what to do if they heard the tornado sirens, even though the campus tornado shelter was around the corner. Public education was noted as a needed action for the plan. In addition, students noted extreme cold and severe winter weather as hazards of concern, especially for commuters (it was a snowy day).

Involving the Public

44 CFR Requirement
44 CFR Part 201.6(b)(1): *The planning process shall include an opportunity for the public to comment on the plan during the drafting stage and prior to plan approval.*

An important component of the mitigation planning process involved public participation. Input from the campus-community (students, faculty, staff, visitors) provides the entire Mitigation Planning Committee with a greater understanding of local concerns and increases the likelihood of successfully implementing mitigation actions by developing community "buy-in" from those directly affected by the decisions of university officials. As members of the campus community become more involved in decisions that affect their safety, they are more likely to gain a greater appreciation of the hazards present on campus and in the greater Ypsilanti area and take the steps necessary to reduce their impact. Public awareness is a key component of any university's overall mitigation strategy aimed at making a campus safer from the potential effects of hazards.

Public involvement during the development of the EMU Hazard Mitigation Plan was sought using three methods: (1) two public meetings were held during the planning process along with an open, staffed booth in the Student Center, as described above, (2) a public survey was conducted (described below) which permitted open comment; and (3) digital copies of the draft plan deliverables were made available and advertised for public review and comment on the University's website.

The public was provided two opportunities to be involved in the development of the plan at two distinct periods during the planning process: (1) during the drafting stage of the plan – two public meetings; and (2) upon completion of a final draft plan – draft plan review, but prior to official plan approval and adoption. A link to an electronic version of the draft plan was posted and advertised via the University's social media channels and the University's website (March XX, 2024 – April XX, 2024). Appendix C documents these advertisements. The final plan was reviewed and approved by the University President on MONTH DD, 2024 (the adoption resolution can be found in Appendix A).

Public Participation Survey

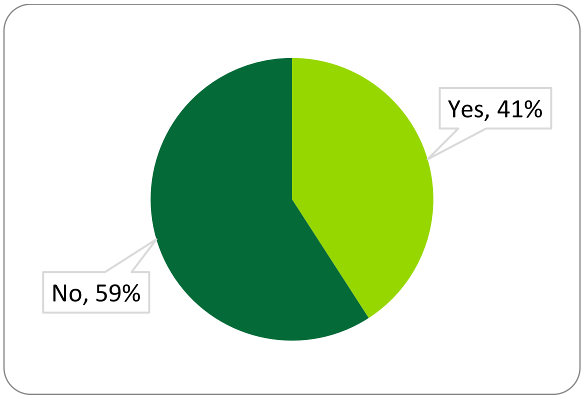
The planning team was successful in getting campus community members to provide input to the mitigation planning process using a Public Participation Survey. The public survey was created to capture concerns and feedback from campus communities, especially those who might not be able to attend public meetings or participate through other means in the mitigation planning process. Details for the Survey results can be found in Appendix B.

A link to an electronic version of each survey was posted and advertised via the University's campuswide listserv (staff, faculty, and students) and the University's website. Public survey links were also disseminated by Mitigation Planning Committee members. Appendix C documents each of these advertisements.

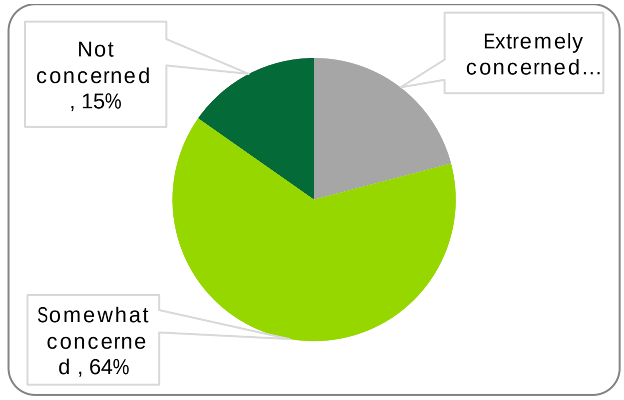
A total of 372 survey responses were received from the campus survey, which provided valuable input for the planning team to consider in the development of the plan. Approximately 98 percent of respondents are affiliated with the campus, while the remaining respondents were community members or others. Selected survey results are presented below. A copy of the survey and a detailed summary of the survey results are provided in Appendix B.

Public Survey Results

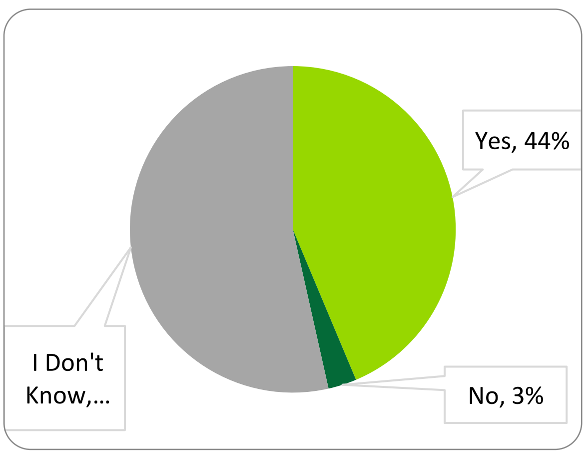
Have you ever experienced or been impacted by a disaster on campus?



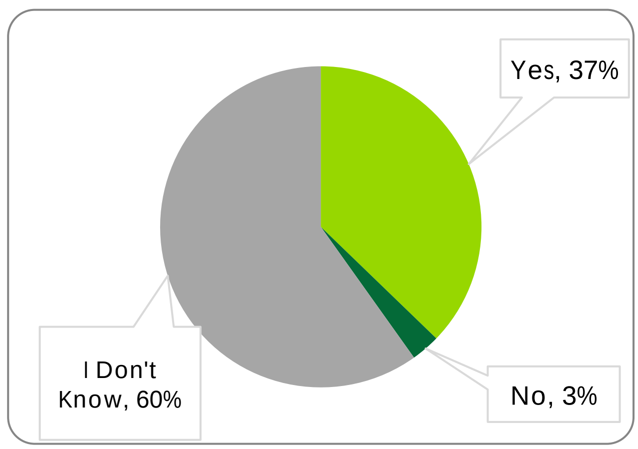
How concerned are you about the possibility of your campus being impacted by a future hazard event?



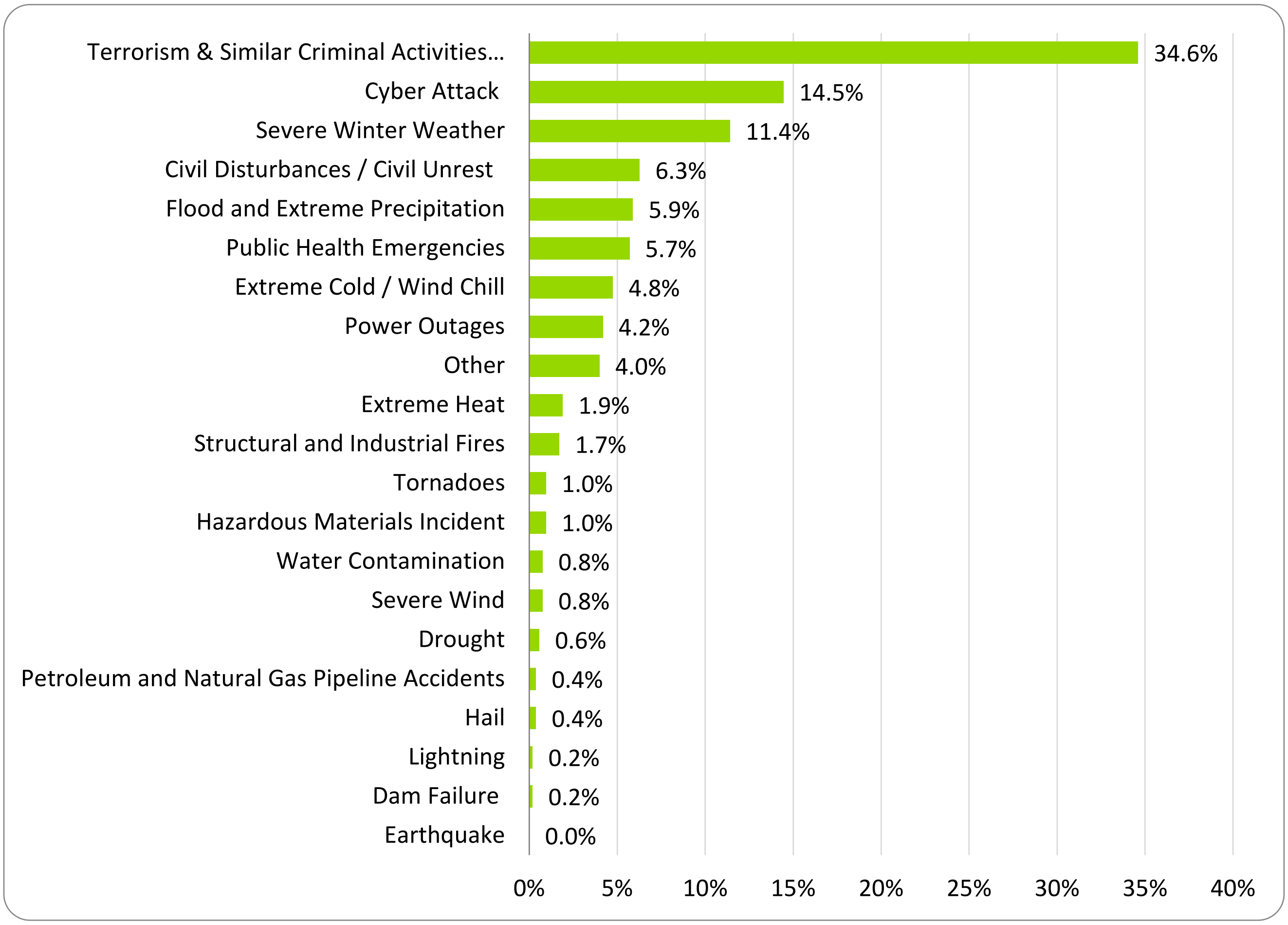
Are some areas of the campus particularly vulnerable to hazards?



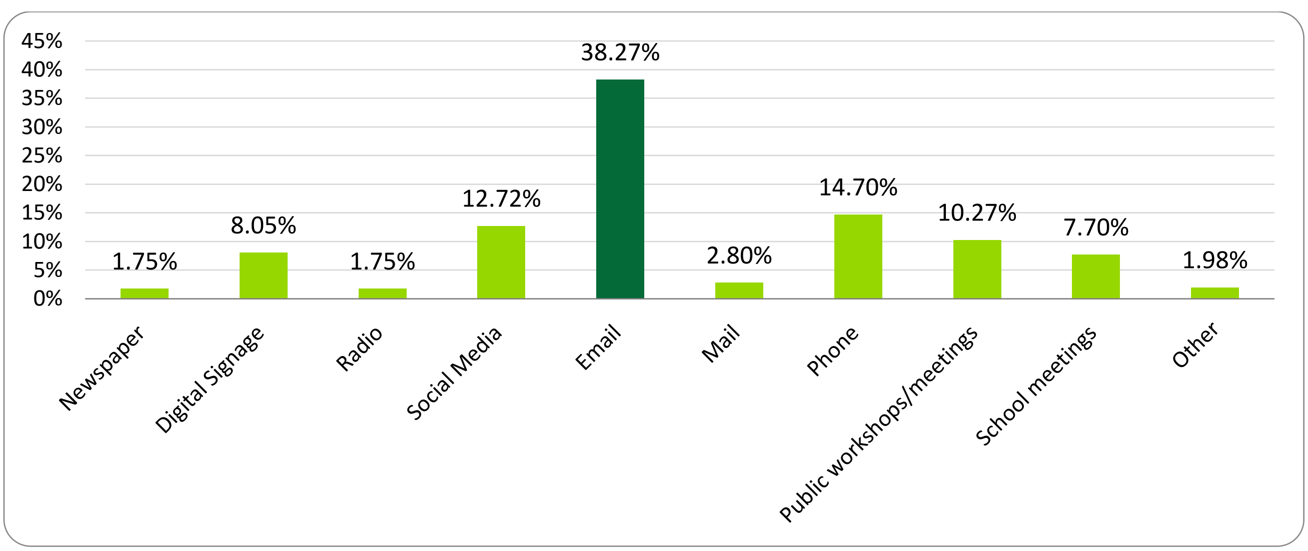
Are some buildings on campus particularly vulnerable to hazards?



Please select the one hazard you think is the greatest threat to the campus:



What is the most effective way for you to receive information about initiatives to make the University more resilient to hazards?



Involving the Stakeholders

44 CFR Requirement
44 CFR Part 201.6(b)(2): *The planning process shall include an opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, and agencies that have the authority to regulate development, as well as businesses, academia and other non-profit interests to be involved in the planning process.*

As demonstration through this section, the planning team worked to provide an opportunity for a wide range of stakeholders, including staff from departments across campus, students, faculty, community members, and others to be involved in the planning process.

In order to involve a wide range of stakeholders, the University made a significant effort to broadly distribute the public survey, advertise public meetings, and solicit comments on the draft plan. The opportunity to be involved and offer input was provided for university officials, students, faculty, staff, and surrounding area community members throughout the mitigation planning process.

Furthermore, the following activities demonstrate broad stakeholder involvement:

- The Mitigation Planning Committee included representation from the Risk and Emergency Management, Environmental Health and Safety, Public Safety, Facilities Planning, the Physical Plant, Housing, Communications, Athletics, the Student Center, and IT, among others.
- Risk assessment data was leveraged from the aforementioned university sources, the county, state, and FEMA.
- The City of Ypsilanti officials and Washtenaw County officials were encouraged to review and provide feedback on the draft plan.
- The final draft plan was publicized on websites for stakeholder comment and review.

Incorporation of Plans, Studies, and Technical Information

44 CFR Requirement
44 CFR Part 201.6(b)(3): *Does the Plan describe the review and incorporation of existing plans, studies, reports, and technical information?*

Several plans and studies have been leveraged during the development of this plan. Each section references these sources at the end, which are mainly found in Section 3 through Section 5. Types of sources leveraged included:

- University planning documents (e.g., capital outlay plans, flood management plans, emergency operations plans)
- Local, state, federal hazard technical information (e.g., USGS Earthquake data, Hazus-MH)
- FEMA hazard mitigation plans and planning guidance

University plans were also queried and reviewed which is discussed further in *Section 5: Capability Assessment*.

Section 3 – Campus Profile

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Introduction and History

Eastern Michigan University (EMU) was founded in 1849, making it the second oldest public university in Michigan.[1] EMU began as a four-acre site in one building. EMU was founded as the Michigan State Normal School and was the first tax-supported college in Michigan open to men and women.[2] The Michigan State Legislature designated EMU as the first institution in Michigan to educate teachers to serve public schools. After a series of additions and changes to the curriculum and programs offered, the school became Eastern Michigan University in 1959.

None of the original buildings from Normal's formative years survive today. Starkweather Hall, and Welch Hall, 2 masonry buildings constructed in 1896 are the only remaining buildings from Normal's early years. The buildings today house administrative and graduate studies offices for EMU.[3] Following rapid expansion in the 1900s, EMU today consists of an 800+ acre campus with 122 buildings on its main campus.[4]

Today, EMU is serves approximately 13,500 students pursing undergraduate, graduate, specialist, doctoral, and certificate degrees. [5] EMU offers more than 300 majors, minors, and concentrations. EMU is among the most diverse public universities in Michigan and is ranked by the U.S. News and World Report in the category of social mobility.

EMU is governed by a board of eight Regents.[6] The Regents are appointed to eight-year terms by the Governor of Michigan.

Geography and Environment

EMU's main campus is located within the City of Ypsilanti in Washtenaw County. EMU is in the lower Great Lakes Region of southeastern Michigan, approximately 35 miles southwest of Detroit. The Huron River runs parallel to most of the main campus just outside of the campus boundary. The University owned golf course is along Ford Lake. The University has grouped areas of the campus into zones, which include North Campus, Mid Campus, South Campus, West Campus, and the Golf Course. The campus zones and the buildings within are presented below by the following figures:

- North Campus: **Figure 3-1**
- Mid Campus: **Figure 3-2**
- South Campus: **Figure 3-3**
- West Campus: **Figure 3-4**
- Golf Couse: **Figure 3-5**

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[1] EMU. (n.d) *About EMU.* Eastern Michigan University. Retrieved on August 17,2023 from Find out more about Eastern Michigan University (emich.edu)
[2] EMU. (n.d). *About Eastern Michigan University.* Eastern Michigan University. Retrieved on August 17, 2023 from About EMU Online - EMU Online (emich.edu)
[3] Wayback Machine. (n.d.) A Brief History of EMU, Retrieved on October 18, 2023, from EMU : Historic Tour (archive.org)
[4] EMU(n.d.) Fast Facts, Retrieved on October 18, 2023 from, Fast Facts - Facts (emich.edu)
[5] EMU. (n.d) *About EMU.* Eastern Michigan University. Retrieved on August 17,2023 from Find out more about Eastern Michigan University (emich.edu)
[6] EMU. (n.d.) *Board of Regents.* Eastern Michigan University. Retrieved on August 17,2023 from Board of Regents - Board of Regents (emich.edu)

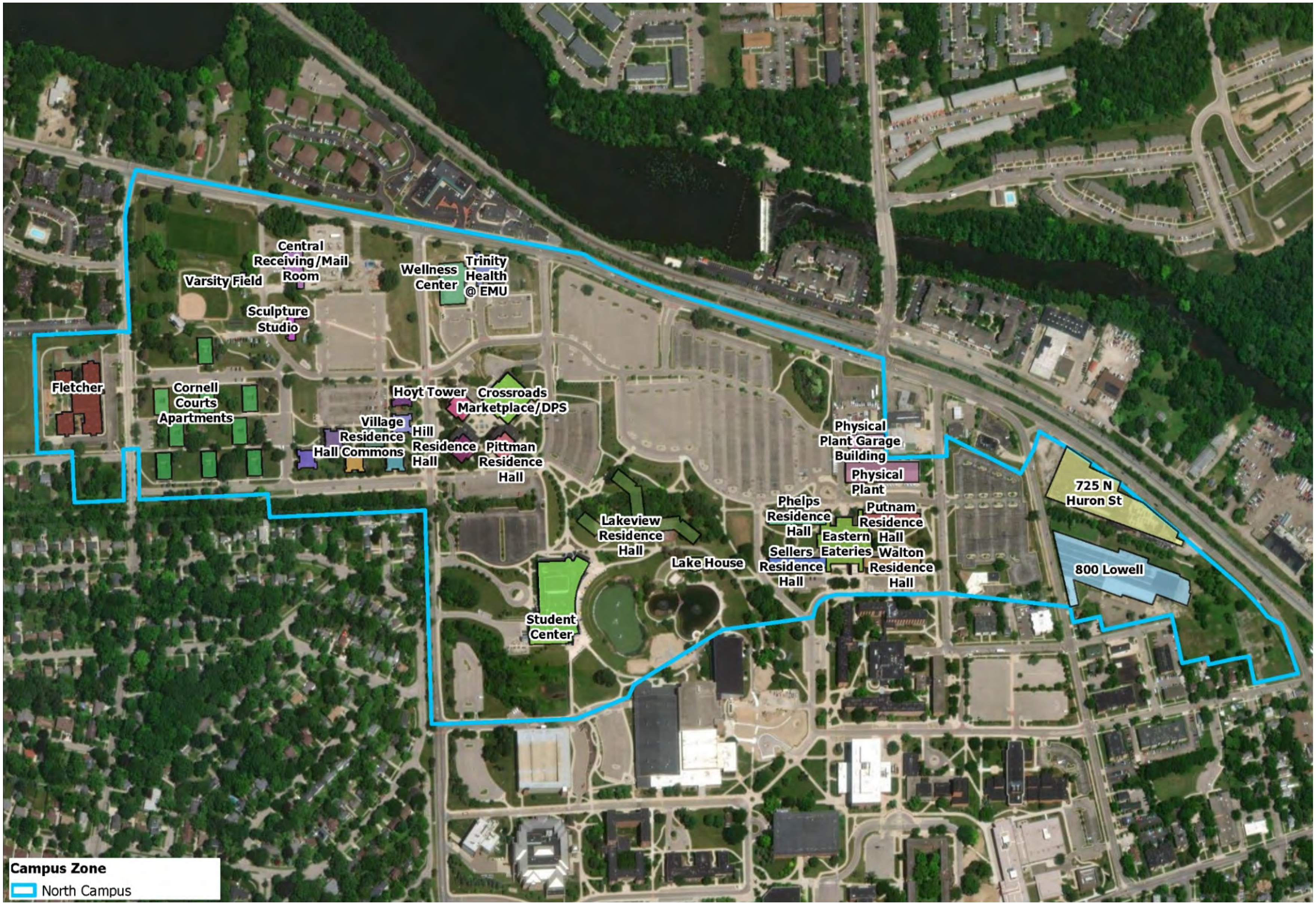

Figure 3-1: EMU North Campus Map

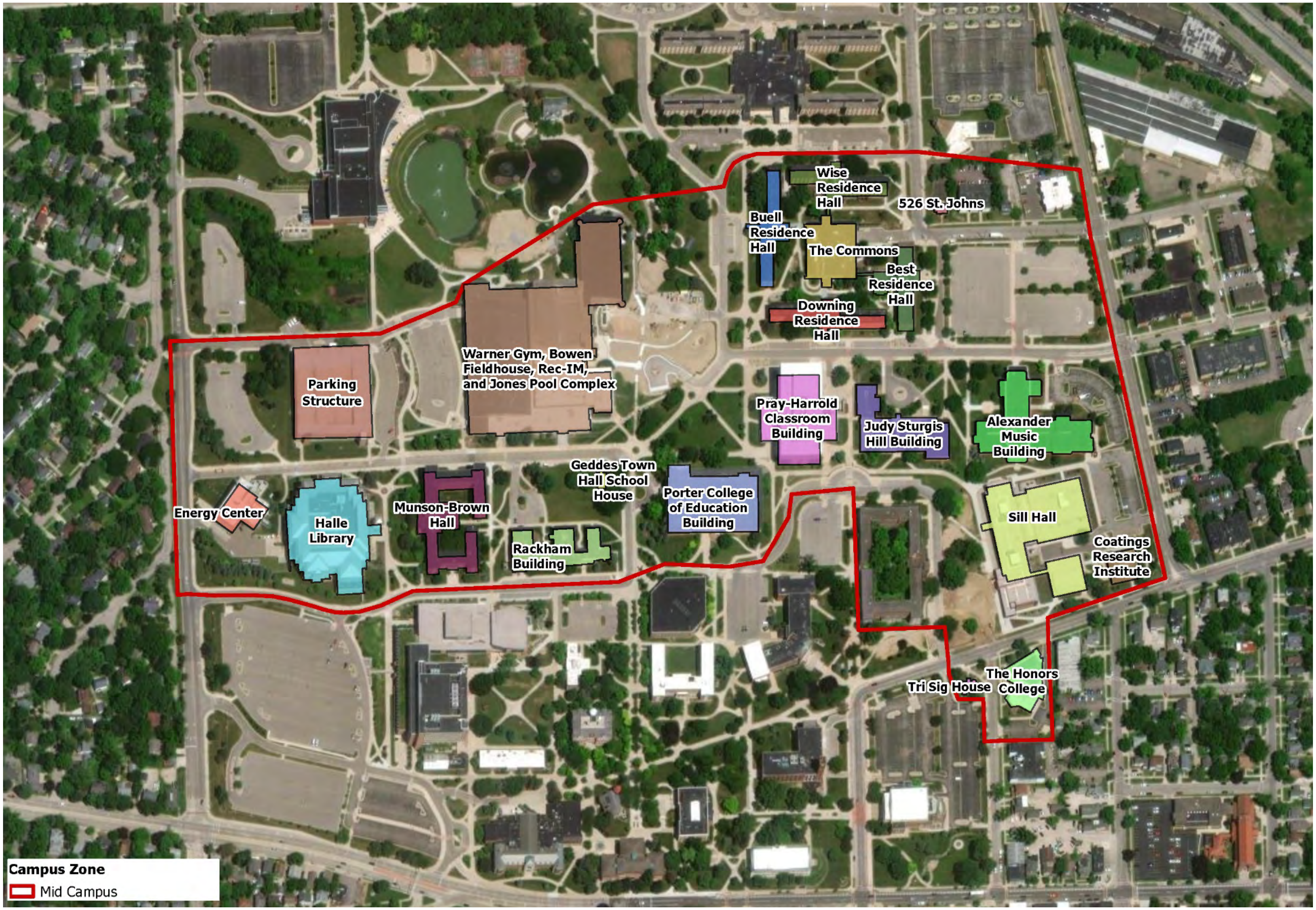

Figure 3-2: EMU Mid Campus Map

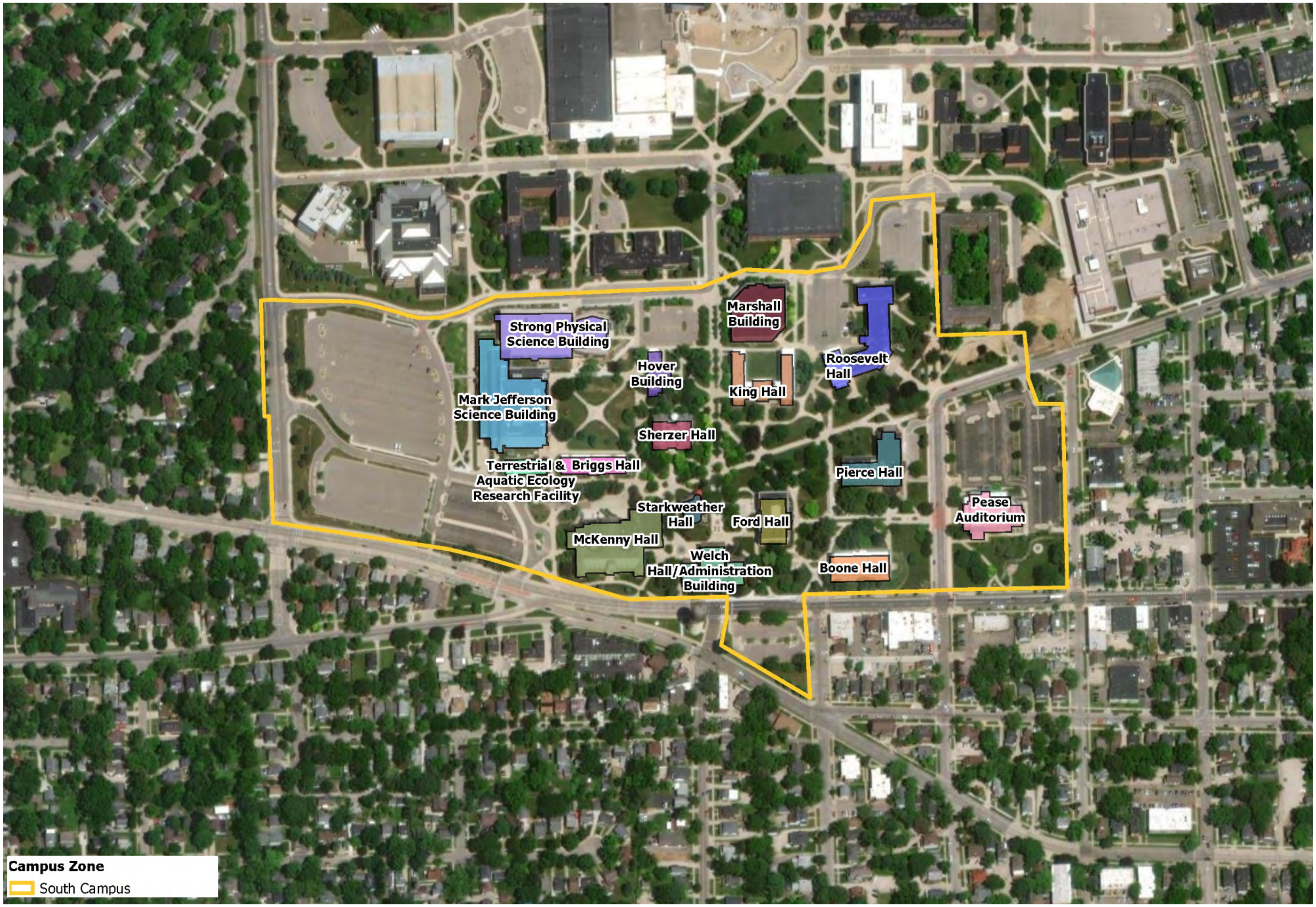

Figure 3-3: EMU South Campus Map

Figure 3-4: EMU West Campus Map

Figure 3-5: Golf Course Campus Map

EMU's gentle rolling river valley topography ranges from approximately 690 feet above sea level to approximately 790 feet.[7] The area enjoys a full four seasons climate with an average annual temperature of approximately 50° F.[8] The region receives 33.7 inches of rainfall, and 45.4 inches of snowfall on average annually. The climate is further characterized by moderate winters normal for the lower Great Lakes Region with hot, humid summer days. Summer high temperatures average in the 80s and only occasionally rise above 90°.

Based on data for the City of Ypsilanti, the campus averages 178 sunny days with the clearest part of the year being June-October. High and low average temperatures range from 28°F to 72°F in the spring, 59°F to 82°F in the summer, 33°F to 75°F in the fall, and 18°F to 36°F in the winter.[9] The coldest temperature recorded at the nearest weather station (located in Ann Arbor) was -22°F (January 1994) while the warmest temperature was 105°F (July 1934).[10]

Snowfall has occurred October through May, although greater snow averages occur in December, January, and February. Most snowfall events in the area result in less than an inch of fresh snow. On average, 31 days a year result in new snow over an inch. Snowstorms resulting in over five inches of snow in a day typically occur a couple times a year in January and February.[11]

In recent decades, data trends show a gradually changing climate. Annual heat days, that is number of days when the "feels like" temperature exceeds 99°F, are projected to rise from 7 to 15 in the next 30 years. Additionally, the likelihood of the campus experiencing a heatwave, that is more than three consecutive hot days, is projected to increase from 51 percent to 80 percent in the next 30 years. [12]

A study conducted at the University of Michigan in the neighboring City of Ann Arbor revealed that the average temperature warmed by 0.7°F from 1951-2014. During that time, annual average precipitation increased by 44 percent. Similarly, heavy precipitation days (in the top 1 percent of daily precipitation totals) increased by 41.2 percent from 1981-2010 when compared to 1951-1980.[13]

Population and Demographics [14]

EMU had over 13,000 students enrolled in the fall of 2023. Enrollment has been consistently falling since 2014. Recent enrollment trends for the University are presented in **Table 3-1.**

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[7] Google. (2022). *Google Earth Pro.*

[8] US Climate Data. (2023). Climate Ypsilanti – Michigan, Retrieved on October 18, 2023 from Climate Ypsilanti - Michigan and Weather averages Ypsilanti (usclimatedata.com)

[9] US Climate Data. (2023). Climate Ypsilanti – Michigan, Retrieved on October 18, 2023 from Climate Ypsilanti - Michigan and Weather averages Ypsilanti (usclimatedata.com)

[10] Ann Arbor U of Michigan. (n.d.) Maximum of Maximum Temperature & Minimum of Minimum Temperature (Degrees Fahrenheit), Retrieved on October 18, 2023 from ANN ARBOR U OF MI, MICHIGAN - Climate Summary (dri.edu)

[11] Weatherspark. (n.d.) Climate and Average Weather Year Round in Ypsilanti, Retrieved on October 18 2023 from, Ypsilanti Climate, Weather By Month, Average Temperature (Michigan, United States) - Weather Spark

[12] Risk Factor. (2023) Heat Risk Overview, Does Ypsilanti have Heat Risk?, Retrieved on October 19, 2023 from, Ypsilanti, MI Heat Factor® | Risk Factor

[13] GLIS. (n.d.) Historical Climatology: Ann Arbor, Michigan, Retrieved on October 18, 2023 from Weatherspark. (n.d.) Climate and Average Weather Year Round in Ypsilanti, Retrieved on October 18 2023 from, Ypsilanti Climate, Weather By Month, Average Temperature (Michigan, United States) - Weather Spark

[14] EMU (2022). Data Book Fall 2023, Retrieved on February 14, 2024 from EMU_Databook_2023_v5.pdf (emich.edu)

Table 3-1: EMU Campus Enrollment Counts

	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Undergraduate	18,208	17,780	17,541	16,997	15,730	14,872	13,572	12,730	11,617	11,129
Graduate	4,053	3,854	3,564	3,316	6,108	2,942	2,752	2,640	2,431	2,223
Grand Total	22,261	21,634	21,105	20,313	18,838	17,814	16,324	15,370	14,048	13,352

Based on the 2023 data, there is a disparity between male and female enrollment. Nearly 39 percent of total enrolled students identifying as male, and 61 percent as female. The racial characteristics of the 2023 student population are presented in **Table 3-2.** Generally, white students make up the majority of the student population, comprising 57 percent of the population. Black students were the next largest proportion of the population, at 17 percent.

Table 3-2: Race/Ethnicity of Enrolled Students

	White	Black	Hispanic/ Latino	Nonresident Alien	Other/ Uknown
Undergraduate	55%	18%	10%	5%	13%
Graduate	69%	12%	3%	7%	10%
Total	**57%**	**17%**	**9%**	**5%**	**12%**

In addition to students, the University employs faculty and staff, with over 1,800 employees in 2023. **Table 3-3** presents recent employment trends in terms of faculty and staff for EMU.

Table 3-3: Faculty and Staff Count

Employment Type	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24
Faculty	1,282	1,214	1,140	1,110	1,069	1,014
Staff	948	888	869	842	797	851
Total	**2,230**	**2,102**	**2,009**	**1,952**	**1,866**	**1,865**

Housing, Infrastructure, and Land Use

Housing

EMU offers a variety of on-campus housing for more than 3,000 students who live on campus in residence halls and apartments.[15] EMU provides on-campus housing for undergraduate students and graduate students. The University has a current initiative as a part of the EMU Welcome Home Plan to transform on-campus student housing.[16] The University has recently upgraded three residence halls and is constructing two new apartment buildings. The Lakeview Apartments and Westview Apartments are scheduled to be opened in Fall 2024. Over the next several years EMU will be demolishing multiple resident halls (Jones/Goddard Hall, Brown/Munson Apartments, Hoyt Hall, Hill Hall, Pittman Hall, Best Hall, and Buell Hall). Aside from on-campus options, students live off-campus in houses, apartments, and fraternity/sorority houses. A majority of students live off-campus and commute to EMU's campus.

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[15] EMU Housing Residence Life. (2023). *Guide to Campus Living 2023-2024.* Retrieved from GTCL2324.pdf (emich.edu) on October 26, 2023.
[16] EMU. (n.d.). *Welcome Home: Campus Living Redefined.* Retrieved from New Student Housing & Renovations at EMU - Welcome Home Plan (emich.edu) ono October 26, 2023.

Infrastructure

Infrastructure includes the fundamental facilities and systems serving the campus. These include the transportation network, utilities, and community facilities that provide essential services to the campus and much of its faculty, students, and staff. EMU maintains a variety of infrastructure including roads, sidewalks, stormwater management infrastructure and most of the campus power supply. EMU's Physical Plant is an organization dedicated to maintaining the physical environment of the University.[17] The Physical Plant includes Facilities/Maintenance and Facilities Planning and Construction.

Transportation

Transportation facilities on campus include roadways, curbs, and walking paths. EMU maintains 5.2 miles of roads, 17.6 miles of curbs, and 22.9 miles of sidewalks.[18]

Some of the major roads used to access the campus facilities internally include:

- College Place
- West Forest Avenue
- West Circle Drive
- East Circle Drive
- Ann Street
- Westview Street

Park EMU, managed by LAZ Parking, is responsible for the operation of EMU's parking system.[19] This includes management of the permit system, parking enforcement, customer service, motorist assistance, and most parking facility maintenance. The EMU parking system consists of over 9,000 parking spaces spread throughout 36 parking lots and 1 parking garage.

EMU does not run its own transit system. Students can get discounted bus passes from The Ann Arbor Area Transportation Authority (TheRide) which operates public transit for the greater Ann Arbor-Ypsilanti area.[20]

An active rail line runs adjacent to the University. Amtrak passenger service and Norfolk Southern freight traverse on the Norfolk Southern rail lines adjacent to the University's campus. This rail line connects to Detroit to the east and Jackson, Battle Creek, Kalamazoo, and Chicago, Illinois to the west.

The Detroit Metropolitan Airport is the largest airport serving southeastern Michigan including EMU. The airport currently offers non-stop commercial flights to over 140 destinations and serves approximately 36.7 annual passengers.[21] This airport is approximately 15 miles from the Ypsilanti campus. Willow Run Airport in Van Buren Charter Township provides freight, corporate, charter, and general aviation and is located approximately 5 miles from EMU.[22] Ann Arbor Municipal Airport is located west of campus in Pittsfield Township approximately 10 miles from EMU. The airport is owned and operated by the City of Ann Arbor and maintains a

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[17] Physical Plant. (n.d). *Physical Plant.*. Retrieved on October 26, 2023 from [Eastern Michigan University: Physical Plant (emich.edu)](#).
[18] Physical Plant. (n.d). *Facilities Planning Services.* Retrieved on October 26, 2023 from [Eastern Michigan University: Physical Plant (emich.edu)](#).
[19] LAZ Parking. (n.d.) *About ParkEMU.* Retrieved on October 26, 2023 from [About ParkEMU | LAZ Parking | Eastern Michigan University Parking](#).
[20] TheRide. (n.d.). *Who We Are.* Retrieved on October 26, 2023 from [About | TheRide](#).
[21] DTW. (n.d). *About DTW.* Retrieved on October 26, 2023 from [About DTW | Wayne County Airport Authority (metroairport.com)](#).
[22] Willow Run Airport. (n.d.). *Services.* Retrieved on October 26, 2023 from [Services | Willow Run Airport](#).

3,500-foot concrete runway and a 2,750-foot turf runway to serve public and business flights, medical flights, flight instruction and charter service.[23]

Utilities

EMU maintains its own energy system, which includes a 55-ton cogeneration system that supplies nearly 98 percent of the heat, and 93 percent of the electricity required on the 800-acre campus, making the University almost entirely energy self-sufficient.[24] Additional infrastructure services present on campus but maintained by others include water, sewer, and supplemental power supply. Water and sewer services are provided by Ypsilanti Community Utilities Authority (YCUA) and supplemental power is provided by DTE Energy.

Campus Facilities

EMU's campus is home to many significant campus facilities.

The EMU **Student Center** is the hub of the campus. The Student Center offers a variety of programs, services, and facilities including dining options, meeting spaces, shopping choices, study space, and student services.[25]

Figure 3-6: EMU Student Center[26]

McKenny Hall was the first student union on campus when it opened in 1931. The historic building houses event space, the Alumni Tower, a gallery of historic EMU artifacts, and administrative offices.[27]

The **Mark Jefferson Science Complex** features technologically modern classrooms, state-of-the-art teaching and research labs, and dedicated study/interaction areas as shown in **Figure 3-7**.[28] The building allows for interdisciplinary research including chemistry, biology, physics/astronomy, psychology, and geology.

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[23] Ann Arbor Airport. (n.d). *Ann Arbor Airport Services.* Retrieved on October 26, 2023 from Ann Arbor Airport (a2gov.org).
[24] EMU. (n.d.) Sustainable Campus Infrastructure, Retrieved on September 13, 2023 from, Sustainable Campus Infrastructure - Sustainability (emich.edu)
[25] EMU. (n.d). *Student Center.* Retrieved on October 26, 2023 from Student Center - Student Center (emich.edu).
[26] Geoff Larcom. (March 2017). *Eastern Michigan University Student Center ranked number one student union in the county.* EMU Today. Retrieved on October 26, 2023 from Eastern Michigan University Student Center ranked number one student union in the country - EMU Today (emich.edu).
[27] EMU. (n.d.). *McKenny Hall.* Retrieved on October 26, 2023 from McKenny Hall - Book EMU (emich.edu).
[28] EMU Department of Chemistry. (n.d). *Chemistry Facilities.* Retrieved on October 26, 2023 from Chemistry Facilities - Chemistry (emich.edu).

Figure 3-7: Mark Jefferson Science Complex

The **Warner Gym, Bowen Fieldhouse, Rec IM, and Jones Pool Complex** is made up of multiple buildings for recreation. The complex is one of the largest recreational facilities in Michigan with five stories and over 188,000 square feet of space.[29] The complex includes an indoor track, exercise classrooms, basketball courts, volleyball courts, fitness studios, fitness training rooms, racquetball courts, and Jones Pool.

Rynearson Stadium is the home venue for the EMU football and track teams as shown in **Figure 3-8**.[30] The stadium is set up with a capacity of 30,2000 but can expand for larger crowds. The stadium includes the Student-Athletic Performance Center in the north end zone. The playing field is a FieldTurf surface.

Figure 3-8: Aerial view of Rynearson Stadium

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[29] REC/IM. (n.d.) *Facilities.* Retrieved on October 26, 2023 from [EMU Rec/IM Center Facilities - REC/IM (emich.edu)].
[30] EMU. (n.d). *Rynearson Stadium.* Retrieved on October 26, 2023 from [Rynearson Stadium - Facilities - Eastern Michigan University Athletics (emueagles.com)]

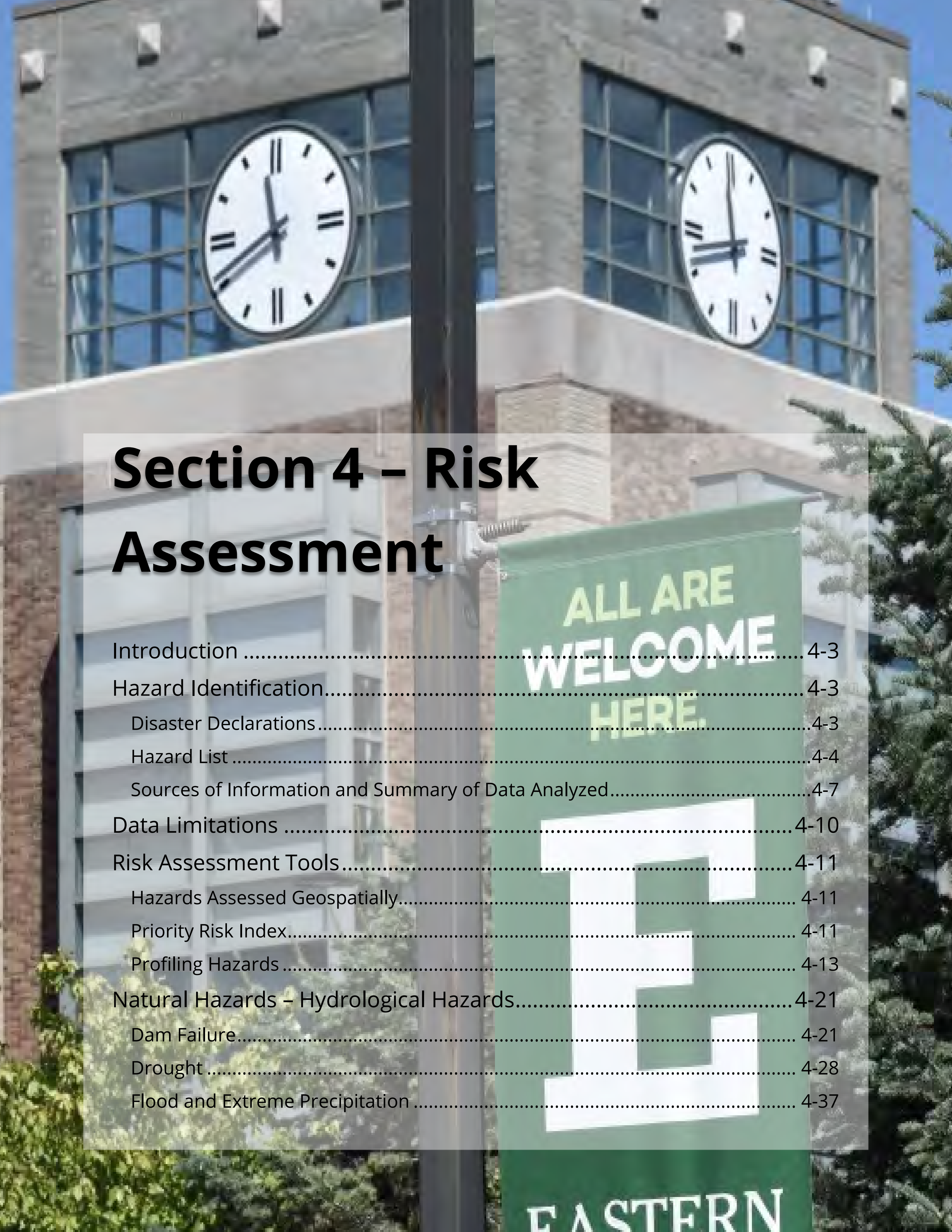
Land Use

The University is currently developing an updated Campus Master Plan which will determine the need for and location of new facilities and open space. There are additional planning efforts such as Capital Plans which the University utilizes to plan for infrastructure and building improvements and upgrades. These plans are discussed in *Section 5 – Capability Assessment*.

North Campus is primarily residential and student services focused. The zone contains residence halls, apartments, Trinity Health, Eastern Eateries, and the Student Center. In addition, some administrative buildings are on North Campus such as the Department of Public Safety, and Physical Plant. **Mid Campus** is primarily academic focused and contains classroom buildings and Halle Library. In addition, there are some residence halls and the Olds-Robbs Student Recreation Center. **South Campus** is also primarily academic focused and contains classroom buildings, the Mark-Jefferson Science Building, and Pease Auditorium. **West Campus** is primarily athletics focused and contains Rynearson Stadium, several sports fields, and the Indoor Practice Facility. The Golf Course Campus zone contains the golf course and associated training facilities.

Aside from the main campus described above, the University owns additional properties off campus. Most of these sites are field laboratories for ecological research such as the Fish Lake Environmental Education Center, Jean Noble Parsons Center for the Study of Art and Science, and Loesell Field Laboratory.[31] This plan focuses on EMU's main campus in Ypsilanti.

[31] EMU Department of Biology. (n.d). *Field Sites.* Retrieved on October 26, 2023 from Field Sites - Biology (emich.edu).



Section 4 – Risk Assessment

Introduction

This chapter provides an assessment of risk for natural, technological, and human-caused hazards that could impact Eastern Michigan University (EMU). This section is specific to EMU's Ypsilanti campus. All identified hazards include a profile inclusive of a vulnerability assessment.

Each hazard profile includes a description of the hazard, previous occurrences and damages incurred, extent (or magnitude) of the hazard, and likelihood or probability of the hazard occurring in the future. EMU's critical facilities and assets have been examined to estimate the potential health, life safety, property damages, and reputational risks attributable to hazards. This is typically a qualitative assessment; however, when data permits, a quantitative analysis was performed (including potential dollar losses). In addition, each hazard profile includes climate change considerations, as applicable.

Hazard Identification

Hazard identification is the process of identifying the types of hazards that can affect the mitigation plan study area – EMU. Hazards were identified from various sources, including the 2013 EMU Multi-Hazard Mitigation Plan, the State of Michigan Hazard Mitigation Plan, and previous disaster declarations. Input from the planning team was also solicited and used to identify hazards. These sources and the process are explained further below.

Disaster Declarations

Since 1965, five hazard events have resulted in damage severe enough to warrant a federal Presidential Disaster Declaration in the planning area. Presidential Disaster Declarations are declared at the county-level; therefore, declarations made for Washtenaw County were considered as relevant to EMU. Details for these declarations are presented in **Table 4-1.**

Table 4-1: Historic Presidential Disaster Declarations for Washtenaw County

Date	Disaster Number	Description
04/14/1965	190	Tornadoes and Severe Thunderstorms
09/08/1980	631	Severe Storms and Flooding
06/30/2004	1527	Severe Storms, Tornadoes, and Flooding
03/27/2020	4494	COVID-19 Pandemic
07/15/2021	4607	Severe Storms, Flooding, and Tornadoes

Hazard List

To determine the hazards to be included in the 2023 EMU Hazard Mitigation Plan, hazards from the 2013 EMU Multi-Hazard Mitigation Plan were reviewed along with hazards listed in the State of Michigan Hazard Mitigation Plan. Input was gathered from the Steering Committee to discern hazards that should be added or removed from a preliminary list derived from the plans above. Hazards were reviewed at the Steering Committee Hazard Mitigation Kickoff Meeting and finalized afterward. **Table 4-2** presents the final hazards list for this plan update and whether each hazard was recognized in the State of Michigan Hazard Mitigation Plan and 2013 EMU Multi-Hazard Mitigation Plan. **Table 4-3** indicates the hazards from the State of Michigan Hazard Mitigation Plan that were excluded from this plan update and provides a justification for exclusion.

Table 4-2: Hazards included in 2023 EMU Hazard Mitigation Plan

2023 EMU Identified Hazards	Michigan SHMP Identified Hazard (YES/NO)	Included in 2013 EMU Multi-Hazard Mitigation Plan (YES/NO)
NATURAL HAZARDS – WEATHER HAZARDS		
Extreme Cold/Wind Chill	YES (as Extreme Cold)	YES (under Ice Storm and Severe Snowstorm)
Extreme Heat	YES	NO
Hail	YES	NO
Lightning	YES	NO
Severe Winter Weather	YES	YES (under Ice Storm and Severe Snowstorm)
Severe Winds	YES	YES
Tornadoes	YES	YES
NATURAL HAZARDS – HYDROLOGICAL HAZARDS		
Dam Failure	YES	NO
Drought	YES	NO
Flood and Extreme Precipitation	YES	YES
NATURAL HAZARDS – GEOLOGICAL HAZARDS		
Earthquakes	YES	YES
TECHNOLOGICAL HAZARDS – INDUSTRIAL AND INFRASTRUCTURE HAZARDS		
HAZMAT – fixed and transportation	YES	YES
Nuclear Power Plant Incidents	YES	NO
Petroleum and Natural Gas Pipeline Accidents	YES	YES (under Infrastructure Failure non-IT or electric)
Power Outages	YES (as Energy Emergencies and Infrastructure Failure)	YES (under Electric Infrastructure Failure)
Structural and Industrial Fires	YES	YES
Water Contamination	YES (under Infrastructure Failure)	YES (under Infrastructure Failure non-IT or electric)

2023 EMU Identified Hazards	Michigan SHMP Identified Hazard (YES/NO)	Included in 2013 EMU Multi-Hazard Mitigation Plan (YES/NO)
HUMAN-CAUSED HAZARDS		
Civil Disturbances	YES	YES
Cyber-Attacks	YES	YES – under IT Systems Failure
Public Health Emergencies	YES	YES (Influenza Outbreak/Pandemic, Public Health Emergency, Food Contamination)
Terrorism and Similar Criminal Activities	YES	YES (Armed Suspect/Active Shooter/Hostage Situation, Improvised Explosive Device Detonation, Bomb Threat)

Table 4-3: Hazards excluded from the 2023 EMU Hazard Mitigation Plan

Michigan SHMP Identified Hazards (Excluded from 2023 EMU Hazard Mitigation Plan)	Justification
NATURAL HAZARDS – WEATHER HAZARDS	
Ice and Sleet Storms	Covered under the Severe Winter Weather hazard profile.
Snowstorms	Covered under the Severe Winter Weather hazard profile.
Fog	The Steering Committee agreed that fog is not of great concern to University Operations.
NATURAL HAZARDS – HYDROLOGICAL HAZARDS	
Great Lakes Shoreline Hazards	EMU does not have facilities on the shoreline of the Great Lakes.
NATURAL HAZARDS – ECOLOGICAL HAZARDS	
Invasive Species	The Steering Committee agreed that invasive species are not of great concern to University assets or operations.
Wildfire	According to the USDA Wildfire Risk to Communities Project, which integrates Wildfire Hazard Potential data, populated areas of Ypsilanti are not likely to be impacted directly or indirectly by wildfires.[1] Ypsilanti was designated as have a low risk to wildfire that is lower than 99% of communities in the United States. No census blocks within the Ypsilanti are designated as wildland-urban-interface areas, five census blocks are indicated as medium density wildland-urban-intermix areas, and two census blocks are indicated as low density intermix areas (with no high). In addition, the Steering Committee indicated that wildfires are not a hazard of concern.

[1] USDA. Wildfire Risk to Communities. Retrieved from Wildfire Risk to Communities.

Michigan SHMP Identified Hazards (Excluded from 2023 EMU Hazard Mitigation Plan)	Justification
NATURAL HAZARDS – GEOLOGICAL HAZARDS	
Subsidence	Steering Committee members agreed that subsidence is not an issue faced by the community and noted that future subsidence is not anticipated. In the State of Michigan Hazard Mitigation Plan, Washtenaw County was not identified for potential subsidence hazards related to mining. Subsidence events caused by water main breaks or failure of conveyance systems are addressed under the *Water Contamination* profile.
Space Weather / Meteorites	The Steering Committee agreed that celestial impacts are not of great concern to the community and noted a lack of historical impacts.
TECHNOLOGICAL HAZARDS – INFRASTRUCTURE PROBLEMS	
Infrastructure Failures	This hazard will be considered for all applicable hazards as a potential vulnerability. Water main breaks are addressed under the *Water Contamination* hazard profile.
Energy Emergencies	This hazard will be considered for all applicable hazards as a potential vulnerability and predominantly addressed under the *Power Outage* hazard profile.
Major Transportation Accidents	This hazard will be considered for all applicable hazards as a potential vulnerability.
HUMAN RELATED HAZARDS	
Catastrophic Incidents (National Emergencies)	National emergencies are not within the scope of this plan.
Nuclear Attack	This hazard is addressed under terrorism. In addition, mitigation of a nuclear attack would likely occur at the national level. Nuclear Power Plant Incidents are addressed under the Nuclear Power Plant Incidents hazard profile.

Sources of Information and Summary of Data Analyzed

Hazard information and data was collected for all hazards from hazard studies, geographic information systems (GIS) spatial data, climate change reports, and descriptions of previous events. This information is cited throughout the plan.

University Data

University sources used in the risk and vulnerability assessment include:

- University reports, plans, and studies, including:
    - 2013 EMU Multi-Hazard Mitigation Plan
    - 2023 EMU Emergency Response Procedures Guide
    - 2022 EMU Annual Security and Annual Fire Safety Report
    - University 2023 Statement of Values
    - 2018 EMU Campus Evacuation Plan
    - EMU Data Books, Fall 2019 through Fall 2023
    - 2023 EMU Pandemic Response Plan
    - 2023 EMU Campus-Wide Business Continuity Plan
    - 2023 Liquid Damage Prevention Program and Flood Response Plan
    - EMU Capital Outlay Plan FY2024
    - Sporting Events Plan Sample – Football gameday Operations Plan 2023
    - Building Emergency Plan Sample – Buell Hall
- Information gathered from the Project Management Team and Steering Committee meetings and calls
- Information recorded by the Steering Committee in the ArcGIS Online Hazardous Materials Application
- EMU Building Footprints
- EMU Parcel Footprints
- EMU Maintenance Claims data

The consulting team worked with the Project Management Team and Steering Committee to combine EMU data sources and information to produce a building footprints database in ArcGIS. The buildings footprints database contains the following fields:

- Building Name
- Campus Subdivision
- Building Category
- HAZMAT Rating
- Historical Marker Presence
- Critical Facility
- Critical IT
- Statement of Value

Since the last plan in 2013, several new buildings that are either under construction or committed to begin construction were added to the buildings database. For these buildings, the consulting team used available plans to create the building footprints. These buildings include:

- GameAbove Golf Performance Center
- Lakeview Residence Hall
- Westview Residence Hall

There were several existing buildings that were not included in the University's existing buildings footprints. These buildings were added to the buildings database based on aerial imagery and available plans. These buildings include:

- The Honors College
- Parking Structure
- 725 N Huron Street
- 800 Lowell
- Wellness Center
- Trinity Health @ EMU
- Westview Residence Hall
- Eagle Crest Golf Athletic Training Facility

University critical facilities were designated in the database based on their identified importance to continued operation of the University and were vetted by the Project Management Team and Steering Committee. These critical facilities provide essential functions for students, faculty, and staff and were identified as vital during and after an emergency or hazardous event. The critical facilities are shown in **Table 4-4.**

Table 4-4: EMU Critical Facilities

Critical Facilities	
Best Residence Hall	Pray-Harrold Classroom Building
Buell Residence Hall	Putnam Residence Hall
Coatings Research Institute	Rynearson Football Stadium
Cornell Courts Apartments	Sellers Residence Hall
Crossroads Marketplace/DPS	Sill Hall
Downing Residence Hall	Student Center
Eastern Eateries	The Commons
Energy Center	Tri Sig House
George Gervin GameAbove Center	Village Residence Hall A
Hill Residence Hall	Village Residence Hall B
Hoyt Tower	Village Residence Hall C
Lakeview Residence Hall	Village Residence Hall Commons
Mark Jefferson Science Building	Village Residence Hall D
Marshall Building	Village Residence Hall E
Munson-Brown Hall	Village Residence Hall F
Phelps Residence Hall	Walton Residence Hall

Critical Facilities	
Physical Plant	Wellness Center
Physical Plant Garage Building	Westview Residence Hall
Pierce Hall	Wise Residence Hall
Pittman Residence Hall	-

Local Data

Local sources used in the risk and vulnerability assessment include:

- City of Ypsilanti plans, reports, and studies
- City of Ann Arbor plans, reports, and studies
- Washtenaw County studies and reports applicable to the planning area
- Washtenaw County geospatial data
- Local news sources (e.g., M Live, Ann Arbor News)

State sources used in the risk and vulnerability assessment include:

- The 2019 State of Michigan Hazard Mitigation Plan
- The 2020 Michigan Hazard Analysis (Supplement to the 2019 Michigan Hazard Analysis)
- Michigan state agency maps, data, reports, and webpages applicable to the planning area, including but not limited to those from the Michigan Department of Natural Resources, Michigan Department of Environmental Quality, Michigan Emergency Management & Homeland Security, and Michigan Dam Inventory
- Great Lakes Integrated Sciences Assessment (GLISA)

Federal Data

Federal sources used in the risk and vulnerability assessment include agency studies, maps, geospatial data, and reports applicable to the planning area, including but not limited to the following:

- Federal Emergency Management Agency (FEMA) mapped flood hazard areas
- National Oceanic and Atmospheric Association (NOAA) National Centers for Environmental Information (NCEI) Storm Events Database
- National Risk Index
- US Fourth National Climate Assessment
- US Drought Monitor data
- Environmental Protection Agency (EPA) information
- US Geological Survey (USGS) data and information
- National Hydrography Dataset data and information
- US DOT Pipeline Hazard Safety Administration data
- US DOT roads and railroads

- US Transportation Safety Administration information
- US Centers for Disease Control information
- US Climate Resilience Toolkit

Data Limitations

Although the University has a wealth of available data, data limitations do constrict the risk analysis at certain points. Data limitations include:

- Previous occurrences for many hazards were gathered from the NOAA NCEI Storm Events Database, which is not reflective of all hazard events that have occurred. In general, the Storm Events Database includes events that are noted on through news sources and/or weather radios. It also does not include specific insurance claims. Therefore, the occurrence of certain hazards is likely under-reported.
- Hazard data, including previous occurrences and risk information, is often available at the county-level or city-level, and events specific to the campus could not be identified. Additional sources for previous occurrences, such as claims data and stakeholder input, were considered when available.
- Building values obtained from the University are from 2023, however there are a few buildings that were not included in the study.
- Not all hazards have identified geographic boundaries therefore, a GIS Intersection analysis could not be performed to identify vulnerable buildings, infrastructure, and populations. In this case, it was assumed that all current and future buildings and populations are at risk.
- Several different sources of climate change data were used to analyze future risk. Different sources use different scenarios, geographic regions, and timelines. Therefore, projections are not always consistent. In addition, future conditions (e.g., emissions, radiative forcing, subsequent impacts) are difficult to predict, and there is a known uncertainty associated with climate projections and models. Uncertainty differs for hazards; for instance, temperature models are considered more certain than precipitation models. For certain hazards, climate impacts were not available or were inconclusive.
- Infrastructure and utility data for the campus was not available.

Risk Assessment Tools

Hazard information was collected for all hazards under consideration using hazard studies, GIS data, and descriptions of previous events. This information is cited throughout the plan.

Hazards Assessed Geospatially

Hazard information was collected for all hazards under consideration using hazard studies, GIS data, and descriptions of previous events. This information is cited throughout the plan.

GIS tools provide a mechanism to perform quantitative analysis. Hazards that have specified geographic boundaries permit analysis using GIS. Profiled hazards that were assessed using GIS include:

- Earthquake
- Flood and Extreme Precipitation
- Hazardous Materials Releases

The objective of the GIS-based analysis was to inform exposure of critical facilities and structures for the identified hazards on campus using best available geospatial data. ESRI® ArcGIS Pro™ 2.9 was used to assess hazard vulnerability utilizing digital hazard data, such as FEMA Flood Insurance Rate Maps (FIRMs). Using these data layers, hazard vulnerability can be assessed by estimating the number, type, and value of structures determined to be in identified geographic hazard area boundaries.

Priority Risk Index

The prioritization and categorization of identified hazards for EMU is based largely on the Priority Risk Index (PRI), a tool used to measure the degree of risk for identified hazards in a particular planning area. The PRI was used to assist the Mitigation Planning Committee in identifying hazards that pose the most significant threat to the University.

The PRI results provide a numerical value for each hazard, allowing hazards to be ranked against one another (i.e., the higher the PRI value, the greater the hazard risk). PRI values are obtained by assigning varying degrees of risk to five categories for each hazard: probability, impact, spatial extent, warning time and duration. Each degree of risk has been assigned a value (1 to 4) and a weighting factor.

To calculate the PRI value for a given hazard, the assigned risk value for each category is multiplied by the weighting factor. The sum of all five categories equals the final PRI value, as demonstrated in the example equation below:

PRI VALUE = [(PROBABILITY x .30) + (IMPACT x .30) + (SPATIAL EXTENT x .20) + (WARNING TIME x .10) + (DURATION x .10)]

According to the weighting scheme applied, the highest possible PRI value is 4.0. **Table 4-5** shows the weighting schemes for each category. By determining a value for each hazard that can be compared to other hazards threatening the planning area, hazards can be ranked with greater ease.

Many of the PRI categories are described within the hazard profiles. The final PRI results, including the calculated values for each hazard on campus, are found at the end of this section in the "Summary of Overall Risk."

Table 4-5: Priority Risk Index Scoring Criteria

PRI Category	Level	Criteria	Index Value	Assigned Index Value
Probability	Unlikely	Less than 10 percent annual probability	1	30 percent
	Possible	Between 10 and 50 percent annual probability	2	
	Likely	Between 50 and 90 percent annual probability	3	
	Highly likely	90 percent+ annual probability	4	
Impact	Minor	Only minor property damage and minimal disruption to government functions and services.	1	30 percent
	Limited	Minor injuries are possible. More than 10 percent of buildings damaged or destroyed.	2	
	Critical	Multiple deaths/injuries possible. More than 25 percent of buildings damaged or destroyed.	3	
	Catastrophic	High number of deaths/injuries possible. More than 50 percent of buildings damaged or destroyed.	4	
Spatial Extent	Negligible	Limited to one specific area.	1	20 percent
	Small	Small areas affected.	2	
	Moderate	Large areas affected.	3	
	Large	All areas affected.	4	
Warning Time	More than 24 hours	self-explanatory	1	10 percent
	12 to 24 hours	self-explanatory	2	
	6 to 12 hours	self-explanatory	3	
	less than 6 hours	self-explanatory	4	
Duration	less than 6 hours	self-explanatory	1	10 percent
	6 to 12 hours	self-explanatory	2	
	12 to 24 hours	self-explanatory	3	
	More than 24 hours	self-explanatory	4	

Profiling Hazards

The hazard profiles are presented by hazard category type: Natural (weather, hydrological, geological); Technological (Industrial and Infrastructure); and Human-Caused Hazards. The hazard categories are described below:

- **Natural hazard:** an event that occurs within nature, such as earthquakes, hurricanes, tornadoes, and floods.
- **Technological hazard:** An event that occurs due to a technological failure such as utilities, hazardous materials releases, etc.
- **Human-caused hazard:** An event that occurs due to human intervention either accidental or planned such as civil disturbance, terrorism, etc.

Specific hazards being considered under each category are defined below.

NATURAL HAZARDS – WEATHER HAZARDS • Extreme Cold/Wind Chill • Extreme Heat • Hail • Lightning • Severe Winter Weather • Severe Winds • Tornadoes	NATURAL HAZARDS – HYDROLOGICAL HAZARDS • Dam Failure • Drought • Flood and Extreme Precipitation
NATURAL HAZARDS – GEOLOGICAL HAZARDS • Earthquake	TECHNOLOGICAL HAZARDS – INDUSTRIAL HAZARDS • HAZMAT – fixed and transportation • Nuclear Power Plant Incident • Petroleum and Natural Gas Accident • Power Outage • Structural and Industrial Fires • Water Contamination
HUMAN-CAUSED HAZARDS • Civil Disturbances • Cyber-Attacks • Public Health Emergencies • Terrorism and Similar Criminal Activities	

44 CFR Requirement
44 CFR 201.6(c)(2)(i) and 44 CFR 201.6(c)(2)(iii): *Does the Plan include a description of the type, location, and extent of all natural hazards that can affect each jurisdiction?* ***44 CFR 201.6(c)(2)(i):*** *Does the Plan include information on previous occurrences of hazard events and on the probability of future hazard events for each jurisdiction?* ***44 CFR 201.6(c)(2)(ii):*** *Is there a description of each identified hazard's impact on the community as well as an overall summary of the community's vulnerability for each jurisdiction?*

As noted above, each hazard is profiled separately to describe the hazard and potential impacts to the University. Where data exists, specific information on hazard location will also be included. When applicable, impacts from climate change are integrated throughout each hazard profile. The profile for each hazard includes:

- Description: A scientific explanation of the hazard including potential magnitude (or severity) and impacts (including climate change considerations);
- Location: Geographical extent of the hazard;
- Previous occurrences: The number of previous impacts from the hazard on the Ypsilanti campus in the past;
- Extent (or magnitude): The severity of the hazard in the past and potential severity in the future. Measures may include wind speed, wave height, or property damage, for example;
- Probability of future events: The likelihood of future events impacting the University. Given that an exact probability is often difficult to quantify, this characteristic is categorized into ranges to be used in hazard profiles:
    - Unlikely: Less than 10 percent annual probability
    - Possible: Between 10 percent and 50 percent annual probability
    - Likely: Between 50+ percent and 90 percent annual probability
    - Highly Likely: Greater than 90 percent annual probability
- Vulnerability assessment: The vulnerability assessment investigates the potential number of and type of structures at risk, potential dollar loss, and potential impacts resulting from each hazard based on available data and information. When applicable, the vulnerability assessment will address the following potential vulnerabilities to each hazard:
    - Impact on buildings and critical facilities, including potential structural damage to buildings or other property damage. The types of critical facilities that are affected are also described;
    - Damage to critical infrastructure;
    - Impacts to health and life safety;
    - Social Vulnerability;
    - Economic impacts due to the University's ability to operate soundly; and
    - Future conditions and how they may affect the hazard impacts.

The University has grouped areas of the campus into zones, which include North Campus, Mid Campus, South Campus, West Campus, and the Golf Course. Sub-campuses and the buildings within are presented below by the following figures:

- North Campus: Figure 4-1
- Mid Campus: Figure 4-2
- South Campus: Figure 4-3
- West Campus: Figure 4-4
- Golf Couse: Figure 4-5

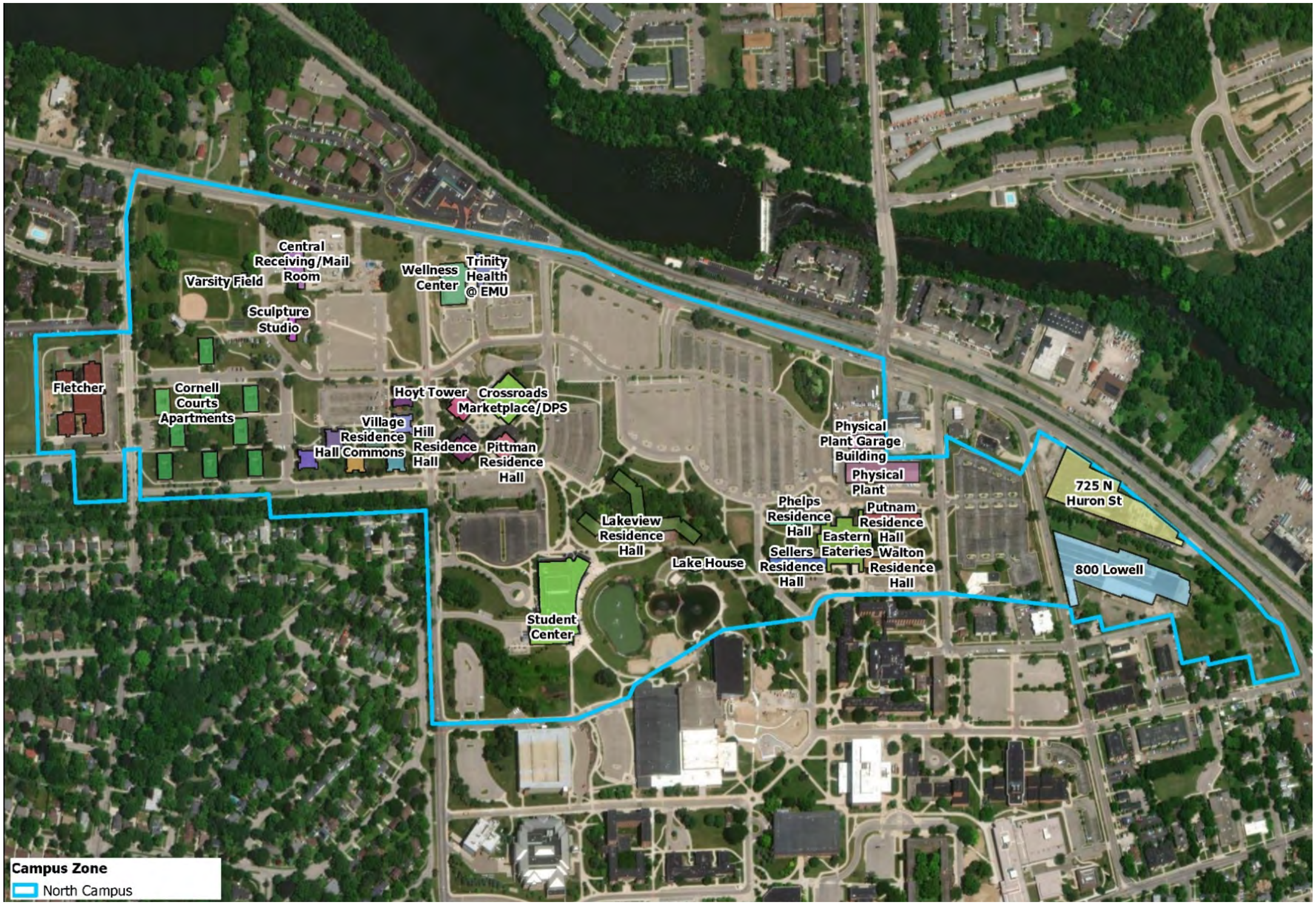


Figure 4-1: EMU North Campus Map

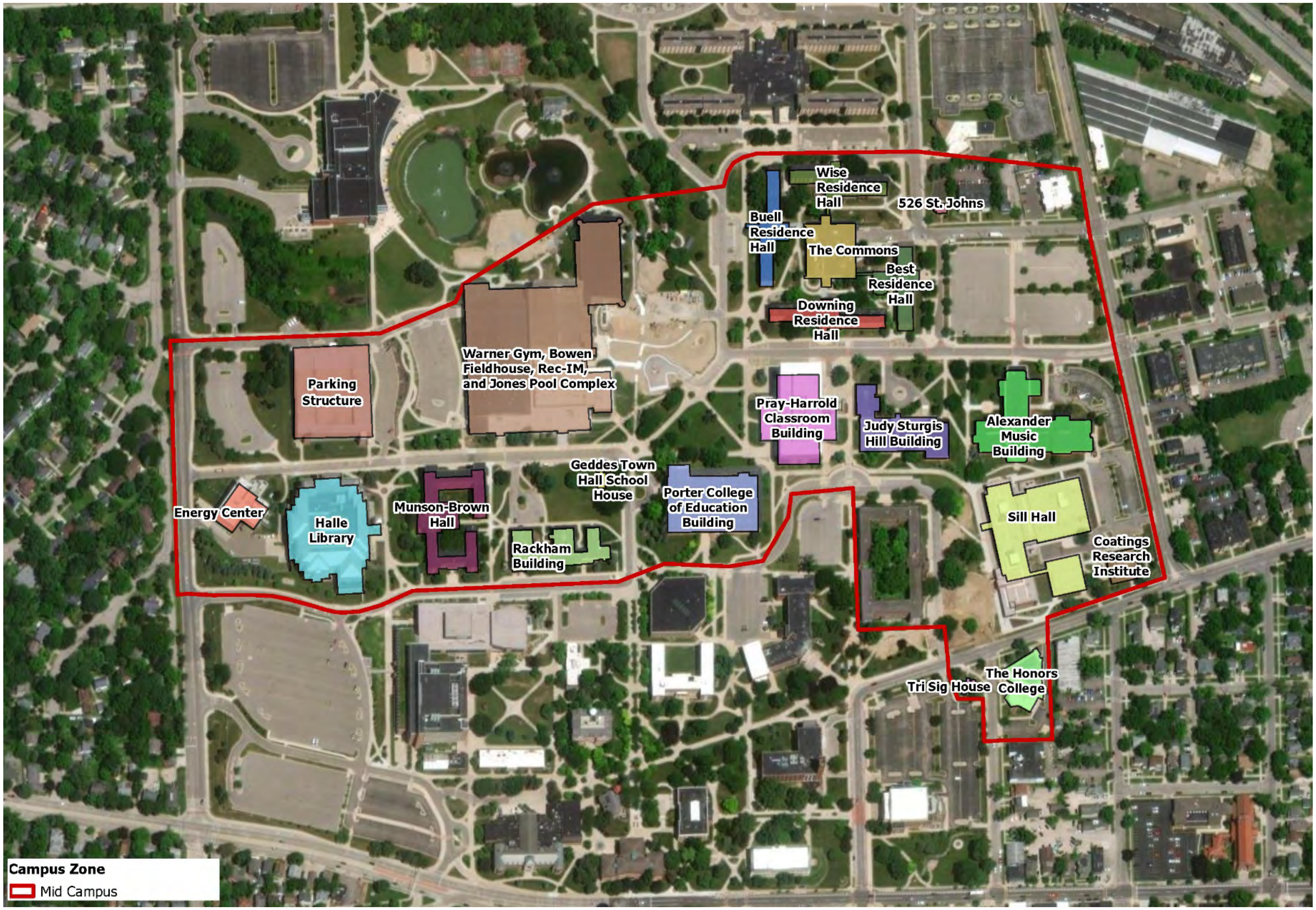


Figure 4-2: EMU Mid Campus Map

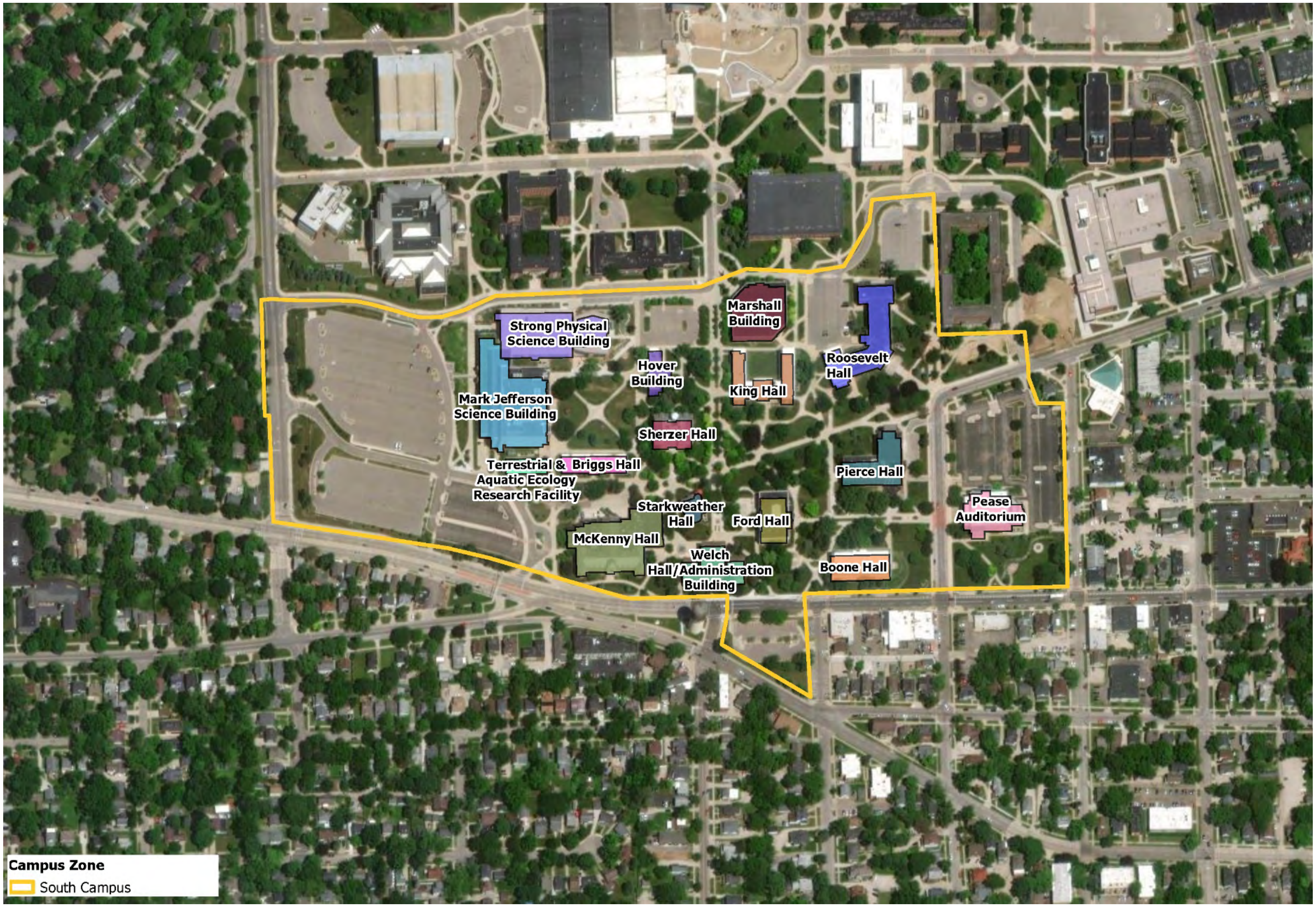


Figure 4-3: EMU South Campus Map

Figure 4-4: EMU West Campus Map

Figure 4-5: Golf Course Campus Map

Natural Hazards – Hydrological Hazards

Dam Failure

Description

A dam is an artificial barrier constructed across a stream channel or a man-made basin for the purpose of storing, controlling, or diverting water. Dams typically are constructed of earth, rock, concrete or mine tailings. The area directly behind the dam where water is impounded or stored is referred to as a reservoir.

A dam failure is the partial or total collapse, breach or other failure of a dam that causes flooding downstream. Dam failures can result from natural events such as a flood event, earthquake or landslide, human-induced events such as improper maintenance, or a combination of both. In the event of a dam failure, the people, property, and infrastructure downstream could be subject to devastating damage.

Dam failures can result from one or more of the following:

- Prolonged periods of rainfall and flooding (the cause of most failures);
- Inadequate spillway capacity resulting in excess flow overtopping the dam;
- Internal erosion caused by embankment or foundation leakage;
- Improper maintenance (including failure to remove trees, repair internal seepage problems, maintain gates, valves and other operational components, etc.);
- Improper design (including use of improper construction materials and practices);
- Negligent operation (including failure to remove or open gates or valves during high flow periods);
- Failure of an upstream dam on the same waterway;
- Landslides into reservoirs which cause surges that result in overtopping of the dam;
- High winds which can cause significant wave action and result in substantial erosion; and
- Earthquakes which can cause longitudinal cracks at the tops of embankments that can weaken entire structures.

Although dam failure is not considered a direct result of a changing climate, changes in climate can impact dams and their functionality. In the Great Lakes Region, increases in precipitation, especially in extreme rainfall events, may result in dam failure due to flooding or inadequate spillway capacity. Decreased snow accumulation and snowfall (falling instead as rain) due to warmer temperatures may have similar impacts.

Dam regulation and classification in Michigan:

The Dam Safety Program administers the provisions of Part 307 (Inland Lake Levels) and Part 315 (Dam Safety) of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended to address dam safety and operation concerns for non-hydropower generating dams.

There are over 2,500 dams in the state, 235 of those are regulated under the Inland Lake Levels Part and 813 regulated by the Dam Safety part.[2]

Inland Lake Levels, Part 307, regulates dams that establish legal lake levels while Dam Safety (Part 315), regulates non-power dams over six feet in height and with more than five acres impounded during the design flood. A DEQ permit must be acquired prior to any construction or repair of regulated dams. Additionally, these dams must be inspected every three to five years based on hazard potential rating. Staff in the Dam Safety program are responsible for reviewing all inspection reports, inspecting all department owned dams, and inspecting municipal dams if requested.

Location

Areas downstream of dams are considered at risk, especially those within mapped inundation areas. The U.S. Army Corps of Engineers National Inventory of Dams (NID) [3] lists three dams that have potential inundation areas that could impact EMU's campus. The three dams are presented in **Table 4-6.**

Table 4-6: Dams Potentially Impacting the EMU Campus

Name	Owner	River	Hazard Potential Class
Geddes Dam	City of Ann Arbor	Huron River	High
Superior Dam	City of Ann Arbor	Huron River	High
Peninsular Paper Dam	City of Ypsilanti	Huron River	High

All three dams are classified as High Hazard Potential Dams (HHPDs) in the NID. HHPDs are those in which a failure or faulty operation may result in loss of life, economic impacts, environmental impacts, and lifeline impacts. HHPDs do not classify the condition of the dam or risk of the dam failing.

The City of Ann Arbor completed dam failure analyses for the Geddes and Superior Dam, including 5-mile inundation areas. Maps of dam inundation areas potentially impacting EMU are included in the *Vulnerability Assessment*, below. The Peninsular Paper Dam is owned and operated by the City of Ypsilanti. At the time of this report, dam failure analyses maps are not available for the dam. The City of Ypsilanti is currently working to remove the Peninsular Paper Dam.[4] In 2014, the Michigan Department of Environment, Great Lakes, and Energy (EGLE) performed an inspection of the dam and required the City of Ypsilanti to either bring the dam up to safety standards or remove the dam. In 2019, the Ypsilanti City Council voted to approve the removal of the dam. The city has taken several steps to prepare for the removal of the dam

[2] Department of Environment, Great Lakes, and Energy. (n.d). *Program Overview.* Department of Environment, Great Lakes, and Energy. Retrieved on August 21, 2023 from [Program overview (michigan.gov)]
[3] From the "National Inventory of Dams", U.S. Army Corps of Engineers, https://nid.usace.army.mil/#/
[4] Referenced from the webpage "Ypsilanti Peninsular Paper Dam", Huron River Watershed Council, https://www.hrwc.org/what-we-do/programs/dams-and-impoundments-program/ypsilanti-peninsular-paper-dam/

including a feasibility study (2018)[5], design and analysis (2022)[6], and draft dam impoundment restoration plan (2022)[7]. The removal of the dam will include the expansion of Peninsular Park. **Figure 4-6** shows the location of the NID-listed dams that could potentially impact the University's campus.

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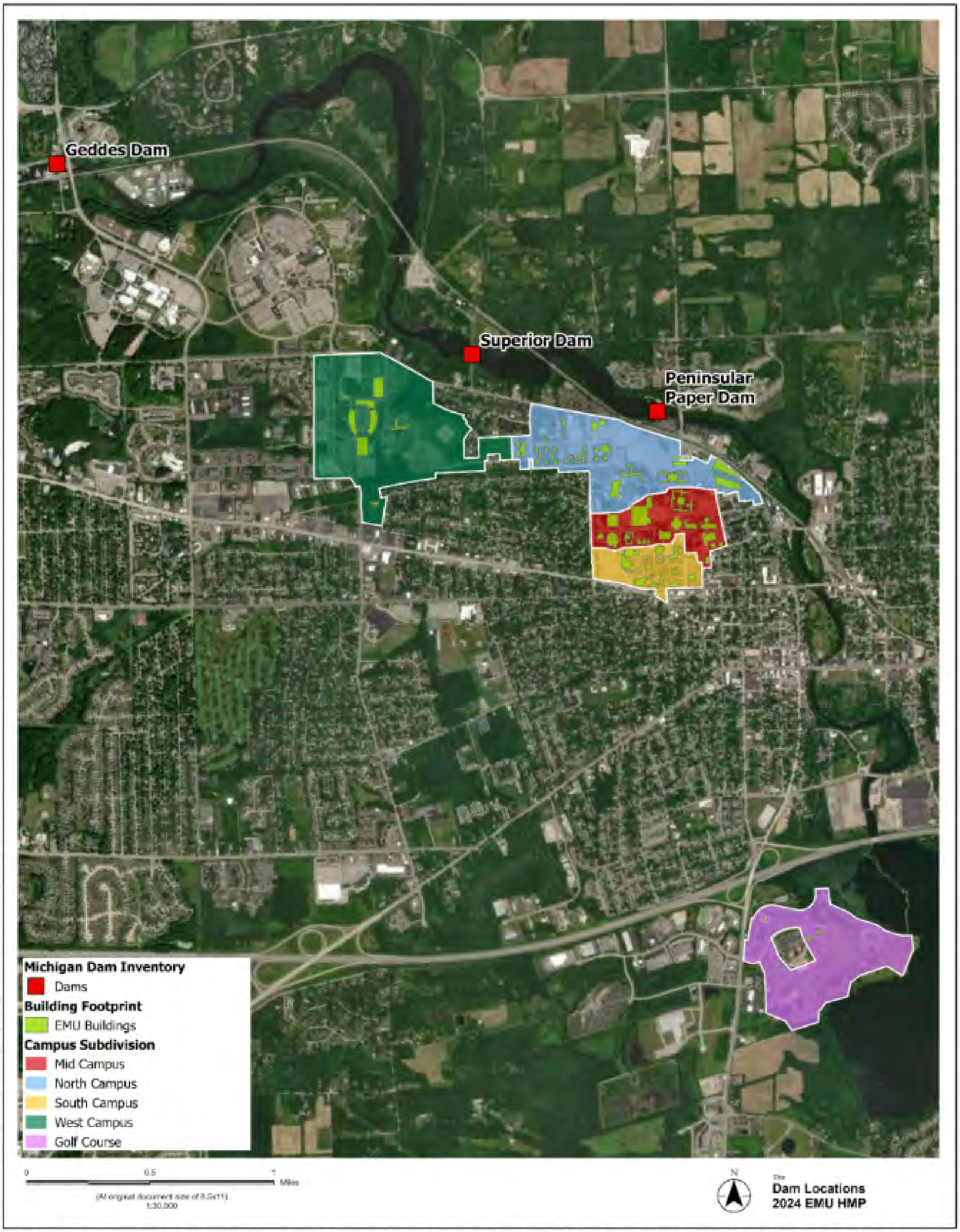
[5] See "Peninsular Paper Dam: Dam Removal Assessment and Feasibility Report", Princeton Hydro (2018), https://www.hrwc.org/wp-content/uploads/PeninsularPaperDamRemovalFeasibilityReportFinal-1.pdf

[6] See "Removal Design and Supporting Analysis of Peninsular Paper Dam on the Huron River in Ypsilanti, MI", LimnoTech (2022), https://www.hrwc.org/wp-content/uploads/Pen_Dam_LimnoTech_2022_Report_Final_Combined.pdf

[7] See "DRAFT Peninsular Paper Dam Impoundment Restoration Plan", Huron River Watershed Council (2022), https://www.hrwc.org/wp-content/uploads/Pen-Dam-Impoundment-Restoration-Plan-Draft-2022-03.pdf



Disclaimer: This document has been prepared based on information provided by others as cited in the Notes section. Stantec has not verified the accuracy and/or completeness of this information and shall not be responsible for any errors or omissions which may be incorporated herein as a result. Stantec assumes no responsibility for data supplied in electronic format, and the recipient accepts full responsibility for verifying the accuracy and completeness of the data.

Figure 4-6: Dam locations in proximity to EMU

Previous Occurrence

As noted by the *2022 Ann Arbor Hazard Mitigation Plan*[8], there is only one recorded instance of dam failure with the Geddes and Superior Dams. In 1968, excessive flooding caused the failure of the Argo and Geddes dams. There was no loss of life or injury from the failure. The dams were rebuilt by 1972. No known impact to EMU was reported.

The Peninsular Paper Dam was originally constructed in 1867 and replaced in 1914.[9] In 1918, the dam failed following heavy rains. It was reported that the waters of the Huron River rose over 12 feet in 10 minutes damaging several bridges along the Huron River. No known impact to EMU was reported with this event.

Extent

Dam failure extent can be measured in terms of loss or life or property, or by amount of water released. Due to the limited number of historic events, the extent of dam failure impacting EMU's campus is difficult to determine, as no deaths or damage costs have been reported. However, loss of life and property due to dam failure is possible. The 1918 failure of the Peninsular Paper Dam resulted in the damage of several bridges along the Huron River.

Probability

With only two reported events potentially impacting the campus, dam failure is not a common occurrence in proximity to EMU's campus; only one occurrence has been reported approximately every 27 years.

Probability of dam failure could increase with changing climate conditions. Increases in precipitation, especially in the frequency and intensity of extreme events, could increase the probability that dams will fail or overtop. Warmer temperatures may negate some of the flooding effects of increased precipitation but may also result in more snow falling as rain.

Considering the above, a probability of unlikely (less than 10 percent annual chance) was assigned to the dam failure hazard.

Vulnerability Assessment

All current and future buildings, infrastructure, and populations in dam inundation areas are considered at risk to dam failure. No dollar losses are reported as a result of dam failure on EMU's campus.

The City of Ann Arbor completed dam failure analyses for the Geddes and Superior Dams. The analyses evaluate impacts on structures, infrastructure, and populations in dam inundation areas (1-mile and 5-mile inundation areas). This assessment considers impacts in the 5-mile inundation zone to include all at-risk areas. The failure analyses were completed over five years

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[8] See "2022 City of Ann Arbor Hazard Mitigation Plan", City of Ann Arbor, https://www.a2gov.org/departments/fire/emergency-management/Documents/FINALA2_HMP_2022_FINAL_WITH_APPENDICES_redacted_reduced.pdf

[9] From "Peninsular Dam & Power Plant", Alvin Rudisill (2008), *Ann Arbor Library District,* https://aadl.org/ypsigleanings/19529

ago. The 2022 Ann Arbor Hazard Mitigation Plan Update noted that the city would benefit from updated, more robust dam failure analysis.[10] For the Dam Failure assessment of the Geddes and Superior Dams, campus facilities and assets were compared to the dam failure inundation zones as shown in **Figure 4-7** and **Figure 4-8**.

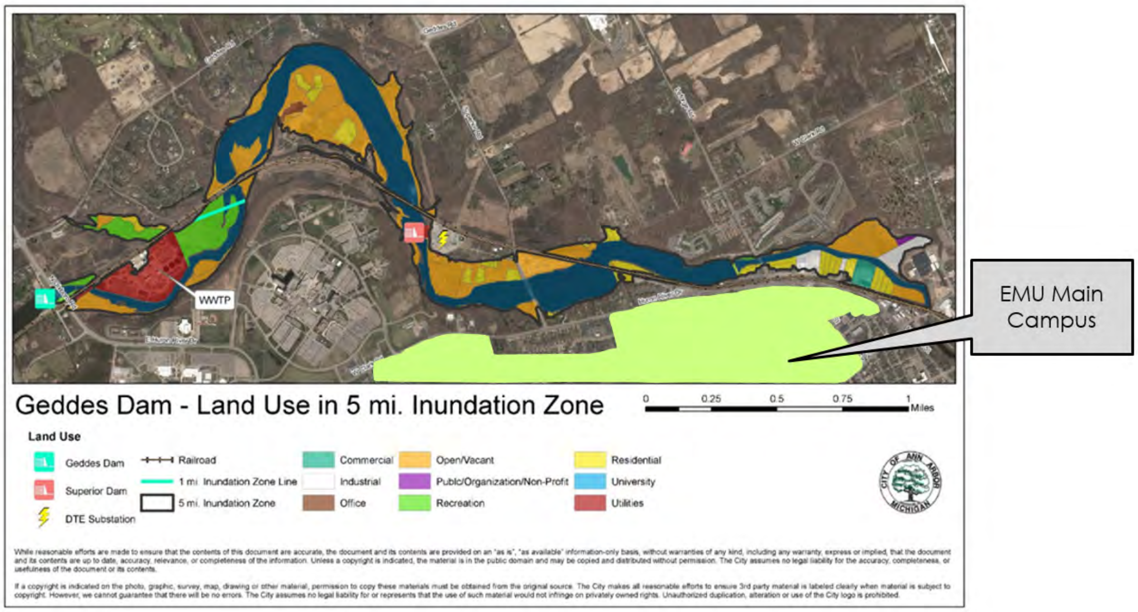

Figure 4-7: Geddes Dam Inundation Zone with EMU Superimposed

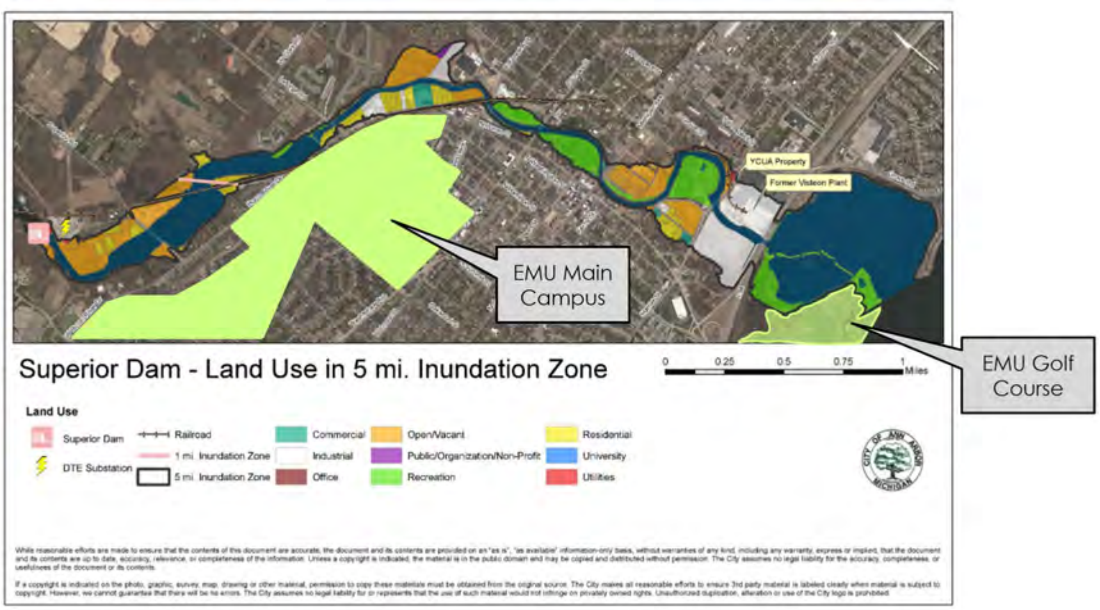

Figure 4-8: Superior Dam Inundation Zone with EMU Superimposed

[10] See "2022 City of Ann Arbor Hazard Mitigation Plan", City of Ann Arbor, https://www.a2gov.org/departments/fire/emergency-management/Documents/FINALA2_HMP_2022_FINAL_WITH_APPENDICES_redacted_reduced.pdf

No main campus facilities are shown to be within the Geddes or Superior Dam inundation zones. In the case of failure of the Superior Dam, the edges of the EMU Golf Course are shown to have some inundation. However, the inundation is not shown to impact any of the buildings associated with the golf course.

As noted previously, inundation maps for the Peninsular Paper Dam are not currently available at the time of this report. The dam was last inspected on June 7, 2022, and was found to be in poor condition. As the City moves forward with removing the dam, EMU should be engaged throughout the process to ensure there are no impacts to campus. Additionally, the floodplain will be affected by the removal of the dam. As stated in the DRAFT Peninsular Paper Dam Impoundment Restoration Plan[7]:

- The anticipated water level drop varies significantly throughout the impoundment, generally with the greatest drop in water level near the location of the existing dam.
- Conditions and depth in the river channel after removal are expected to be very similar to conditions and depths currently downstream of the dam.
- Hydraulic modelling shows the statistical risk of damaging floods (FEMA 100-year flood) will be significantly reduced to homes and property adjacent to the current impoundment.

As the *Peninsular Paper Dam Impoundment Restoration Plan* is a **draft** report, EMU should actively monitor the progression of the dam removal project and the potential impacts to campus.

While not managed by the University, damage to infrastructure located within inundation areas could impact the campus through power outages or water contamination. Further, access to campus could be impacted in the event that highways, local roads, railroads, or bridges are inundated during a dam failure event and deemed impassable.

All populations within dam inundation areas are considered at-risk to dam failure. This includes populations who reside in inundation areas, as well as populations in the inundation area for work or recreation. While the University does not have buildings within dam inundation areas, students, faculty, or staff living in off-campus housing may live in the area. Dam failure can result in injuries and loss of life and result in the need for evacuations.

Climate change can have many indirect impacts on dam failure. The cause of most dam failures is flooding from prolonged periods of rainfall. In the planning area, increased precipitation, and increases in extreme precipitation events, can increase the likelihood of dam failure due to increased flooding or inadequate spillway capacity. Warmer temperatures resulting in decreased snow accumulations and more snow falling as rain could have a similar effect. Further, many dams, including the ones analyzed for this plan, were constructed 30 or more years ago, and were originally designed based on climate conditions effective at the time of construction. Dam upgrades and renewals should consider changing climate conditions; such actions are typically addressed in a dam management plan and are out of the scope of this plan.

Drought

Description

Drought is conceptually defined by the National Drought Mitigation Center as "a protracted period of deficient precipitation resulting in extensive damage to crops, resulting in loss of yield." Although sometimes considered a rare and random event, drought is a normal, recurrent feature of climate. Climatic factors such as high temperatures, high wind, and low relative humidity are often associated with drought. Drought occurs in virtually all climatic zones, varying significantly from one region to another, and can be defined according to meteorological, hydrological, agricultural, socioeconomic, or ecological criteria, as categorized in **Table 4-7**.[11] Drought is differentiated based on the use and need for water.

Table 4-7: Drought Classification Definitions

Drought Classification	Description
Meteorological Drought	The degree of dryness or departure of actual precipitation from an expected average or normal amount based on monthly, seasonal, or annual time scales. (Dry weather patterns dominate an area; can begin/end rapidly).
Hydrological Drought	The effects of precipitation shortfalls on stream flows and reservoir, lake, and groundwater levels. (Low water supply is evident; conditions take longer to develop and then recover.
Agricultural Drought	Soil moisture deficiencies relative to water demands of plant life, usually crops. (Crops significantly affected).
Socioeconomic Drought	The effect of demands for water exceeding the supply because of a weather-related supply shortfall.
Ecological Drought	A prolonged and widespread deficit in naturally available water supplies — including changes in natural and managed hydrology — that create multiple stresses across ecosystems

The severity of a drought depends on the degree of moisture deficiency, the duration, and the size and location of the affected area. It is generally difficult to pinpoint the beginning and the end of a drought. Because the impacts of a drought accumulate slowly at first, a drought may not be recognized until it has become well established. Even during a drought there may be one or two months with above average precipitation totals. These wet months do not necessarily signal the end of a drought and generally do not have a major impact on moisture deficits. Droughts can be short, lasting just a few months. Conversely, they can persist for several years before regional climate conditions return to normal. While drought conditions can occur at any

[11] Types of Drought. (2023). The National Drought Mitigation Center. Retrieved June 19, 2023, from https://drought.unl.edu/Education/DroughtIn-depth/TypesofDrought.aspx.

time throughout the year, the most apparent time is during the summer months. Nationally, drought impacts often exceed $1 billion due in part to the sheer size of the areas affected.[12]

Research supports that climate change will have significant impacts on drought frequency and intensity, which will vary by region. Higher temperatures lead to increased evaporation rates, including more loss of moisture through soil and plant leaves. Even in regions where precipitation does not decrease, increases in surface evaporation will lead to more rapid drying of soil if not offset by other changing factors, such as reduced wind speed or humidity. As soil dries out, a larger proportion of the sun's incoming heat will go toward heating soil and adjacent air rather than evaporating moisture, resulting in hotter temperatures and drier conditions.[13]. Future projections show a potential increase in seasonal drought, in which excessive soil moisture levels in spring will transition to insufficient levels in summer, driven by higher temperatures.[14] In Michigan, trends appear to show a lessening of the long-term drought hazard as precipitation levels have increased over time.

Human activities often exacerbate the impact of drought. For example, excessive water use can deplete groundwater supply or result in low reservoir levels. Eastern Michigan University's Ypsilanti campus ultimately gets its water from the Detroit River, through supply from the Great Lakes Water Authority (GLWA) to the city.[15]

Measuring Droughts: There are several quantitative methods for measuring drought in the United States. How these indices measure drought depends on the discipline affected (e.g., agriculture, hydrology, meteorology, etc.) and the region being considered. Two main methods are the Palmer Drought Severity Index (PDSI) and the U.S. Drought Monitor. The PDSI was the first comprehensive drought index developed in the United States. The U.S. Drought Monitor is a relatively new index that combines quantitative measures with input from experts in the field. The U.S. Drought Monitor is used in this plan to assess drought occurrences that likely impacted the University's Ypsilanti campus.

U.S. Drought Monitor: The U.S. Drought Monitor is designed to provide the public, media, government officials, and others with an easily understandable overview of weekly drought conditions across a county throughout the United States. The U.S. Drought Monitor is unique because it assesses multiple numeric measures of drought, including the PDSI and three other indices, as well as the interpretations of experts to create a weekly map depicting drought conditions across the United States. The U.S. Drought Monitor uses five drought intensity categories, D0 through D4, to identify areas of drought.[16] These categories are shown in **Table 4-8**.

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[12] NOAA National Centers for Environmental Information. (2023) U.S. Billion-Dollar Weather and Climate Disasters. Retrieved on September 28th, 2023 from https://www.ncei.noaa.gov/access/billions/

[13] Hayhoe, K., et al. (2018) Our Changing Climate. In *Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Volume II*. Retrieved on August 11, 2023, from Our Changing Climate - Fourth National Climate Assessment (globalchange.gov)

[14] Fourth National Climate Assessment (2018). *Chapter 21 Midwest*. Region. Retrieved on September 7, 2023 from Midwest - Fourth National Climate Assessment (globalchange.gov).

[15] YCUA. (2021) Drinking Water Quality Report, retrieved on September 16, 2023 from waterreport.pdf (ycua.org)

[16] National Drought Mitigation Center. (2023) *What is the USDM?*. U.S. Drought Monitor Retrieved on September 6, 2023 from What is the USDM? | U.S. Drought Monitor (unl.edu)

Table 4-8: U.S. Drought Monitor Categories

Category	Description	Effects
D0	Abnormally Dry	Going into drought: short-term dryness slowing planting, growth of crops or pastures. Coming out of drought: some lingering water deficits; pastures or crops not fully recovered
D1	Moderate Drought	Some damage to crops, pastures; streams, reservoirs, or wells low, some water shortages developing or imminent; voluntary water-use restrictions requested
D2	Severe Drought	Crop or pasture losses likely; water shortages common; water restrictions imposed
D3	Extreme Drought	Major crop/pasture losses; widespread water shortages or restrictions
D4	Exceptional Drought	Exceptional and widespread crop/pasture losses; shortages of water in reservoirs, streams, and wells creating water emergencies

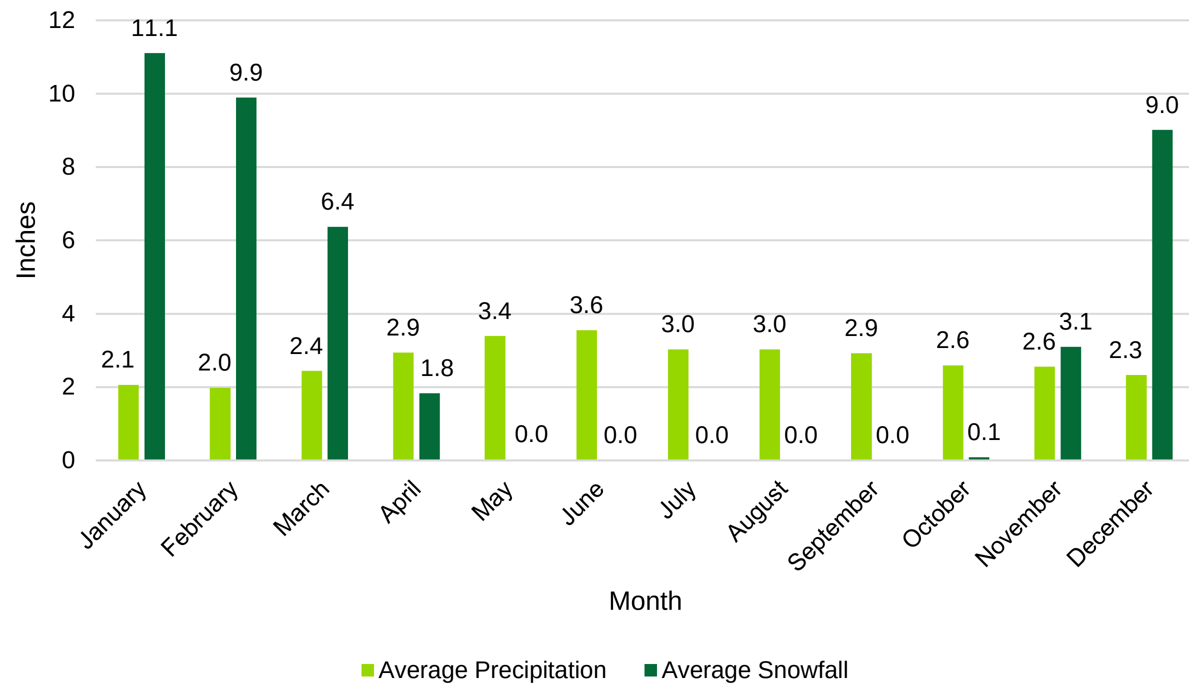
Location

A drought is a regional event that is not confined to geographic or political boundaries; it can affect several areas at once. It can also range in severity across those areas. The University's entire Ypsilanti campus is at risk to drought occurrence and impacts.

Previous Occurrences

To understand the conditions of past drought, it can be helpful to understand the typical precipitation received each year. The closest weather monitoring station through NOAA is located at the University of Michigan in Ann Arbor which is approximately 6 miles from Eastern Michigan University. The University of Michigan's Ann Arbor weather station reports an annual average of 32.4 inches of precipitation and 41.7 inches of snowfall. Monthly averages are shown in **Figure 4-9.**[17]

[17] Ann Arbor U of M. (2017). Western Regional Climate Center. Retrieved August 29, 2023 from https://wrcc.dri.edu/cgi-bin/cliMAIN.pl?mi0230.



Source: Western Regional Climate Center, Ann Arbor U of M Station (200230)

**Based on records from 1880-2022*

Figure 4-9: Average Precipitation and Snowfall by Month at the UM Weather Monitoring Station

The U.S. Drought Monitor was used to ascertain historical drought levels for the area. Campus-specific data was not available, but due to the regional nature of drought, it can be assumed that any drought impacting Washtenaw County also impacted the EMU campus. The U.S. Drought Monitor reports data on drought conditions from 2000 through 2022. Drought conditions are reported by category as percentages. Therefore, it is possible that more than one drought category was reported in each week. In such cases, the highest drought category reported was used. This information is compiled and presented in **Table 4-9** below.

Table 4-9: Historic Drought Conditions

Abnormally Dry	Moderate Drought	Severe Drought	Extreme Drought	Exceptional Drought

Year	Duration
2000	**Severe** (up to 2 weeks)
2001	**Moderate** (up to 1 week)
2002	**Moderate** (up to 20 weeks)
2003	**Severe** (up to 10 weeks)
2004	**Moderate** (up to 2 weeks)
2005	**Moderate** (up to 5 weeks)

Year	Duration
2006	**Normal** (52 weeks)
2007	**Moderate** (up to 5 weeks)
2008	**Abnormal** (up to 3 weeks)
2009	**Normal** (52 weeks)
2010	**Moderate** (up to 4 weeks)
2011	**Abnormal** (up to 2 weeks)
2012	**Severe** (up to 4 weeks)
2013	**Abnormal** (up to 9 weeks)
2014	**Normal** (52 weeks)
2015	**Moderate** (up to 10 weeks)
2016	**Severe** (up to 1 week)
2017	**Abnormal** (up to 20 weeks)
2018	**Moderate** (up to 11 weeks)
2019	**Abnormal** (up to 10 weeks)
2020	**Moderate** (up to 4 weeks)
2021	**Severe** (up to 1 week)
2022	**Moderate** (3 weeks)

In the study period, severe drought conditions occurred in 2000, 2003, 2012, 2016, and 2021. However, a notable trend is that drought conditions were present in 20 of the 23 years studied, possibly indicating a long-term issue.

In addition to data from the U.S. Drought Monitor, it is important to note three historic droughts that impacted the area, also mentioned in the 2022 Ann Arbor Hazard Mitigation Plan. As droughts are regional in nature, it is likely these droughts impacted the planning area:

Heat Wave / Drought of 1988

The 1988 drought/heat wave in the Central and Eastern U.S. also greatly impacted Michigan. Nationwide, the drought caused an estimated $40 billion in damages from agricultural losses, disruption of river transportation, water supply shortages, wildfires, and related economic impacts. The heat wave that accompanied the drought conditions was particularly long in Michigan – 39 days with 90 degree or better heat – eclipsing the previous record of 36 days recorded in the “dust bowl” days of 1934. During that 39-day stretch, the temperature in Southeast Michigan (including the Ypsilanti area) topped the 100-degree mark on five occasions.

Drought of the 1960s

A period from 1962-1965 was the only clear and serious statewide drought event to take place since the 1930s, which partially demonstrates a general trend of lessening drought problems in Michigan (including the Ypsilanti area) during the second half of the 20th Century when compared with the first half. Nevertheless, this was the worst drought event to strike Michigan since the 1930s. In this event, the entire Southern Lower Peninsula had to endure at least 30 consecutive drought months, many of which were at the D2 level, or worse. Again, there was a pattern in which the drought was felt more intensely the farther to the east one was located. Southeastern Michigan experienced nine consecutive months at the exceptional D4 level of drought. The middle years of 1963-1964 were the worst phase of this event, for most parts of the state.

Droughts of the 1930s

Without a doubt, the “Dust Bowl” drought of the 1930s was the most famous drought ever to occur in the U.S. That drought was an ecological and human disaster of huge proportions. It was caused by misuse of the land combined with years with lack of rainfall. As the land dried up, great clouds of dust and sand, carried by the wind, covered everything and the term “Dust Bowl” was coined. As a result of this drought, millions of acres of farmland became useless, forcing hundreds of thousands of people to leave their farms and seek an existence elsewhere. Although exact figures were not kept, some researchers estimate that nearly $1 billion (in 1930s dollars) was provided in assistance to victims of the Dust Bowl drought. That event also ushered in a new era or farming and conservation programs and practices aimed at preventing a recurrence of a drought of the magnitude and impact of the Dust Bowl drought.

In Southeastern Michigan, (including the Ypsilanti area) this “dust bowl” period took the form of a most severe statewide drought condition from 1930 to 1932, followed by a less severe period from 1933 to 1937, and finally a period of limited spotty problems between 1939 and 1940. Between 1930 and 1932, Michigan’s 10th climate division experienced a severe level of drought for about 24 continuous months. The entire state was struck very hard by this event. During December and January of 1934-1935 the southeastern Michigan region set an all-time state record for the longest number of consecutive months under drought conditions—the 42 months between August 1933 and January 1937. Although the area had some months of relief in early 1938, drought conditions resumed by the end of the year for a period of 8 consecutive months; and then between 1939 and 1940, another 12-month period of drought followed.

The State of Michigan Hazard Mitigation Plan lists historic drought occurrences by division. The University’s Ypsilanti campus is in Division 10, for which the following drought occurrences are listed:

- The most extreme drought was in August 1931, when the Palmer index hit a record low of -6.98.
- Lengthy drought incidents took place in:
    - 1901-1902 (24 months)
    - 1922-1923 (10 months)
    - 1930-1931 (17 months)
    - 1933-1936 (34 months)
    - 1963-1965 (31 months)
    - 1971-1972 (9 months)
    - 1998-1999 (10 months)
    - 1999-2000 (8 months)
    - 2002-2003 (8 months)

Extent

Extent can be defined by the highest drought monitor category: Exceptional Drought. The most severe drought on record for Washtenaw County (which includes the University’s Ypsilanti campus) occurred between 1963 and 1964. Southeastern Michigan experienced 35 consecutive months ranging from Severe to Exceptional Drought.[18] It is also likely that Exceptional Drought status was reached during the 1930s droughts, and that these droughts were even more severe than those of the 1960s. Since the U.S. Drought Monitor began in 2000, there have been no reported weeks where all or part of Ypsilanti experienced Exceptional Drought. The highest drought category experienced by Washtenaw County (which includes Ypsilanti) during this time was Severe Drought (18 weeks total) in 2000, 2003, 2012, and 2016. However, drought events more severe than those occurring in the 1930s and 1960s are possible. The EMU planning area is projected to experience increased extreme heat days in the summer months, which may contribute to more severe droughts in the future than those experienced in the past.

Probability

An exact probability of drought is difficult to quantify given a limited reporting period (23 years; 2000-2022). Drought conditions were reported in 20 out of 23 years for the city. This equates to a historic rate of occurrence of approximately 87 percent.

When determining future probability, the historic frequency must be considered along with projected future conditions. It is difficult to quantify the impact climate change will have on the future drought occurrence, as several factors, such as precipitation, humidity, and temperature, influence the formation of drought conditions. Summer temperatures in Ypsilanti are projected to increase, as are extreme heat days (e.g., days above 90°F). Drought is most likely to occur during summer months, when high temperatures increase the amount of surface evaporation. Summer temperatures in Ypsilanti are projected to increase 5.25 to 5.5°F degrees by 2040-2059.[19] Further, a report from GLISA found that changes in summer precipitation in the planning area are uncertain; precipitation is highly variable by location in the region. For much of the state, precipitation could increase slightly, stay the same, or be reduced. For the Ypsilanti area, this suggests slight increases in the summer by the middle of the century. Data from Headwaters Economics indicates that under the higher emissions scenario, annual average precipitation in Ypsilanti will increase by approximately 3 inches by end of century, from 33 inches to 36 inches.[20] Even with overall increases in precipitation, there is potential for an increase in seasonal summer drought conditions. These changes are likely to lead to an increase in summer droughts and subsequently, a higher rate of soil moisture loss.[21]

Based on historic frequency and projected future conditions, the probability of future drought occurrences is highly likely (greater than 90 percent annual chance). However, the probability of exceptional drought is less likely.

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[18] Michigan Department of State Police. (2019). *Michigan Hazard Analysis*. Michigan Department of State Police

[19] Great Lakes Regional Climate Change Maps. (n.d.). GLISA. Retrieved August 17, 2023 from http://glisa.umich.edu/resources/great-lakes-regional-climate-change-maps.

[20] Headwaters Eocnomics.(2023).Neighborhoods at Risk. *Climate Projections*. Headwaters Economics. Retrieved on September 7, 2023 from Neighborhoods at Risk (headwaterseconomics.org)

[21] Frankson, R., et al.(2022). Michigan State Climate Summary 2022. NOAA Technical Report NESDIS 150-MI. NOAA/NESDIS, Silver Spring, MD, 4 pp.

Vulnerability Assessment

The region in which Eastern Michigan University lies is generally considered water-rich but has the potential to be significantly impacted by a drought. All current and future buildings, populations, infrastructure, and critical facilities on campus are at risk to drought.

Many drought impacts, however, are not structural but societal in nature. A drought's impacts on society, and thus the University, result from the interplay between a natural event and the demand people place on water supply. Community members and facilities may be forced to limit water via City of Ypsilanti requirements. This could pose a threat to sensitive research projects.

Surface water levels in lakes, impoundments, and reservoirs can drop dramatically during drought. Groundwater supply can also be impacted. Any potential campus recreational activities along the Huron River, such as canoeing, kayaking, tubing, and swimming have the potential to be impacted.

As noted above, drought has minimal impacts on structures although it could have impacts on the functionality of the building if water supply is disrupted. In addition, structural issues could occur in the event that drought impacts building foundations or footings. There are no known losses associated with drought and buildings on EMU's campus.

Drought is expected to have minimal impacts on infrastructure. The efficiency of the University's cogeneration power plants, which in part, generates steam, have the potential to be impacted. Green infrastructure, such as green stormwater infrastructure, may incur minor damages during drought occurrences if plants cannot resist drought.

Drought tends to have a ripple effect through the economy and may impact the cost of food and even water. There is limited agriculture on campus, but a regional drought could have severe impacts to local food prices. The city may also have to purchase water which could impact operating costs for the University.

Economically constrained households may face difficulty paying for water if a drought causes rate hikes introduced to spur conservation. Ability for economically vulnerable populations to pay should be considered in any changes to water pricing. Economically constrained households may also face challenges in the event food prices rise due to drought, both locally and in areas from where food is grown.

The quality of life and living conditions for students, faculty/staff, and community members inhabiting the area may be impacted. Drought can directly impact sanitation, hygiene, and air quality. Particulate matter from the dried land areas can lead to respiratory illnesses or irritation. Food and nutrition services may also be impacted or slowed down, contributing to overall health risk.

It is difficult to quantify the impact climate change will have on the future drought occurrence as several factors influence drought. In the planning area, current projections show climate change increasing summer drought intensity. Drought is most likely to occur during summer months, when high temperatures increase the amount of surface evaporation. Summer temperatures on campus are projected to increase 5 to 5.5°F by 2040-2059. Warmer temperatures cause drought conditions by causing reduction in soil moisture. Further, maps produced by GLISA22 show a change in precipitation in the summer season by 1 to 1.25 inches of rain by the middle of the century. Other areas in the region show more gradual decreases, as shown in **Figure 4-10**. It is important to consider that climate change research suggests that the intensity and frequency of hotter summer months will persist, which can gradually influence moisture, even as precipitation increases. Even with overall increases in precipitation, there is potential for an increase in seasonal summer drought conditions and drought intensity.

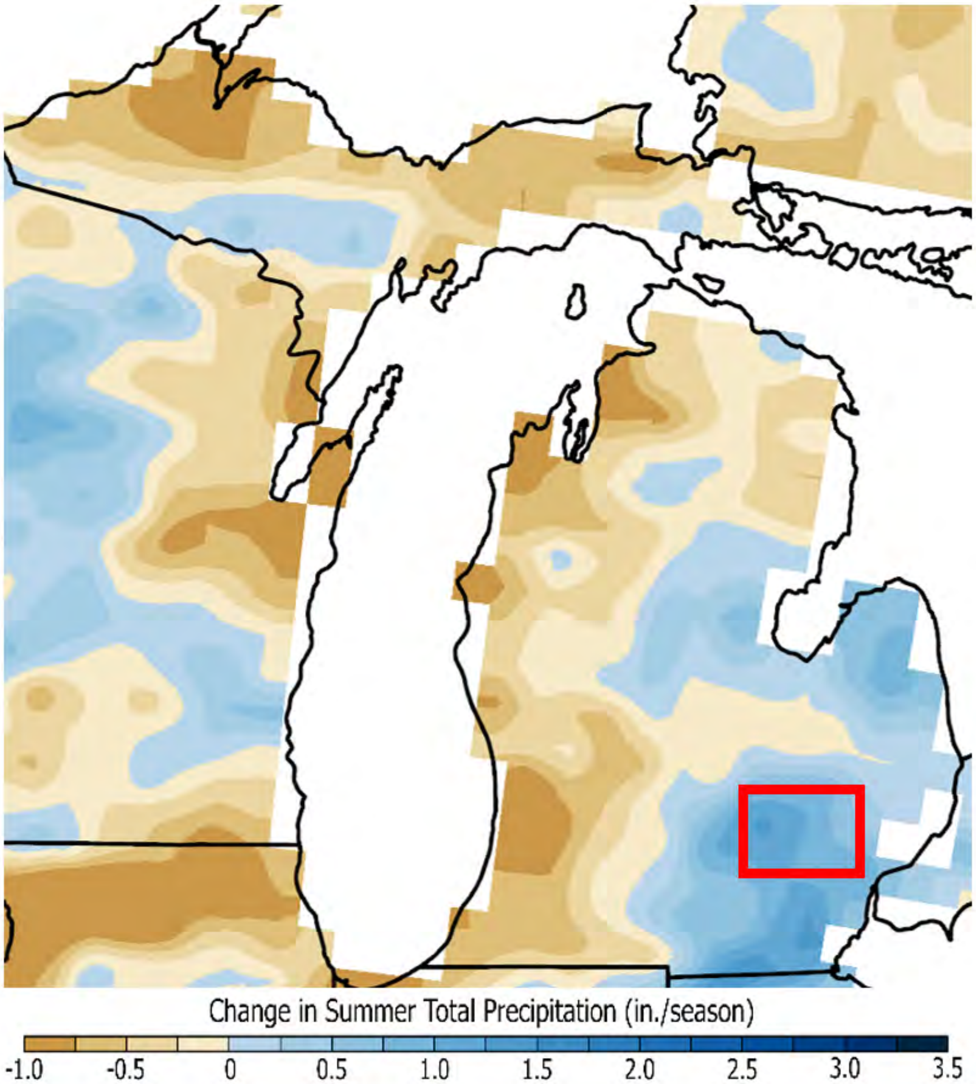

Figure 4-10: Projected Change in Summer Total Precipitation from 2040-2059

[22] Great Lakes Regional Climate Change Maps. (n.d.). GLISA. Retrieved August 30, 2023 from http://glisa.umich.edu/resources/great-lakes-regional-climate-change-maps.

Flood and Extreme Precipitation

Description

Flooding is a very frequent, dangerous, and costly hazard. Globally, it accounts for 44 percent of all natural disasters and 16 percent of all deaths from natural disasters.[23] In the U.S., flooding results in an average of 88 deaths annually.[24] Approximately 75 percent of presidential disaster declarations are associated with flooding.[25]

Floods cause utility damage and outages, infrastructure damage (both to transportation and communication systems), structural damage to buildings, crop loss, decreased land values and impede travel.

Flooding is the most common environmental hazard, due to the widespread geographical distribution of valleys and coastal areas, and the population density in these areas. The severity of a flooding event is typically determined by a combination of several major factors, including stream and river basin topography and physiography; precipitation and weather patterns; recent soil moisture conditions; and the degree of vegetative clearing and impervious surface. Flooding events can be brought on by severe (heavy) rain. There are several types of flooding, which are presented below.

Flash Flooding: Flash floods occur within a few minutes or hours of heavy amounts of rainfall and can destroy buildings, uproot trees, and scour out new drainage channels. Heavy rains that produce flash floods can also trigger mudslides and landslides. Most flash flooding is caused by slow-moving thunderstorms or repeated thunderstorms in a local area, or by heavy rains from hurricanes and tropical storms (not applicable to EMU). Although flash flooding often occurs in mountainous areas, it is also common in urban centers where much of the ground is covered by impervious surfaces.

Sheet Flooding: Sheet flooding is a condition where storm water runoff forms a sheet of water to a depth of six inches or more. Sheet flooding and ponding are often found in areas where there are no clearly defined channels, and the path of flooding is unpredictable. It is also more common in flat areas. Most floodplains are adjacent to streams or oceans; although almost any area can flood under the right conditions where water may accumulate.

Urban Flooding: Urban flooding is usually caused by heavy rain over a short period of time. As land is converted from fields or woodlands to roads and parking lots, it loses its ability to absorb rainfall. Since sidewalks and roads are non-absorbent, rivers of water flow down streets and into sewers. Roads and buildings generate more runoff than forestland. Fixed drainage channels in urban areas may be unable to contain the runoff that is generated by relatively short, but intense, rainfall events. Urbanization increases runoff two to six times over what would occur on

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[23] World Meteorological Organization. (2022). *WMO Atlas of Mortality and Economic Losses from Weather, Climate, and Weather Extremes (1970-2019).* World Meteorological Organization. Retrieved on August 21, 2023 from [doc_num.php (wmo.int)]

[24] NOAA. (2023). *Thunderstorm Hazards – Flash Floods.* NOAA. Retrieved on August 21, 2023 from [Thunderstorm Hazards - Flash Floods | National Oceanic and Atmospheric Administration (noaa.gov)]

[25] National Weather Service. (n.d.). *Flood Related Hazards.* National Weather Service. Retrieved on August 21, 2023 from [Flood Related Hazards (weather.gov)]

natural terrain. [26] This high volume of water can turn parking lots into lakes, flood basements and businesses, and cause lakes to form in roads where drainage is poor or overwhelmed.

Urban flooding, which can include flash flooding and sheet flooding, can also occur where there has been development within stream floodplains. This is partly a result of the use of waterways for transportation purposes in earlier times. Sites adjacent to rivers and coastal inlets provided convenient places to ship and receive commodities. The price of this accessibility has increased flooding in the ensuing urban areas. Urbanization intensifies the magnitude and frequency of floods by increasing impermeable surfaces, amplifying the speed of drainage collection, reducing the carrying capacity of the land and, occasionally, overwhelming sewer systems.

Riverine Flooding: Periodic flooding of lands adjacent to non-tidal rivers and streams (known as the floodplain) is a natural and inevitable occurrence. When stream flow exceeds the capacity of the normal watercourse, some of the above-normal stream flows onto adjacent lands within the floodplain. Riverine flooding is a function of precipitation levels and water runoff volumes within the watershed of a stream or river. According to USGS, the recurrence interval of a flood is defined as probability of an event in any given year (e.g. 1 percent annual chance). Flood magnitude increases with increasing recurrence interval.

In addition, there are several types of floodplains. These are identified areas of flood occurrence. However, not all flooding occurs in such areas. Localized urban flooding and flash flooding often occur outside of designated floodplain areas.

Floodplains: A floodplain is generally the land area susceptible to being inundated or flooded by water from any source (i.e., river, stream, lake, estuary, etc.). Floodplains are natural features of any river or stream. Streams that drain more than one square mile have their estimated floodplain areas mapped in most areas. The mapped floodplain areas are called the regulatory floodplain. The regulatory floodplain mapping is a result of the hydrologic (rainfall) and hydraulic (runoff) analysis of the watershed and stream.

The regulatory floodplain is also known as the 100-year floodplain, base flood elevation, 1.0-percent annual chance floodplain or the Special Flood Hazard Area. The 100-year floodplain is the land area that is subject to a 1.0 percent or greater chance of flooding in any given year. The term “100-year flood” is often misinterpreted. The 100-year flood does not mean that it will occur once every 100 years. A 100-year flood has a 1/100 (1 percent) chance of occurring in any given year. A 100-year flood could occur two times in the same year or two years in a row. It is also possible not to have a 100-year flood event over the course of 100 years or more.

The floodway is portion of the floodplain required to convey the flood event. The flood fringe provides flood water storage. The floodway is the high velocity area and structures or obstructions in the floodway can increase flood heights. The floodway is regulated by the Michigan Department of Environmental Quality (DEQ) and local regulations. Michigan DEQ regulations prohibit residential construction in the floodway.

While the 100-year (or base flood) is the standard most commonly used for floodplain management and regulatory purposes in the United States, the 500-year flood, also known as the 0.2-percent annual chance flood area, is the national standard for protecting critical facilities, such as hospitals and power plants (when federally funded). A 500-year flood has a 1/500 (0.2

[26] National Weather Service. (n.d). Floods. Retrieved on December 20, 2023 from [Floods (weather.gov)](https://www.weather.gov).

percent) chance of occurring in any given year. It is generally deeper than a 100-year flood and covers a greater amount of area; however, it is statistically less likely to occur.

Special Flood Hazard Area and Flood Insurance Rate Maps: A Special Flood Hazard Area (SFHA) shown on a Flood Insurance Rate Map (FIRM) is the regulatory floodplain. FIRMs are produced by FEMA. SFHAs are delineated on the FIRMs and may be designated as Zones A, AE, AO, AH, AR V, VE, A-99. Structures located in the SFHA are highly susceptible to flooding. Structures located in the SFHA A-Zones are required by lenders to purchase flood insurance. Anyone in a community that participates in the NFIP may voluntarily purchase flood insurance.

The following SFHA zone is present on the EMU's campus (Golf Course):

- Zone AE: Zone AE is the flood insurance rate zone that corresponds to the 100-year floodplains determined in the Flood Insurance Study by detailed methods. In most instances, BFEs derived from the detailed hydraulic analyses are shown at selected intervals within this zone. Mandatory flood insurance purchase requirements for structures apply.

Flooding can occur any time of year. The severity of flooding is determined by a combination of topography and physiography, ground cover, precipitation and weather patterns and recent soil moisture conditions. Flooding is also governed by the size and the nature of the stream's watershed. A watershed is the geographic area of land where all runoff drains to a common point. EMU's campus is located within the Huron River Basin, and its landscape includes six watersheds that flow into tributaries of the Huron River. Including Allen Creek, Malletts Creek, the Huron River, Traver Creek, Millers Creek, and Fleming Creek. The watershed is shown in **Figure 4-11.**

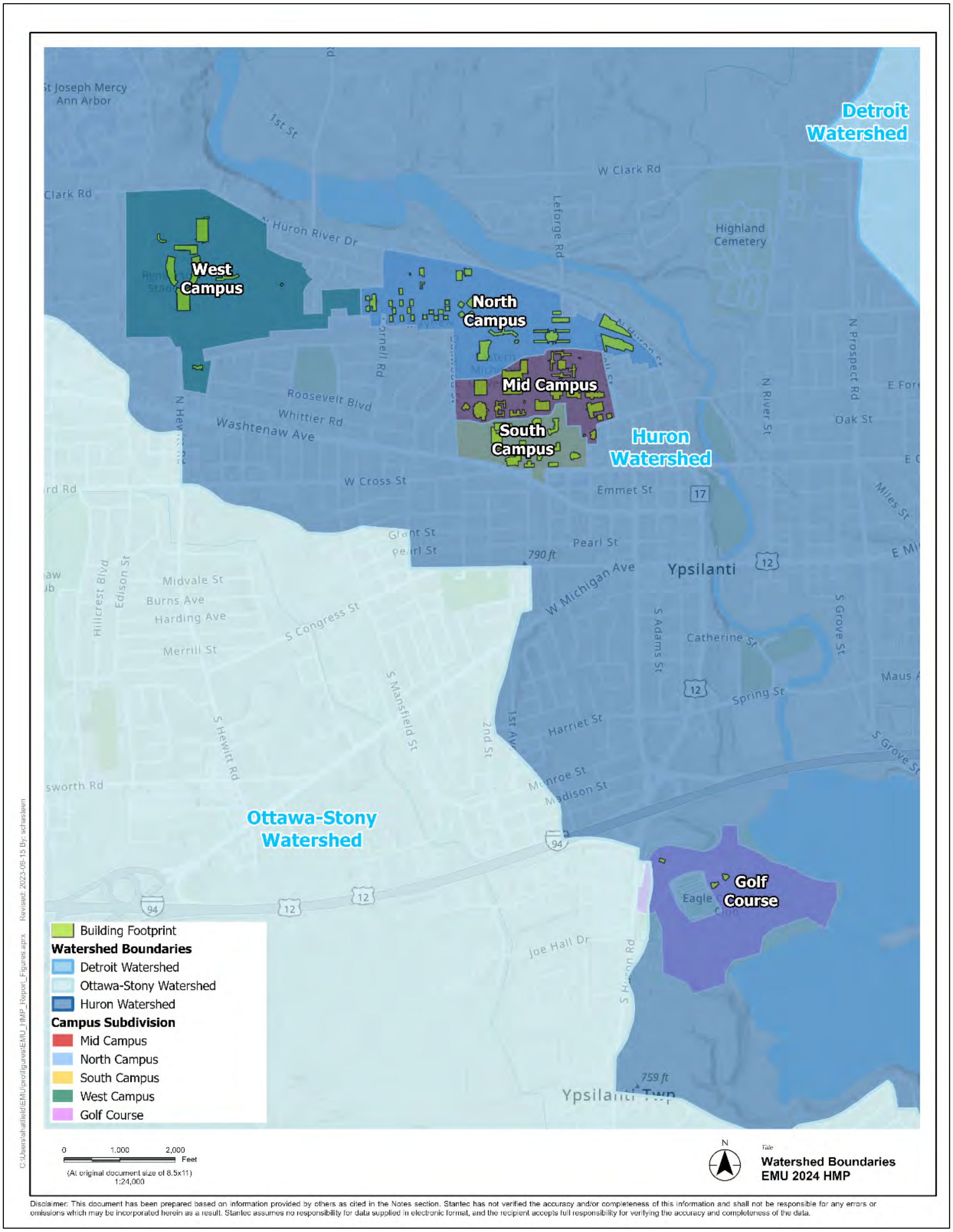


Figure 4-11: EMU Watersheds

Within the watershed, the condition of the land affects how precipitation flows or infiltrates. For example, more rainwater will run off the land's surface and into streams if the terrain is steep, if the ground is already saturated from previous rains, if the surface is significantly covered with impervious pavement (e.g., parking lots, rooftops), or if depressional water storage areas have been filled.[27]

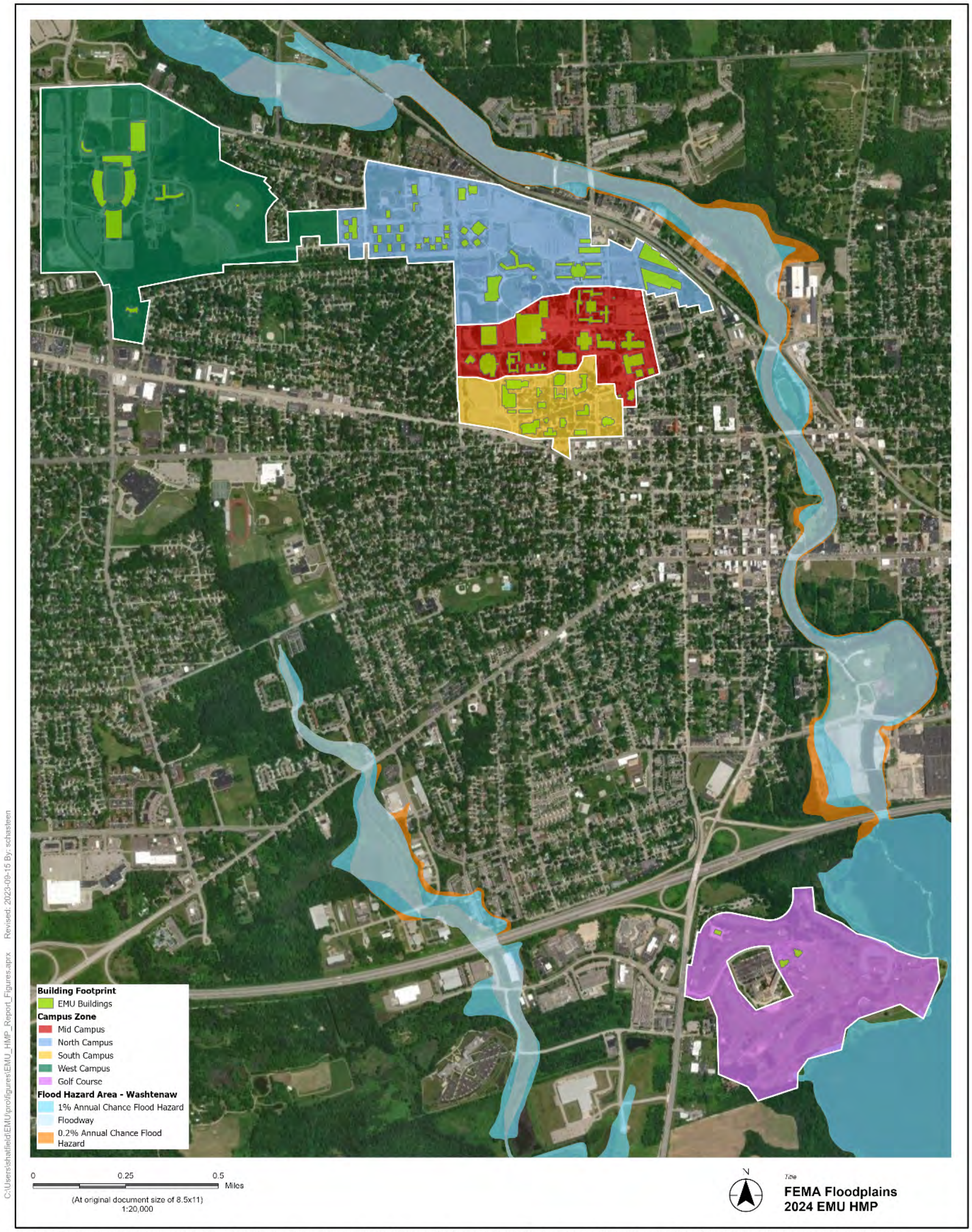
Scientists have established that climate change will have significant impacts on flood frequency and intensity, which will vary by region. Generally, higher temperatures will result in drier conditions and will reduce flood magnitude and frequency. Precipitation changes will vary across the United States. Generally, wet areas will get wetter, and dry areas will get drier. Increased precipitation is typically associated with increased flood frequency and magnitude. What may have more of an effect on flooding is increasing heavy precipitation events. Heavy rainfall events have increased for most of the United States over the last several decades. The Midwest has experienced a 42 percent increase in the amount of precipitation falling in heavy rainfall events from 1958, and climate projections suggest this trend will continue.[28]

Location

The Washtenaw County FIRMs, which include EMU's campus, indicate both the 1.0-percent annual chance (100-year) floodplain and 0.2-percent annual chance (500-year) floodplain areas as shown in **Figure 4-12**. These FIRMs became effective in 2012. The EMU campus is located outside of mapped floodplain areas, with the exception of approximately 1.5 acres in the 1.0-percent annual chance flood area which occurs on the Golf Course Zone.

[27] Changnon, S. A., Angel, J. R., Kunkel, K. E., & Lehmann, C. M. (2004). *Climate Atlas of Illinois.* Illinois Water Survey.

[28] Fourth National Climate Assessment. (2018). *Our Changing Climate.* Retrieved on August 30, 2023 from Our Changing Climate - Fourth National Climate Assessment (globalchange.gov).



Disclaimer: This document has been prepared based on information provided by others as cited in the Notes section. Stantec has not verified the accuracy and/or completeness of this information and shall not be responsible for any errors or omissions which may be incorporated herein as a result. Stantec assumes no responsibility for data supplied in electronic format, and the recipient accepts full responsibility for verifying the accuracy and completeness of the data.

Figure 4-12: Floodplain locations near EMU

However, it should be noted that flooding outside of the FEMA designated flood areas is possible. A more severe event could exceed the 0.2-percent annual chance (500-year) floodplain boundaries shown. Urban flooding and sheet flooding are possible throughout the planning area and have been noted as a recurring problem by the Planning Team on EMU's campus.

Previous Occurrences

Data regarding previous flood occurrences came from several different sources, including the NOAA NCEI Storm Events Database and University Maintenance claims data.

NCEI Storm Events Database

The NCEI Storm Events Database records flood, flash flood, and heavy rain events by county; data specific to the campus is not available. Therefore, all flood, flash flood, and heavy rain events reported for Washtenaw County are included. According to NCEI, there has been a total of 35 flood events in Washtenaw County since 1998. The flood events are summarized by event type in **Table 4-10**. No injuries or fatalities were reported as a result of flooding. Over $10.8 million (2023 dollars) in damages were reported. Due to the nature of national reporting, it is likely that localized flood incidents have not been captured by NCEI. Significant flooding events are summarized in **Table 4-11**.

Table 4-10: NCEI Reported Flood Events in Washtenaw County

Event Type	Number of Events	Deaths/ Injuries	Property Damage (2023 dollars)
Flood	20	0/0	$684,026
Flash Flood	14	0/0	$9,818,140
Heavy Rain	1	0/0	$394,717
Total	**35**	**0/0**	**$10,896,883**

Table 4-11: Previous Significant Flooding Events in Washtenaw County

Date	Deaths/ Injuries	Property Damage (2023 dollars)	Details
8/6/1998	0/0	$1,665,265	Urban areas in the heavy rain swath saw substantial flooding, including Adrian and Ann Arbor. In Ann Arbor, Mallets Creek rose out of its banks. The creek destroyed sidewalks in the Briarwood Mall area and swept three cars into a retention pond. Some flooding also took place on the Athletic (South) Campus of the University of Michigan. In Northville, a train derailed when it attempted to cross tracks that were washed out. Nineteen hundred gallons of diesel fuel was spilled as a result.

Date	Deaths/ Injuries	Property Damage (2023 dollars)	Details
9/11/2000	0/0	$78,943	Water levels in Ford Lake, and its inflowing streams, resulted in erosion of the roadway along Ford Lake Dam. **In addition, street flooding in the city of Ypsilanti was widespread.** Ann Arbor had numerous stalled cars and flooded intersections, including a foot of water over Huron Street and Washtenaw Avenue. The heavy rain indirectly contributed to a fatality, when a female pedestrian was struck and killed by a University of Michigan bus during a blinding downpour.
2/9/2001	0/0	$9,581	The Huron River in Ann Arbor rose above flood stage of 15 feet. The river crested at 15.7 feet. There was isolated road flooding across the county, with some cars stalled out in water.
9/14/2008	0/0	$311,593	Heavy rain fell over southeast Michigan from September 12th-14th. A slow-moving cold front interacted with the remnants of two tropical systems led to the extreme rainfall totals. This heavy rain caused some widespread flooding across much of southeast Michigan, but mostly minor flooding was reported, such as large pools of water on roads, road closures, along with some basement flooding. Residents of the Manor of Farmington Hills had to be evacuated as water flowed through the patients' rooms. A Clinton Township woman also had to be rescued as her car became submerged.
6/27/2013	0/0	$0	Heavy rain from thunderstorms caused flooding up to 4 feet deep, with several high-water rescues needed from emergency personnel as cars stalled in the high water. Spotter reports indicate 2 to 4 inches of rain fell within a 2-to-3-hour window. Scattered severe thunderstorms developed, with Oakland and Washtenaw Counties being hardest hit, where flash flooding also occurred.
7/30/2016	0/0	$49,195	Numerous streets were closed due to flooding with power lines also brought down. A nursing home roof collapsed due to the weight of the water. Trees were stripped of their leaves indicative of the heavy rainfall rates. The leaves clogged storm drains which exacerbated the flooding. **Flash flooding was reported in Ypsilanti.**
6/25/2021	0/0	$7,956,750	Numerous roads became impassable due to flash flooding. Parts of Ann Arbor received around 5.5 inches of rainfall, **with Ypsilanti reporting the highest total of 6.76 inches**. Forty-four homes suffered major flood damage, while 127 homes experienced flood damage across the county.

University Data

In addition to the events reported by NCEI, the University provided maintenance incident data from December 2008 to August 2022. The dataset was focused on incidents involving water. Events were also described by the Steering Committee.

In recent years, the University has experienced stormwater backup into some of the campus buildings during heavy rains. In June 2021, a 50-year equivalent rainstorm flooded numerous buildings causing substantial damage to building systems and finishes. This included the flooding of Jones Pool, including the mechanical room, resulting in an estimated $3 million in damages.

The University operates and maintains approximately 54,100 lineal feet of storm sewer.[29] This system catches all the surface water from roofs, parking lots, and streets on campus. The campus storm system is connected to the City of Ypsilanti and Washtenaw County systems. These systems eventually drain into the Huron River.

City of Ypsilanti and Washtenaw County systems include a 24-inch main running down Cross Street and the 66-inch Owen Drain that runs through the center of campus. This drain collects water from, and intersects with, the 24-inch main, as well as other lines on the northern perimeter. The University has expressed concern that the stormwater drainage system has reached or exceeded capacity especially with the lines feeding from the City of Ypsilanti and Washtenaw County.

From December 2008 – December 2022, there were 47 incidents where the identified hazard was water, water damage, flooding, or stormwater in the University maintenance data. The following trends were identified:

- 9 of the 47 incidents could be attributed to stormwater
- 6 buildings had incidents attributed to stormwater
- Several facilities had more than one incident attributed to stormwater
    - College of Business / Owen (2)
    - Fletcher (2)
    - Judy Sturgis Hill Building (2)
- Over $4,778,892 in damages can be attributed to incidents related to stormwater
- The most expensive incident was $3,200,000 from the Jones Pool Flooding in June 2021.

The stormwater incidents are summarized in **Table 4-12**.

[29] See "Asset Management Plan Wastewater & Stormwater Collection Systems", Eastern Michigan University (2020)

Table 4-12: Stormwater Incidents University Maintenance Incident Data

Building	Date	Estimated Cost	Description
Fletcher	8/16/2016	$4,091	Water from the courtyard entered rooms and hallways.
Fletcher	3/28/2020	$1,400	Flooding from a rainstorm impacted a classroom and office.
Pierce Hall	8/10/2015	$11,807	Heavy rains
Rynearson Football Stadium	4/9/2015	$10,000	Heavy rains
Judy Sturgis Hill Building	6/27/2013	$7,141	Runoff from constructed parking lot
Judy Sturgis Hill Building	7/15/2013	$12,024	Runoff from constructed parking lot
Campus-Wide (Jones Pool most significant)	6/25/2021	$3,200,000	During the June 2021 rain event, the storm water system failed leading to watering flooding Jones Pool including the mechanical room.
College of Business/Owen	6/19/2018	$3,332	Rainwater entered the vestibule.
College of Business/Owen	10/6/2018	$10,300	Vestibule flooded either from rainwater or foundation leak.

In addition to these reports, several respondents from the public survey reported facing impacts from flooding and extreme precipitation on several campus buildings, classrooms, and residence halls. The reported impacts include roof leaks, flooded classroom and office spaces, and mold from dampness.

The first floor of Marshall is reported to have flooded over Christmas Break in December 2022, prompting the relocation of offices in that building. The departments housed in the building reported losing $35,000 worth of reagents in the incident. McKenny, Mark Jefferson Hall, Halle Library, and Boone Hall were among other campus buildings reported to have been impacted by flooding.

During the preparation of the plan, Ypsilanti experienced a 500-year rainstorm on August 23, 2023. Nearly 5 inches of rain fell in Washtenaw County in roughly three hours. Impacts included a washout of the Tyler Dam in Ypsilanti.[30] University staff reported impacts to McKenny Hall from stormwater and a blockage in the City's sanitary sewer line. Operations in the building will likely be relocated for the remainder of the semester due to the damages.

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[30] Lucas Smolcic Larson. (2023). *Parts of Washtenaw County get almost 5 inches of rain in 3 hours during 500-year storm.* M Live. Retrieved from [Parts of Washtenaw County get almost 5 inches of rain in 3 hours during 500-year storm - mlive.com]() on October 2, 2023.

Extent

Flood extent, or magnitude, can be defined in several ways including peak flow or discharge rate (cubic feet per second), height of flood waters, and damages. United States Geological Survey (USGS) stream gage data can often be used to determine the above factors.

There are two USGS stream gages near EMU: one on the Huron River and a second on Mallets Creek. Discharge rates were available for the Huron River gage; drainage area, discharge rates, and available flood stage data are shown in **Table 4-13**.[31] Maximum discharge and maximum gage height are used to indicate extent through October 2, 2023. Median gage height data was not available.

Table 4-13: USGS Stream Gage Data for the Huron River at Ann Arbor

Water Feature	Max Discharge (cubic feet/second)	Drainage Area (square miles)	Max Gage Height (feet)
Huron River	1950	729	14.77

In addition, damages can be used to measure extent. The largest losses reported from flooding was over $3.2 million from the Jones Pool flooding incident in 2021. Greater floods than what has been experienced by the University to date are possible, especially with increasing precipitation due to climate change and development pressure within the watershed. Increasing impervious cover within the watershed results in increased runoff volumes and consequently, increased flooding. In addition, development within floodplains can, over time, increase base flood geographic extents and elevations, as well as increasing the number of people and businesses located in flood hazard areas, resulting in more property damage, injuries, and loss of life. EMU has taken measures to reduce flood risk on campus, such as the implementation of detention basins and upgrades to storm sewer infrastructure.

Probability

In the last 25 years, there have been 35 reported flood occurrences in Washtenaw County according to NCEI. These records do not consider events that occurred prior to NCEI recorded (1996). Further, many events go unreported. It is likely that not all of these events impacted the EMU campus.

Probability of flooding could increase with changing climate conditions. Increases in precipitation, especially in the frequency and intensity of extreme events, could increase the probability of flooding. Warmer temperatures may negate some of the flooding effects of increased precipitation but may also result in more snow falling as rain. The Midwest, including Michigan, has experienced a 42 percent increase in observed heavy precipitation (99th percentile precipitation) between 1958 and 2016.[32] According to GLISA, Ypsilanti will

[31] USGS. (2023). *National Water Dashboard.* Retrieved from [USGS | Monitoring Station] on October 2, 2023.
[32] NOAA. (2020). *Midwest.* U.S. Climate Resilience Toolkit. Retrieved on August 30, 2023 from [Midwest | U.S. Climate Resilience Toolkit]

experience an increase of approximately 2 inches of annual rainfall by Mid-Century as shown in **Figure 4-13**.[33]

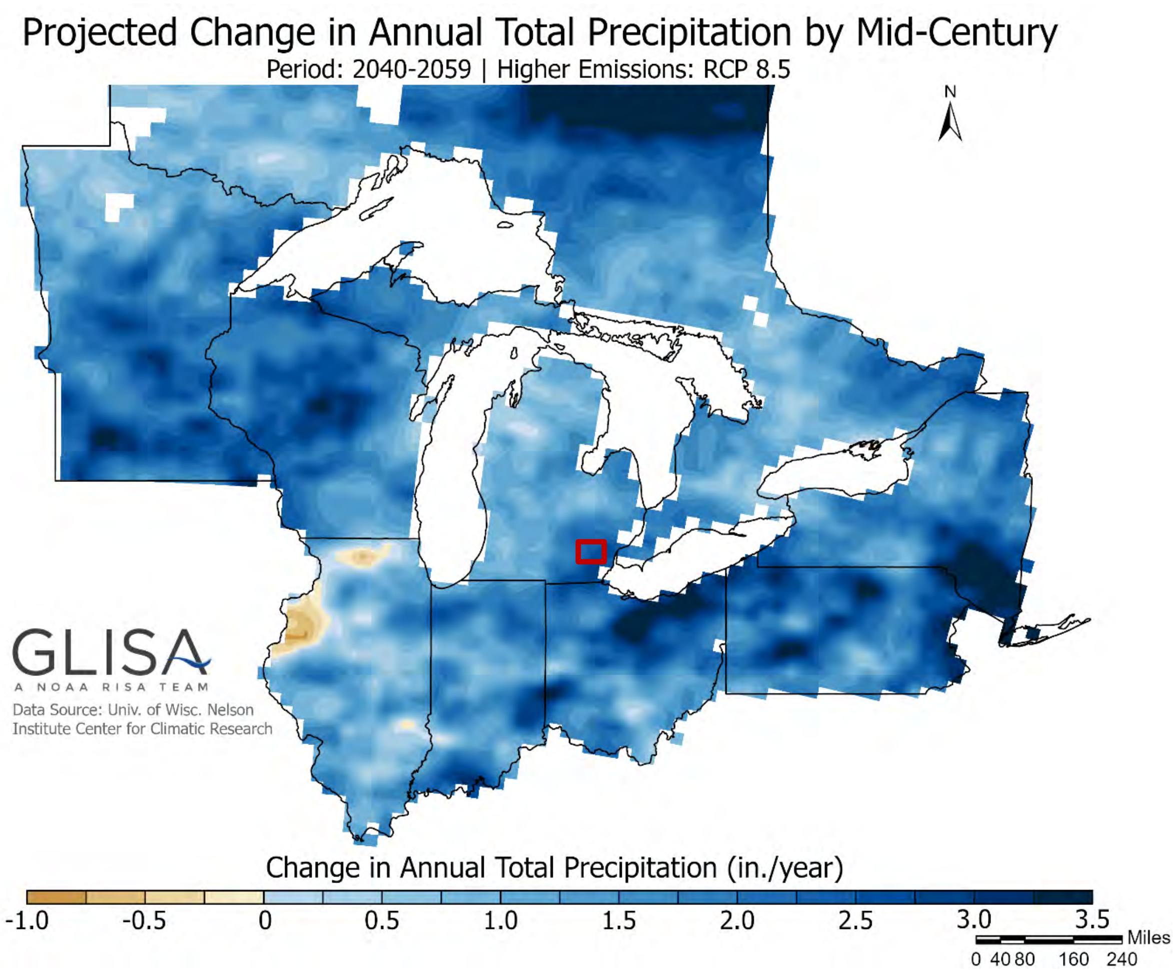

Figure 4-13: GLISA Projected Change in Annual Total Precipitation by Mid-Century

Based on the above, a probability of highly likely (greater than 90 percent annual chance) was assigned. While flooding, especially urban flooding, is a regular occurrence at EMU, it is possible to have years with no flood events and years with multiple flood events.

Vulnerability Assessment

The University is vulnerable to impacts due to flooding and is susceptible to increased flooding. Increased flooding is possible as the campus expands and development surrounding the campus continues throughout Ypsilanti. (These activities reduce drainage areas resulting in

[33] GLISA. (n.d.). *Great Lakes Regional Climate Change Maps.* Retrieved on August 30, 2023 from [Great Lakes Regional Climate Change Maps | GLISA (umich.edu)]()

localized flooding). The University has taken steps to reduce the potential for new flood damages. These efforts are discussed in **Section 5: Capability Assessment**.

Despite these steps, the University is still vulnerable to flooding. All current and future buildings, infrastructure, and populations on the EMU campus are considered at risk to flooding.

Structures exposed to flooding, including critical facilities, can be severely damaged. Building contents can be lost, damaged, or destroyed, and structures themselves can be compromised by floodwaters. Pressure from floodwater, especially as seepage through soil, can damage building foundations. After a flood, wooden structures may rot.

Flooding has the potential to not only cause economic losses, but also to destroy rare or priceless documents such as rare books, maps, artwork, historical collections, or scientific equipment across the campus. The University has these types of items located throughout campus and should take precautions to safeguard these sensitive materials against flooding and other natural disasters.

Floodwaters often contain contaminants such as bacteria and chemical hazards. Flooding often results in combined sewer overflows, resulting in sewage in floodwaters. Individuals traversing floodwaters can contract diseases, injuries, and infections.

Structures exposed to floodwaters can also present public health hazards. Damaged electrical systems, natural gas tanks, and fuel storage present risk of fire and explosions. People with asthma, allergies, or breathing conditions may be at a higher risk to mold.[34] Buildings containing hazardous materials, such as medical facilities and research laboratories, have the potential for spills or hazardous materials releases if flooded.

The public often underestimates the dangers presented by floodwaters. Flooding is often localized to certain parts of a community (e.g., certain roads, intersections, or neighborhoods), and floodwaters can prevent normal access to buildings and facilities. This presents a danger when motorists and pedestrians attempt to traverse floodwaters. Motor vehicles and pedestrians can get swept up in flood currents, increasing the risk for drowning. Even in shallow waters, fast-moving currents can carry individuals or vehicles into deeper waters, where pressure from flowing water can prevent drivers from escaping submerged vehicles. As little as six inches of floodwater can move a vehicle, and as little as two inches can move a person. In addition, floodwaters often conceal conditions that are a danger to those on foot, including electrical wires, debris, and other hazards hidden beneath the surface. In addition, roads and bridges can be weakened by flood impacts, making them unsafe for travel.

In order to assess flood risk, a GIS-based analysis was used to estimate exposure to riverine flood events using Flood Insurance Rate Map (FIRM) data in combination with building footprint data and building replacement values from the University. No campus buildings fall within the 1% Flood Hazard or 0.2% Flood Hazard Area. However, the northern boundary of North Campus is approximately 200 feet from the 1% Flood Hazard Area and 175 feet from the 0.2% Flood Hazard Area as shown in **Figure 4-14.** The EMU Golf Course is alongside Ford Lake. The 1% Flood Hazard Area intersects the edges of the golf course as shown in **Figure 4-15.** No buildings associated with the golf course fall within the floodplain.

[34] CDC. (2020). *Mold.* Natural Disasters and Severe Weather. Retrieved from Mold | CDC on October 2, 2023.

Types of infrastructure that are vulnerable to flooding include roads, bridges, utilities, and water/sewer infrastructure. When comparing the footprint of campus to the floodplains, the only flood hazard areas present on campus were along the edges of the golf course. As with all models, this methodology is used to assess potential flood damage includes some level of uncertainty. It should also be noted that flooding occurs outside of mapped floodplains. For example, structure elevation is not considered which may limit flood impacts.

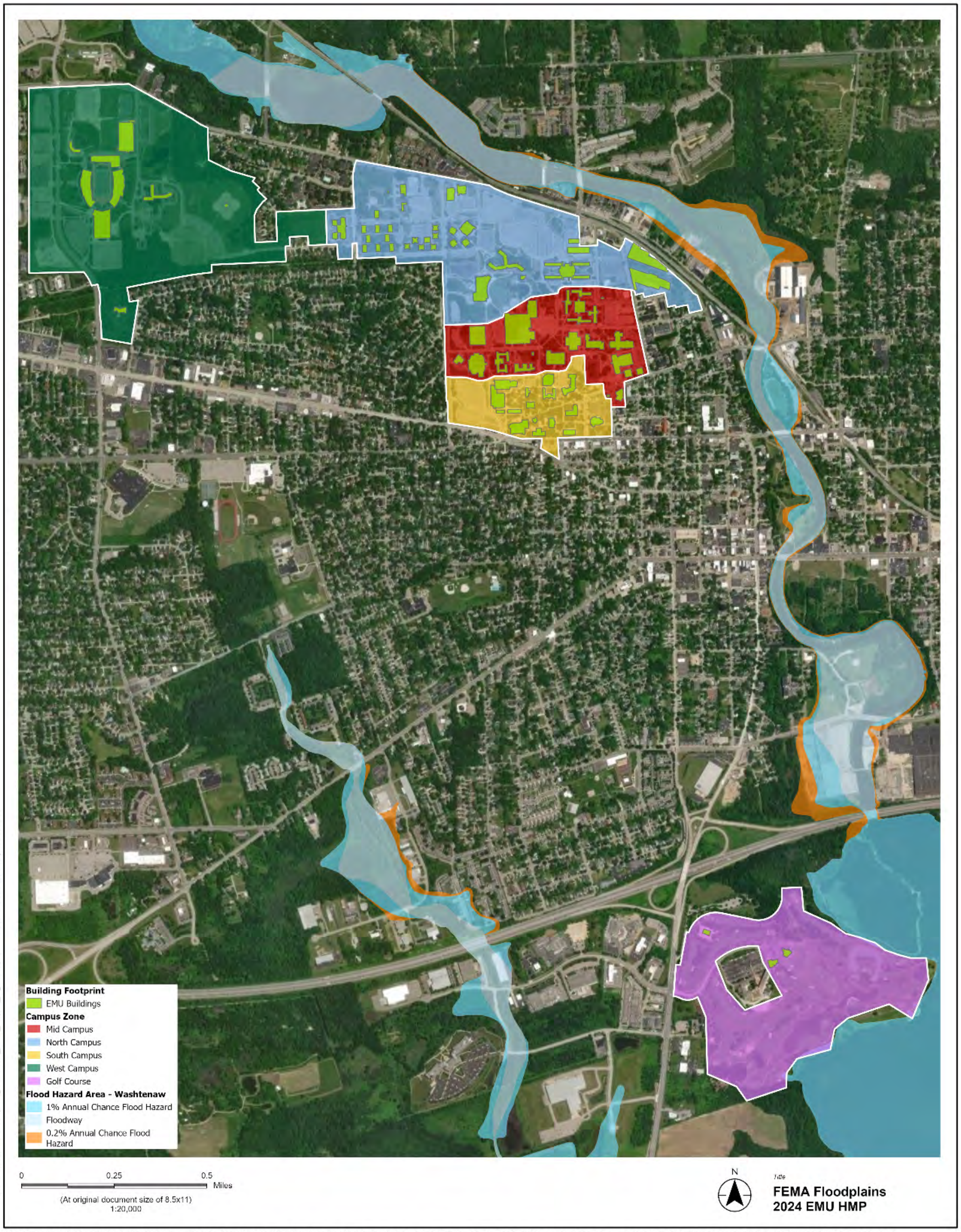

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Figure 4-14: EMU Campus in relation to FEMA Flood Hazard Areas

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Figure 4-15: EMU Golf Course in relation to FEMA Flood Hazard Areas

As a college campus, EMU is heavily developed, resulting in significant stormwater runoff. Stormwater flooding has been an increasing concern for EMU as the University has had increasing impacts from stormwater flooding and several insurance claims. In addition to the stormwater captured on campus, the storm sewer pipes running through campus serve large areas of the city that are "upstream" of the campus.

To assess stormwater risk, multiple data sources were reviewed including previous studies. In December 2022, Zurich (EMU's prior insurance provider) performed a *Risk Assessment and Risk Improvement Assessment*.[35] From that assessment, Zurich identified several potential flood points on campus based on topography including:

- The west side of the Mark Jefferson Science Complex
- The heating plant along West Circle Drive
- Buell Hall and Downing Hall entrance doors at East Circle Drive
- North side of Wise Hall
- East side of Dining Common No. 1
- Three lowest north side entry doors, Quirk Theater along East Circle Drive
- Low areas of Rec/IM complex

Zurich developed insurance zone ratings of high, medium, and low for each building on campus to demonstrate insurance risk from flooding of the EMU buildings.

In addition, the University developed an *Asset Management Plan Wastewater & Stormwater Collection* as a part of the Stormwater, Asset Management, and Wastewater (SAW) Program.[36] A Business Risk Evaluation (BRE) score was developed for each asset in the stormwater system. The BRE score was calculated by multiplying the probability of failure by the consequence of failure for each asset. The probability of failure was developed based on the asset's age, condition, failure history, historical knowledge, experience with the asset, records, and knowledge regarding how the asset is likely to fail. The consequence of failure was calculated based on the cost of repair, social cost, collateral damage, legal costs, environmental costs, loss of revenue, and other associated costs.

Where the data was sufficient to map, the BRE score of high, medium, or low was mapped in comparison to the EMU campus and Zurich insurance zone ratings. Additionally, the University has completed several drainage and retention projects to help mitigate stormwater flooding. Treatments applied through this project include the installation of new detention basins, underground storage, bioswale installation, grading and Stormcepter installations. The BRE scores, insurance zone ratings, and retention improvements are shown for each zone in **Figure 4-16, Figure 4-17, Figure 4-18, and Figure 4-19.**

[35] Zurich. (2023). *Risk Engineering, Risk Assessment and Risk Improvement.*
[36] Eastern Michigan University. (2020). *Asset Management Plan, Wastewater & Stormwater Collection Systems.*

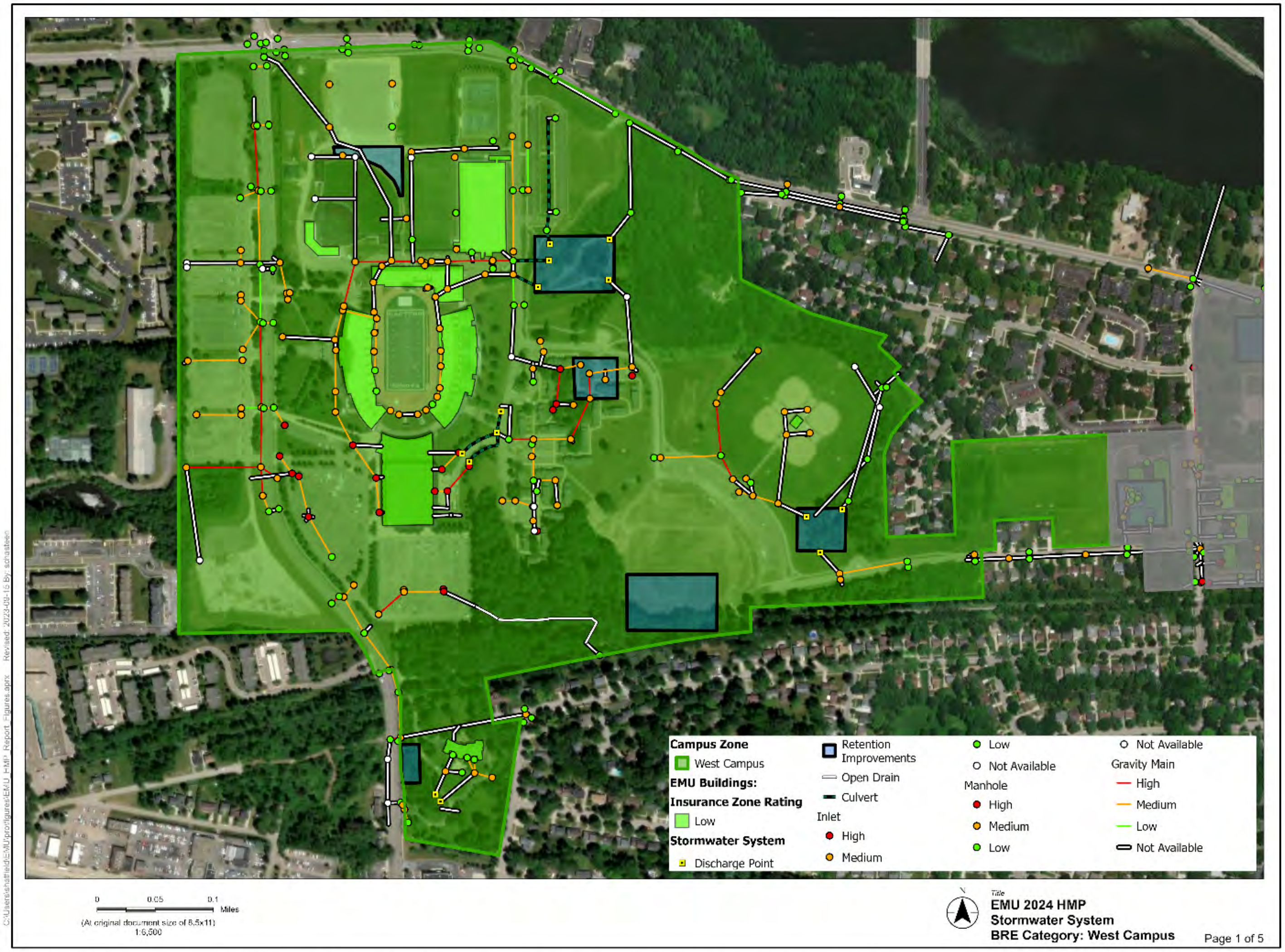

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Figure 4-16: West Campus Stormwater BRE scores and Insurance Zone Ratings

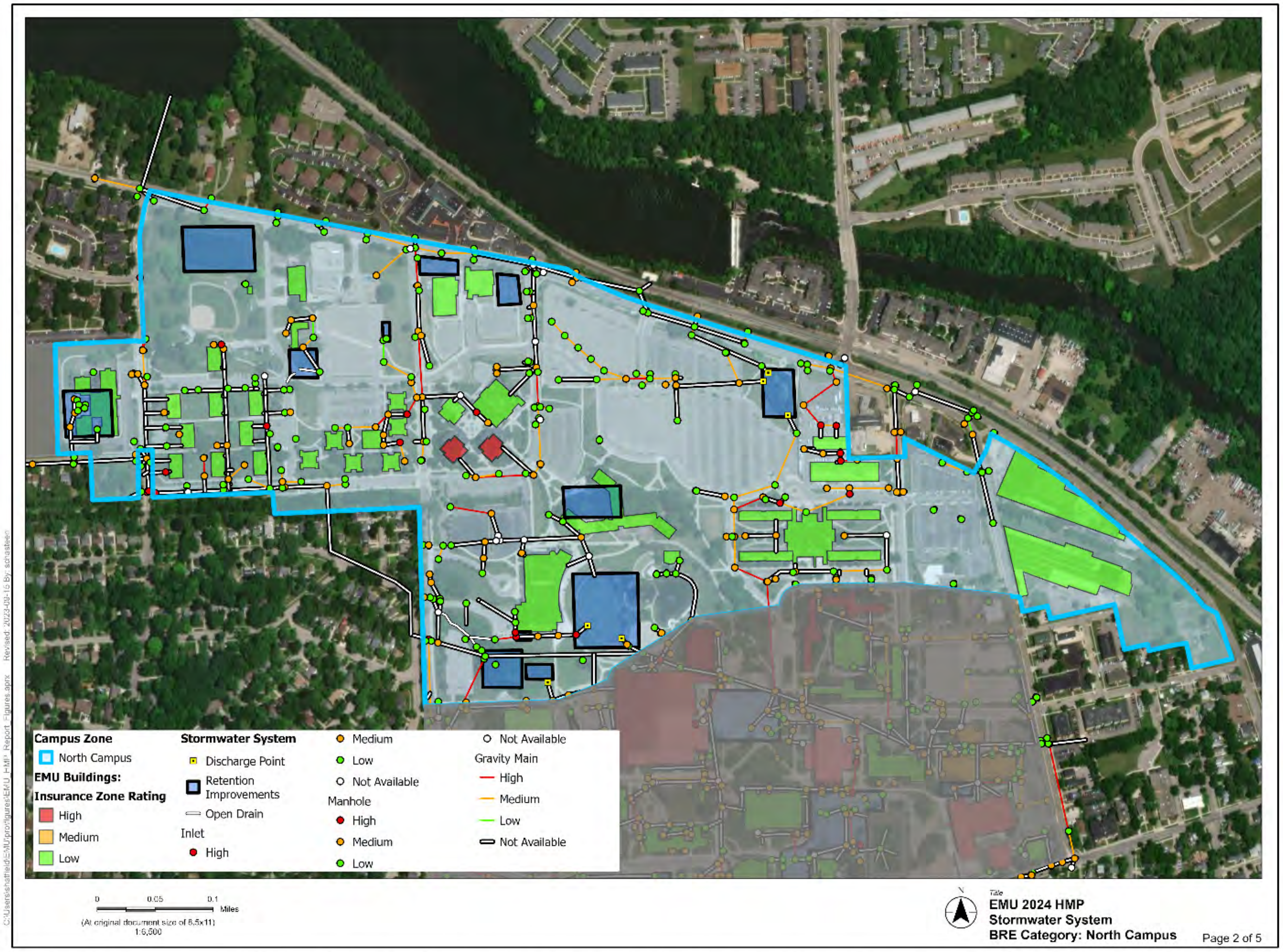

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Figure 4-17: North Campus Stormwater BRE Scores and Insurance Zone Ratings

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Figure 4-18: Mid Campus Stormwater BRE Scores and Insurance Zone Ratings

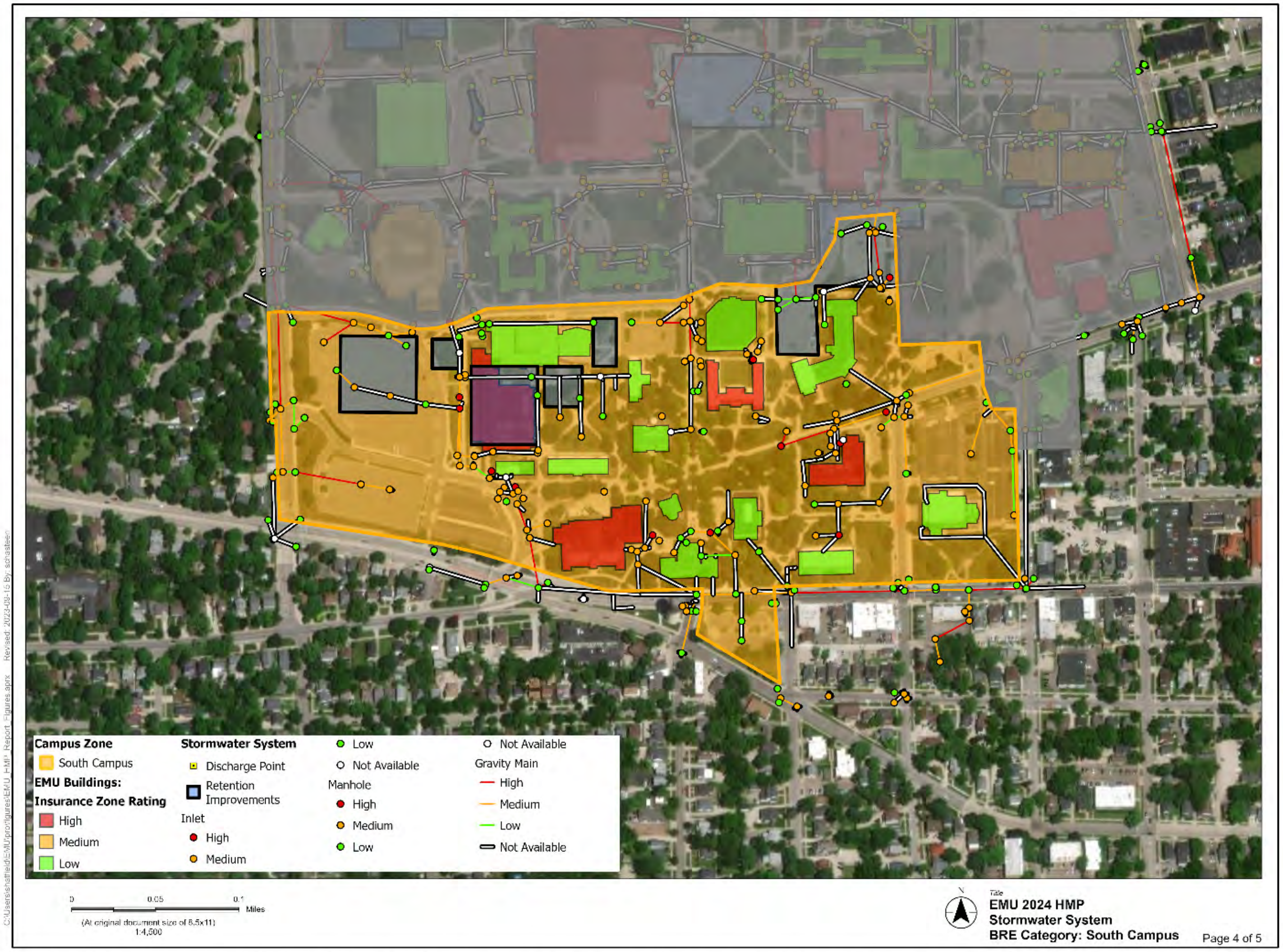

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Figure 4-19: South Campus Stormwater BRE scores and Insurance Zone Ratings

From comparing the two sources (Stormwater BRE and Insurance Zone Ratings), the following key points were identified:

- Most of the stormwater system along Cornell Drive and around Rynearson Football Stadium is shown as medium to high BRE.
- Hill Residence Hall and Pittman Residence Hall are both shown as high risk by the insurance zone rating and connect to gravity mains shown as high risk.
- Most of the Eastern Eateries and surrounding residence halls are surrounded by stormwater systems that are medium to high risk.
- Further analysis is needed to evaluate Mid Campus.
- The gravity main along McKenny Hall is shown as high risk. McKenny Hall is also in a high-risk insurance zone.

The following buildings were classified by Zurich as high risk for flood insurance. The buildings are presented with their associate values and attributes in **Table 4-14.**

Table 4-14: EMU buildings with high-risk flood insurance ratings

Building Name	Subdivision	Category	HazMat	Historical Marker	Critical Facility	Critical IT	Statement of Value
McKenny Hall	South Campus	Meetings/ Special Events	Medium	Historical Register	No	No	$ 22,620,882
Pierce Hall	South Campus	Non-Residential	Low	Historic	Yes	Yes	$ 10,829,106
Mark Jefferson Science Building	South Campus	Classrooms	High	Not Specified	Yes	No	$ 104,589,835
King Hall	South Campus	Classrooms	Low	Historic	No	No	$ 9,495,926
Sill Hall	Mid Campus	Classrooms	Medium	Not Specified	Yes	No	$ 58,183,062
Pray-Harrold Classroom Building	Mid Campus	Classrooms	Medium	Not Specified	Yes	Yes	$ 54,768,841
Warner Gym, Bowen Fieldhouse, Rec-IM, and Jones Pool Complex	Mid Campus	-	High	Not Specified	No	No	$ 88,797,785
Buell Residence Hall	Mid Campus	Residence/ Apartments	Low	Not Specified	Yes	No	$ 11,957,807
Wise Residence Hall	Mid Campus	Residence/ Apartments	Low	Not Specified	Yes	No	$ 18,367,751
Hill Residence Hall	North Campus	Residence/ Apartments	Low	Not Specified	Yes	No	$ 15,824,970
Pittman Residence Hall	North Campus	Residence/ Apartments	Low	Not Specified	Yes	No	$ 15,824,970

Development and Redevelopment Trends

In addition to current at-risk structures, future structures in the floodplain or in high-risk stormwater areas are also at risk. One way to assess potential future risk is to analyze planned future buildings on campus. The University is constructing several new buildings including the GameAbove Golf Performance Center, Lakeview Residence Hall, and Westview Residence Hall. While none of these new buildings are in the floodplain, increased development increases the amount of impermeable surface. New buildings can increase stormwater problems on the already strained stormwater system. Conversely, EMU is in the process of removing several structures, which may aid in reducing flood risk.

Climate change could affect future flood impacts on campus as data shows increasing precipitation trends for the planning area. Further, the frequency of severe precipitation events has increased in the planning area over the last 30 years; the frequency of the 25-year, 24-hour storm event has increased by nine percent, and the 100-year, 24-hour storm event has increased by 17 percent.[37] Further, heavy rainfall events have grown faster than total precipitation, meaning that more precipitation is concentrated in extreme rainfall events, which in turn could lead to increased flooding. In addition, more snow falling as rain in the winter months, as temperatures warm, could increase precipitation totals. According to the State of Michigan Hazard Mitigation Plan, spring flooding could worsen as snowfall melting patterns change with increasing temperatures. It should also be noted that warmer temperatures could negate some of the projected increases in precipitation by increasing evaporation and creating drier conditions, especially in the summer months. Future flood-risk will depend upon a number of future factors: realized increases in temperature combined with realized increases in precipitation and heavy rainfall events, as well as future development trends and adopted mitigation actions.

Natural Hazards – Weather Hazards

Extreme Cold / Wind Chill

Description

The term “extreme cold” can have varying definitions in hazard identification. It may or may not be associated with a winter storm. Generally, extreme cold events refer to a prolonged period of time (days) with extremely cold temperatures. An extreme cold event to the National Weather Service can refer to a single day of extreme or record-breaking day of sub-zero temperatures. Extended or single day extreme cold events can be hazardous to people and animals, and cause problems with buildings and transportation. Extreme cold and winter storm events are generally predictable along with larger weather patterns.

“Very cold” weather is relative to where you are located and what kinds of weather a population is accustomed to. It also depends on air temperature combined with wind speed. Higher winds make any given temperature “feel” colder because of the extra cooling effect moving air causes.

The National Weather Service uses the Wind Chill Index to normalize these factors and provide a more effective categorization of when temperatures become dangerously cold.

[37] Implications of NOAA Atlas 14: Precipitation-Frequency Atlas of the United States for Stormwater Management. (n.d.). Huron River Watershed Council. Retrieved from August 29, 2017.

The National Weather Service weather forecast offices routinely issue two types of alerts to warn people about dangerously low wind chill temperatures.

- A **Wind Chill Advisory** is issued when wind chill temperatures are potentially hazardous.
- A **Wind Chill Warning** is issued when wind chill temperatures are life-threatening.

The Wind Chill Index is a measure of the rate of heat loss from exposed skin caused by the combined effects of wind and cold. As the wind increases, heat is carried away from the body at a faster rate, driving down both the skin temperature and eventually the internal body temperature. Exposure to extreme wind chills can be life-threatening. **Figure 4-20** includes the NOAA Wind Chill Chart which demonstrates the Wind Chill Index as it corresponds to various temperatures and wind speeds.[38] For example, if the air temperature is 5°F and the wind speed is 10 miles per hour, then the wind chill would be -10°F.

	AIR TEMPERATURE (F)																		
WIND SPEED (mph)	50	45	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40
5	48	42	36	31	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40	-46	-52	-57
10	46	40	34	27	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47	-53	-59	-66
15	45	38	32	25	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51	-58	-64	-71
20	44	37	30	24	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55	-61	-68	-74
25	43	36	29	23	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58	-64	-71	-78
30	42	35	28	22	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60	-67	-73	-80
35	41	35	28	21	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62	-69	-76	-82
40	41	34	27	20	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64	-71	-78	-84
45	40	33	26	19	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79	-86
50	40	33	26	19	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81	-88
55	40	32	25	18	11	4	-3	-11	-18	-25	-32	-39	-46	-54	-61	-68	-75	-82	-89
60	39	32	25	17	10	3	-4	-11	-19	-26	-33	-40	-48	-55	-62	-69	-76	-84	-91
65	39	32	24	17	10	2	-5	-12	-19	-27	-34	-41	-49	-56	-63	-70	-78	-85	-92
70	38	31	24	16	9	2	-6	-13	-20	-27	-35	-42	-49	-57	-64	-71	-79	-86	-93
75	38	31	23	16	9	1	-6	-13	-21	-28	-36	-43	-50	-58	-65	-72	-80	-87	-95
80	38	30	23	16	8	1	-7	-14	-21	-29	-36	-44	-51	-59	-66	-73	-81	-88	-96
85	38	30	23	15	8	0	-7	-15	-22	-30	-37	-44	-52	-59	-67	-74	-82	-89	-97
90	37	30	22	15	7	0	-8	-15	-23	-30	-38	-45	-53	-60	-68	-75	-83	-90	-98
95	37	29	22	14	7	-1	-8	-16	-23	-31	-38	-46	-53	-61	-68	-76	-84	-91	-99
100	37	29	22	14	6	-1	-9	-16	-24	-31	-39	-47	-54	-62	-69	-77	-84	-92	-100

Approx frostbite times: 30 min | 10 min | 5 min

Figure 4-20: National Weather Service Wind Chill Index Chart

Frostbite and hypothermia are both extreme cold-related impacts that result when individuals are exposed to extreme temperatures and wind chills, in many cases as a result of severe winter storms. During exposure to extremely cold weather, the body reduces circulation to the extremities (e.g., feet, hands, nose, cheeks, ears, etc.) in order to maintain its core temperature. If the extremities are exposed, then this reduction in circulation coupled with the cold temperatures can cause the tissue to freeze. The following describes the symptoms associated with frostbite and hypothermia.

- **Frostbite:** is characterized by a loss of feeling and a white or pale appearance. At a wind chill of -19°F, exposed skin can freeze in as little as 30 minutes. It can permanently damage tissue and in severe cases can lead to amputation.

[38] National Weather Service. Safety – Winter Hazards. Retrieved from [Safety - Winter Hazards (weather.gov)]

- **Hypothermia:** occurs when the body begins to lose heat faster than it can produce. As a result, the body's temperature begins to fall. Hypothermia is characterized by uncontrollable shivering, memory loss, disorientation, incoherence, slurred speech, drowsiness, and exhaustion. Left untreated, hypothermia will lead to death. Hypothermia occurs most commonly at very cold temperatures but can occur at cool temperatures (above 40°F) if an individual isn't properly clothed or becomes chilled.

NOAA's Warnings and Advisories for Extreme Cold/Wind Chill

The Detroit/Pontiac NWS Weather Forecast Station has the following thresholds for wind chill:

A **Wind Chill Advisory** is issued if wind chill values drop between -15 and -24°F. A **Wind Chill Warning** is issued if wind chill values fall to -25°F or below.

Nationally, climate change is expected to result in increasing temperatures for all parts of the country. Climate scientists expect that warming temperatures will result in the coldest days being less cold which would reduce the extreme cold/wind chill hazard. Trends show temperature increases on cold days growing larger farther north across the United States.

Location

The entire campus is uniformly exposed to the Extreme Cold/Wind Chill hazard.

Previous Occurrences

To understand extremes, it is beneficial to understand typical temperatures. The closest weather monitoring station through NOAA is located at the University of Michigan in Ann Arbor which is approximately 6 miles from Eastern Michigan University. **Figure 4-21** shows average minimum temperatures and extreme minimum temperatures for the weather monitoring station at the University of Michigan in Ann Arbor. Average low temperatures are freezing or below from November through March.

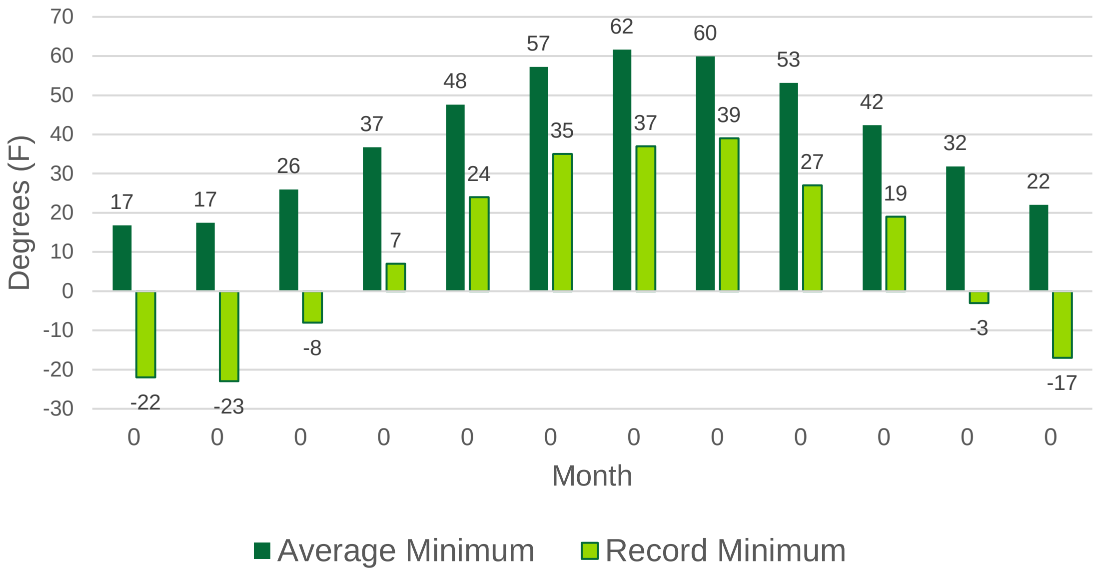


Figure 4-21: Local Average Minimum and Extreme Minimum Temperatures

Source: Western Regional Climate Center, Ann Arbor U of M Station (200230)
*Based on records from 1880-2022

Data regarding extreme cold/freeze previous occurrences came from several different sources, including the NOAA National Centers for Environmental Information (NCEI) Storm Events Database and University maintenance incident data.

NCEI Storm Events Database

The NCEI Storm Events Database records extreme-cold events by county; data specific to the campus is not available. Therefore, all extreme cold events reported for Washtenaw County are included. According to NCEI, there has been a total of three extreme cold events in Washtenaw County since 2000; as cold temperatures are a regular occurrence during winter months, events have likely gone unrecorded. Details for the three reported events are included in **Table 4-15.**

Table 4-15: Previous Extreme Cold/Wind Chill Occurrences in Washtenaw County

Date	Deaths/ Injuries	Property Damage (2023 dollars)	Details
12/21/2000	0/0	$937,454	Temperatures never got out of single digits on the 22nd, with Detroit seeing a high of only 4 degrees, after a morning low of -3 degrees. The cold hampered shipping interests. Ice formation was extremely rapid on the Great Lakes and the connecting waterways. Average temperatures for the month were 19.3 degrees in Detroit, which was the 4th coldest December on record. Burst pipes reported through the area.
1/14/2009	0/0	$0	An arctic airmass become firmly established over the Great Lakes region on January 14th and persisted through the 18th. Temperatures fell below zero all four days, with wind chill values in

Date	Deaths/ Injuries	Property Damage (2023 dollars)	Details
			the 5 to -30 degrees range during the majority of the time.
2/14/2015	0/0	$0	Arctic airmass ushered in by northwest winds produced wind chills around -30 degrees across most of Southeast Michigan the early morning of February 15th. Temperatures of -5 to 5 above zero in the evening hours of February 14th coupled with northwest winds of 15 to 20 mph produced wind chills around 25 below zero. Although winds diminished to around 10 mph during the early morning hours of February 15th, temperatures bottomed between 5 to 15 below zero. Temperatures slowly rose during the morning hours with corresponding wind chills climbing above -20 degrees during the afternoon hours.

University Maintenance Incident Data

In addition to the events reported by NCEI, the University provided maintenance incident data from December 2008 to August 2022. The dataset was focused on incidents involving water. However, 10 of the 32 reported incidents cited freezing and 59% of the incidents took place in the winter. The incidents citing freezing cost over $2 million (2023 dollars) and are shown in **Table 4-16**.

Table 4-16: EMU Maintenance Claims Citing Freezing

Building	Date	Cost (2023 dollars)	Description
McKenny Hall	12/24/2008	$1,032,932	Burst pipe from freezing
Goddard Residence Hall	12/25/2010	$45,525	Broken pipe due to freezing
Mark Jefferson Science Building	1/22/2013	$53,508	Broken pipe fitting due to freezing
University House	2/21/2015	$22,802	Frozen pipe - fire suppression
Westview Apartments	2/1/2019	$264,495	Pipe Burst Frozen (Bldg F, R, O, B, I)
Wise Residence Hall	2/1/2019	$56,275	Frozen pipe
Indoor Practice Facility	2/2/2019	$11,255	Toilet froze, pipe busted, mold
Marshall Building	12/24/2022	$257,500	Frozen sprinkler heads due to loss of heat
Pray-Harrold Classroom Building	12/25/2022	$72,100	Frozen burst pipe - 2 steam release valves froze

Building	Date	Cost (2023 dollars)	Description
Village Residence Hall E	12/26/2022	$206,000	Frozen sprinkler head from a student turning off heat.

Further, several respondents in EMU's public survey reported facing impacts from Extreme Cold events. Most significantly, several campus buildings were reported to be under-equipped to meet heating requirements in winter months. Roosevelt Hall, Sherzer Hall, and several residence halls are among the buildings on campus about which respondents raised concerns.

Extent

The extent of extreme cold/wind chill extent (i.e., severity) can be defined with record lows and the NWS Wind Chill Index. The record temperature at the University of Michigan monitoring station approximately 6 miles from Eastern Michigan University is -22°F, occurring in January 1994.[39] This correlates to frostbite exposure times of 5-30 minutes (**Figure 4-20**). However, colder events are possible. Warming temperatures associated with climate change may result is less severe extreme cold events in the future.

Probability

With only three recorded events since 1995, data indicates that Washtenaw County experiences less than one recorded extreme cold/wind chill event every nine years. However, it is likely events have gone unreported, as freezing temperatures are a regular occurrence during the County's winter months. Additionally, the University reports a claim associated with freezing approximately every year. Considering the current climate, with average lows below freezing November to March, and projected climate conditions for increasing winter temperatures, the probability assigned to the extreme cold/wind chill hazard is likely (between 50+ percent and 90 percent annual chance).

Nationally, climate change is expected to result in increasing temperatures for all parts of the country, often along with increased precipitation. Climate scientists expect that warming temperatures will result in the coldest days being less cold which would reduce frequency of the extreme cold/wind chill hazard. Increased precipitation could complicate cold weather by bringing more ice storms. The University should not count on past winter weather patterns remaining stable into the future.

According to the *Fourth National Climate Assessment*, average US temperatures have increased by 1.3°F to 1.9°F since 1895, when recordkeeping began. Since 1970, temperature increases have occurred rapidly. Increases in average temperature will result in more hot weather and an increasing number of extreme heat days. According to the *Fourth National Climate Assessment*, average annual temperatures are projected to increase by at least 2°F in Michigan by Mid-Century and at least 4°F Late Century as shown in **Figure 4-22**.[40]

[39] NOAA. (n.d.). *Climate Data Online*. Retrieved on August 17, 2023 from Climate Data Online (CDO) - The National Climatic Data Center's (NCDC) Climate Data Online (CDO) provides free access to NCDC's archive of historical weather and climate data in addition to station history information. | National Climatic Data Center (NCDC) (noaa.gov)

[40] Chapter 1: Overview. Fourth National Climate Assessment. Retrieved from Overview - Fourth National Climate Assessment (globalchange.gov)

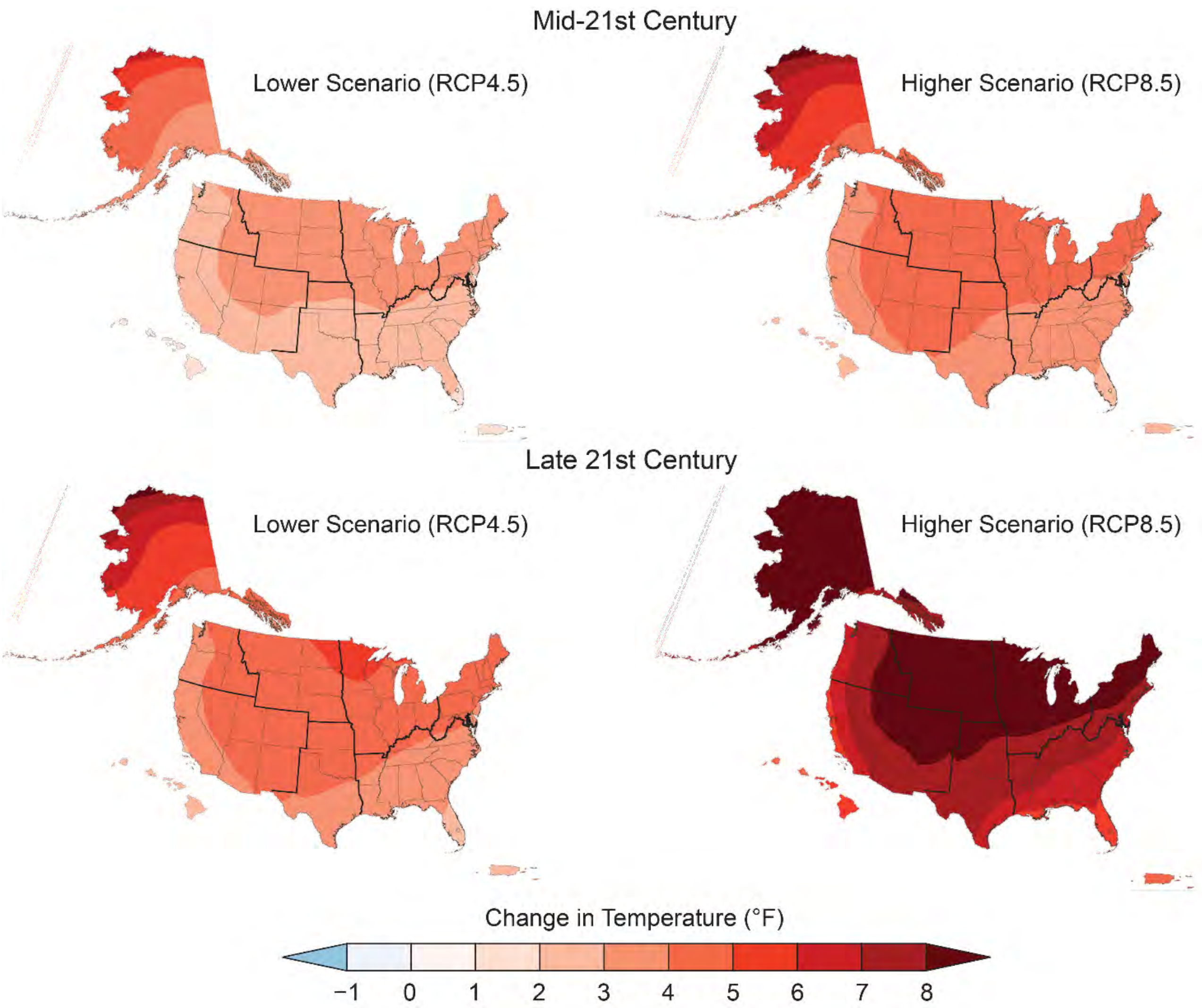


Figure 4-22: Projected Average Annual Temperature Changes in the United States

Vulnerability Assessment

The entire Eastern Michigan University campus, including current and future buildings, populations, infrastructure, and other assets, is vulnerable to extreme cold/wind chill events.

Extreme cold can result in damage to buildings, including critical facilities, typically from internal pipes freezing and bursting. Frozen water lines can interrupt water supplies and cause enormous damage to buildings and property from burst pipes. With many students and personnel living and working on campus, burst pipes from freezing can lead to large operational disruptions. Damages from frozen pipes on campus has cost over $2 million dollars since 2008. Extreme cold/wind chill can also result in damage to infrastructure, including broken water mains and stress to concrete and asphalt.

Extreme cold/wind chill can result in frostbite or hypothermia, even after only a few minutes of exposure. Certain populations, such as the elderly, young children, and those without access to an adequate heat source are considered at a higher risk to the impacts of extreme cold, which could include death. Some extreme cold/wind chill events may result in advisories for people to remain indoors to limit exposure. Evacuations are not likely for extreme cold events; however, people may be advised to remain indoors. New students coming from warmer climates are also considered a vulnerable population as they may not be used to colder climates and may not have proper clothing and equipment.

Wide-scale impacts to public health from extreme cold/wind chill events are limited. Carbon monoxide-related deaths are highest during extreme cold events, due to the increased use of gas-powered furnaces and alternative heating sources (e.g., generators, grills, and camp stoves) inside homes and buildings.[41] Risk for fire and electric shock also increases when using alternative heating and power sources, such as space heaters. Energy emergencies may exacerbate the impacts of extreme cold events and increase the risk of pipes freezing.

Socially vulnerable populations have high risk to extreme cold events. Economically constrained households are more likely to live in homes with inadequate heat (e.g., substandard or aging housing) and less able to find or even seek out a warm place. Further, such populations may have little to no financial buffers that would facilitate preparedness or mitigation actions such as repair or insulation of homes, purchase and installation of safe heating options, or the ability to afford a heating bill surge resulting from an extreme cold event. This often results in use of improper heat sources (such as use of a stove) which creates further dangers like carbon monoxide poisoning. People with housing insecurity also face increased risks and may struggle finding or traveling to a heated location. Students living In housing with inadequate or aging heating systems may be more vulnerable to extreme cold events.

Climate change has the potential to decrease the severity and frequency of extreme cold events. However, EMU is likely to continue to experience extreme cold temperatures. Annual average temperatures are expected to increase as shown in **Figure 4-22**. Average winter temperatures and average minimum winter temperatures are also expected to increase. The GLISA NOAA Climate Adaptation Partnership studies climate to help communities understand, plan for, and respond to climate impacts within the Great Lakes Region. GLISA projects the number of days below 20°F will decrease by 2.5 to 5 days in Ypsilanti by Mid-Century as shown in **Figure 4-23**.[42]

[41] Extreme Weather & Public Health. Arizona Department of Health Services. Retrieved from ADHS - Extreme Weather & Public Health - Extreme Cold - Carbon Monoxide Poisoning (azdhs.gov)
[42] Great Lakes Regional Climate Change Maps. GLISA. Retrieved from Great Lakes Regional Climate Change Maps | GLISA (umich.edu)

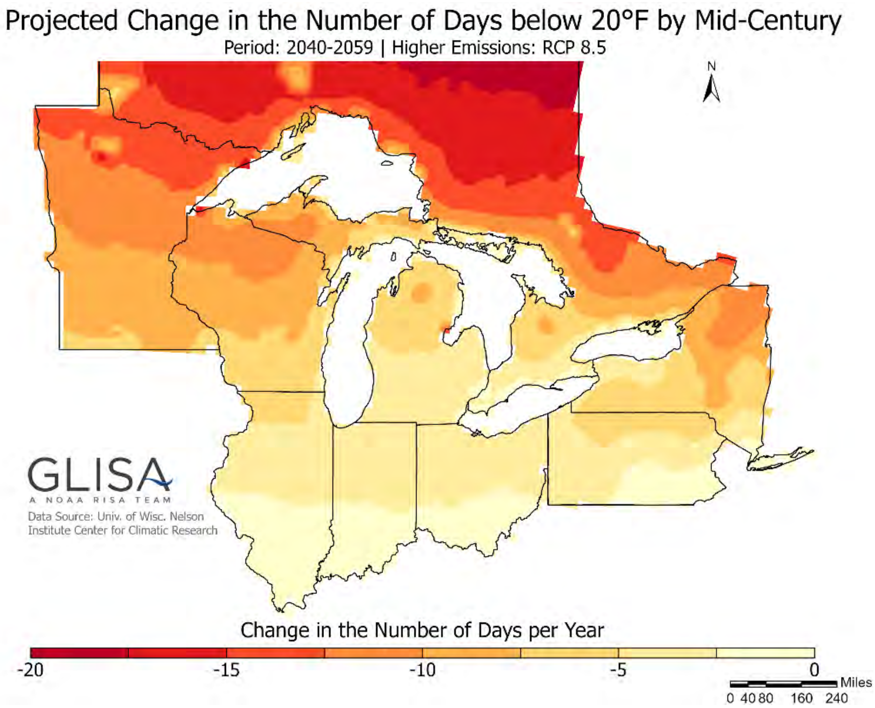


Figure 4-23: Change in Number of Days below 20°F by Mid-Century

Projected temperature increases will likely reduce the frequency and severity of extreme cold/wind chill events in the future, which will potentially lessen future impacts. However, EMU is likely to continue to experience temperatures below freezing and those capable of causing frostbite in future.

Extreme Heat

Description

Extreme heat is characterized by temperatures that hover 10 degrees or more above the average high temperature of a region for several days to several weeks. In comparison, a heat wave may occur when temperatures hover 10 degrees or more above the average high temperature for the region and last for an extended period. The actual temperature threshold depends on norms for the region.[43]

Extreme heat events are usually a result of both high temperatures and high relative humidity. (Relative humidity refers to the amount of moisture in the air.) The higher the relative humidity or the more moisture in the air, the less likely that evaporation will take place. This becomes significant when high relative humidity is coupled with soaring temperatures. On hot days, the human body relies on the evaporation of perspiration or sweat to cool and regulate the body's internal temperature. Sweating does nothing to cool

[43] Extreme heat. (n.d.). University of Washington. Retrieved August 10, 2017 from https://www.washington.edu/uwem/preparedness/know-your- hazards/extreme-heat/.

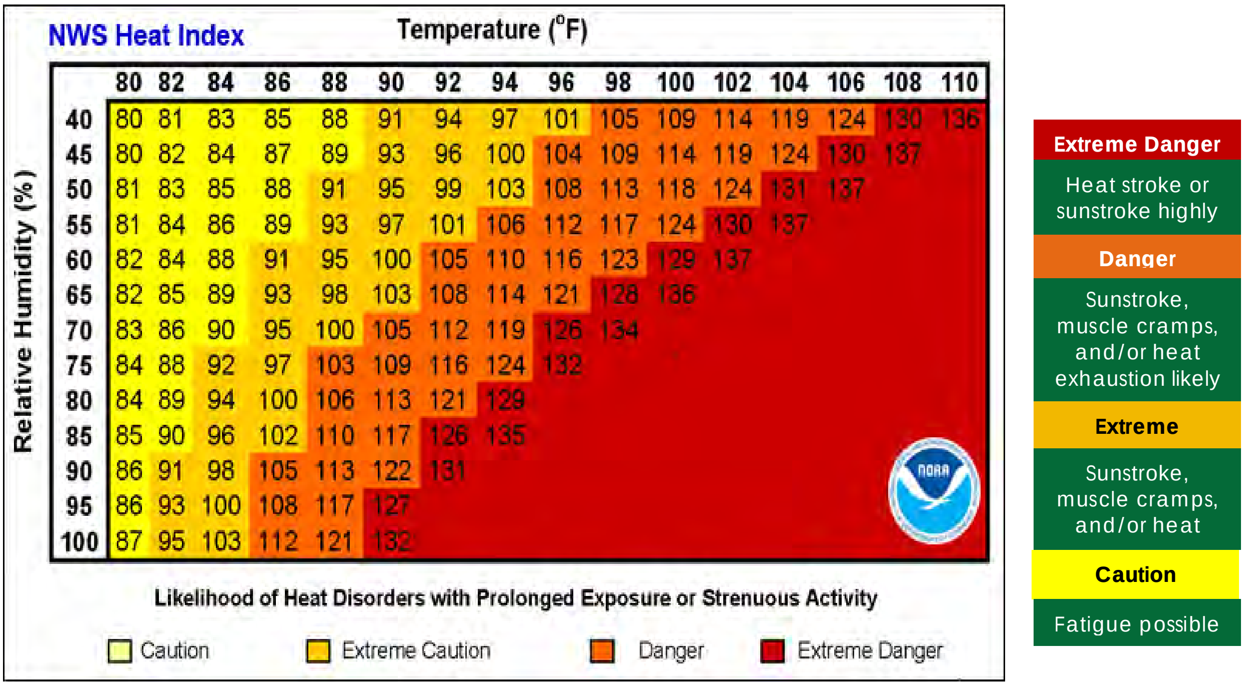
the body unless the water is removed by evaporation. When the relative humidity is high, then the evaporation process is hindered, robbing the body of its ability to cool itself.

NOAA's Warnings and Advisories for Extreme Heat

The Detroit/Pontiac NWS Weather Forecast Station has the following thresholds for heat waves:

A heat wave is a prolonged period of excessive heat and humidity. An **Excessive Heat Warning** is issued if the heat index equals or exceeds 105° for at least three consecutive hours. **Heat Advisories** are posted when the heat index is expected to exceed 100° for three consecutive hours and can be extended into the night if low temperatures are in the 70s or higher. **Excessive Heat Warnings and Heat Advisories** can be issued below criteria with additional guidance, or if a prolonged event is occurring or forecast.

The National Weather Service Weather Fatalities Database has records of heat-related fatalities beginning in 1986. Since 1986, there has been an approximate 30-year-average of 168 heat-related deaths annually.[44] To raise the public's awareness of the hazards of extreme heat, the National Weather Service has devised the "Heat Index." The Heat Index Chart, shown in **Figure 4-24**, uses air temperature and humidity to determine the heat index or apparent temperature.[45] In addition, information regarding the health dangers by temperature range is presented.



RH (%)	80	82	84	86	88	90	92	94	96	98	100	102	104	106	108	110
40	80	81	83	85	88	91	94	97	101	105	109	114	119	124	130	136
45	80	82	84	87	89	93	96	100	104	109	114	119	124	130	137	
50	81	83	85	88	91	95	99	103	108	113	118	124	131	137		
55	81	84	86	89	93	97	101	106	112	117	124	130	137			
60	82	84	88	91	95	100	105	110	116	123	129	137				
65	82	85	89	93	98	103	108	114	121	128	136					
70	83	86	90	95	100	105	112	119	126	134						
75	84	88	92	97	103	109	116	124	132							
80	84	89	94	100	106	113	121	129								
85	85	90	96	102	110	117	126	135								
90	86	91	98	105	113	122	131									
95	86	93	100	108	117	127										
100	87	95	103	112	121	132										

Figure 4-24: National Weather Service Heat Index Chart

[44] National Weather Service. (2022). *Weather Related Fatality and Injury Statistics*. NOAA. Retrieved on August 18, 2023 from Weather Related Fatality and Injury Statistics
[45] Extreme heat. (n.d.). University of Washington. Retrieved August 10, 2017 from https://www.washington.edu/uwem/preparedness/know-your- hazards/extreme-heat/.

Some of the heat dangers associated with extreme heat are described below. Some populations, such as the elderly and young children, are more susceptible to heat danger than other segments of the population.

Heat Disorders: Heat disorders are illnesses caused by prolonged exposure to hot temperatures and are characterized by the body's inability to shed excess heat. These disorders develop when the heat gain exceeds the level the body can remove or if the body cannot compensate for fluids and salt lost through perspiration. In either case, the body loses its ability to regulate its internal temperature. All heat disorders share one common feature: the individual has been overexposed to heat, or over exercised for their age and physical condition on a hot day. The following describes the symptoms associated with the different heat disorders.

Sunburn: Sunburn is characterized by redness and pain of skin exposed too long to the sun without proper protection. In severe cases it can cause swelling, blisters, fever, and headaches. It can significantly limit the skin's ability to shed excess heat.

Heat Cramps: Heat cramps are characterized by heavy sweating and painful spasms, usually in the muscles of the legs and possibly the abdomen. The loss of fluid through perspiration leaves the body dehydrated resulting in muscle cramps. This is usually the first sign that the body is experiencing trouble dealing with heat.

Heat Exhaustion: Heat exhaustion is characterized by heavy sweating, weakness, nausea, exhaustion, dizziness and faintness. Breathing may become rapid and shallow and the pulse weak. The skin may appear cool, moist and pale. Blood flow to the skin increases, causing blood flow to decrease to the vital organs. This results in a mild form of shock. If not treated, the victim's condition will worsen.

Heat Stroke (Sunstroke): Heat stroke is a life-threatening condition characterized by a high body temperature (106°F or higher). The skin appears to be dry and flushed with very little perspiration present. The individual may become mentally confused and exhibit behavior such as aggression. The pulse is rapid and strong. There is a possibility that the individual will faint or slip into unconsciousness. If the body is not cooled quickly, brain damage and death may result.

Studies indicate that, all things being equal, the severity of heat disorders tend to increase with age. Heat cramps in a 17-year-old may be heat exhaustion in someone 40-years-old and heat stroke in a person over 60. Elderly persons, small children, chronic invalids, those on certain medications and persons with weight or alcohol problems are particularly susceptible to heat reactions.

Nationally, climate change is expected to result in increasing temperatures for all parts of the country. According to the Fourth National Climate Assessment, average US temperatures have increased by 1.2°F over the last two decades and by 1.8°F relative to the start of the century. Since 1970, temperature increases have occurred rapidly. **Figure 4-25** shows changes in temperatures across the United States from 1986-2016, compared to the 1901-1960 average. Warming is projected for all parts of the country over the next several decades. The degree of warming will ultimately depend on greenhouse gas emissions. Warming will also vary by location; generally, the farthest north regions are projected to experience the greatest amount of warming, with the southeast experiencing the least.

Depending on location, the US is expected to warm by 3 to 5°F under a lower emissions scenario and by 4 to 8+°F under a higher emissions scenario in the late 21st century.[46]

Warming temperatures have already had an impact on heat waves. Analyses from the National Climate Assessment show that there has been an increased frequency of heat waves since the 1960s. In the like, the intensity of these waves area expected to be greater than that of cold waves, as temperatures reach values higher than average, In 2011 and 2012, the number of intense heat waves were almost triple the long-term average, and analyses from the Fourth National Climate Assessment show that climate change has increased the probability of heat waves.

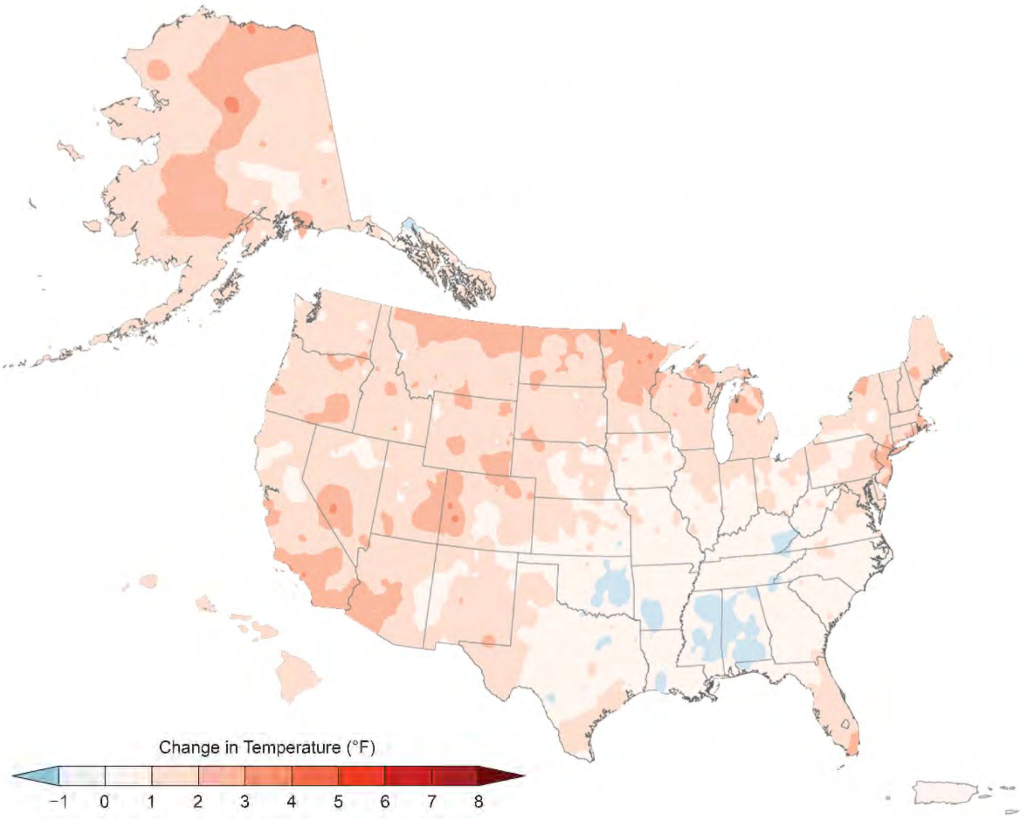


Figure 4-25: US Temperature Changes (1986-2016)

*Compared to the 1901-1960 average
Source: The Fourth National Climate Assessment

Extreme heat events can be exacerbated in localized places by what are known as “heat islands.” Heat islands form when open land and vegetation is replaced with impermeable surfaces, such as concrete, asphalt, and building rooftops. On hot, sunny, days exposed surfaces can absorb and radiate heat, sometimes to temperatures 50 to 90 degrees

[46] Hayhoe, K., et al. (2018) Our Changing Climate. In *Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Volume II*. Retrieved on August 11, 2023 from [Our Changing Climate - Fourth National Climate Assessment (globalchange.gov)]

Fahrenheit hotter than the air temperature.[47] In contrast, vegetated areas tend to remain close to air temperatures, and trees can provide shade for people, buildings, and automobiles. **Figure 4-26** demonstrates the temperature variations that can occur due to different types of land cover, resulting in heat islands in developed locations.[48]

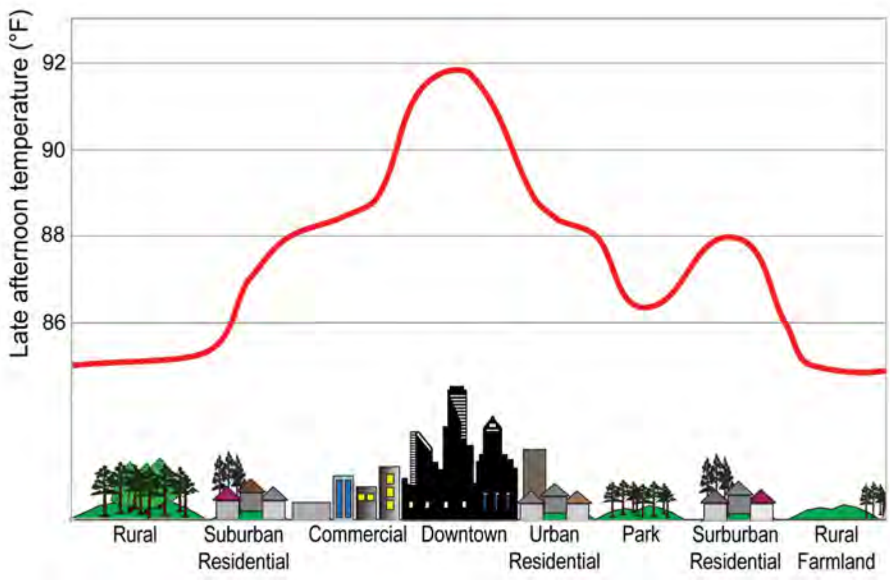


Figure 4-26: The Urban Heat Island Effect

Location

The entire campus is impacted by extreme heat events.

Previous Occurrences

To understand extremes, it is beneficial to understand typical temperatures. **Figure 4-27** shows average maximum temperatures and extreme maximum temperatures for Eastern Michigan University, as observed from a weather station on the University of Michigan Ann Arbor campus, approximately 6 miles away. Summer months, or June through August, are generally the warmest months with average maximum temperatures of 79ºF to 81ºF.

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[47] Heat Island Impacts. (2017). US Environmental Protection Agency. Retrieved August 10, 2023 from https://www.epa.gov/heat-islands/heat-island-impacts.

[48] Global Climate Change Impacts in the United States: Urban Heat Island Effect. (2009). U.S. Global Change Research Program. Retrieved August 10, 2023 from https://nca2009.globalchange.gov/urban-heat-island-effect/index.html.

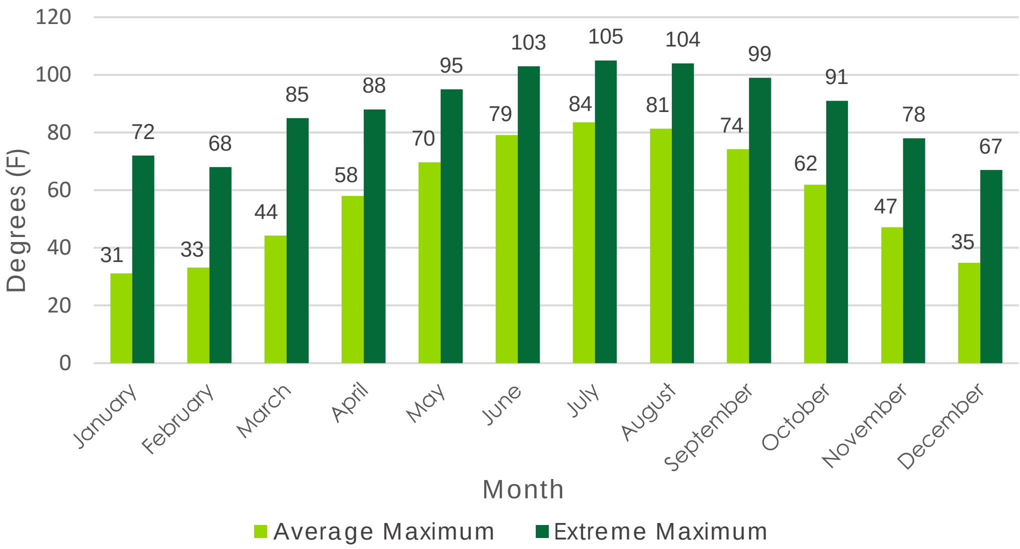

Figure 4-27: Average and Record High Temperatures in Ann Arbor

Source: Western Regional Climate Center, Ann Arbor U of M Station (200230)

**Based on records from 1880-2022*

Data regarding extreme heat previous occurrences came from the NOAA National Centers for Environmental Information (NCEI) Storm Events Database.

The NCEI Storm Events Database reports extreme-heat events by county; city- or campus-specific data is generally not available. Therefore, all extreme heat events reported for Washtenaw County are included. Due to the regional nature of extreme heat events, it is likely that events impacting Washtenaw County likely impacted the University's Ypsilanti campus. According to NCEI, there has been a total of 12 extreme heat events in Washtenaw County since 1996. These events resulted in no deaths or damages but did result in 17 injuries. Previous extreme heat events are detailed in **Table 4-17**.

Table 4-17: Previous Extreme Heat Occurrences in Washtenaw County

Date	Deaths/ Injuries	Details
2/11/1999	0/0	--
7/4/1999	0/0	--
3/8/2000	0/0	--
8/6/2001	0/2	High heat and humidity allowed daytime heat indices to exceed 100 degrees four days in a row across Southeast Michigan. Heat advisories were in effect for all southeast Michigan for the afternoons and evenings of the 7th, 8th, and 9th. During this time period, heat indices ranged from 105 to 110 degrees. The heat caused several people to seek emergency care for heat stroke and heat exhaustion. Thousands of power outages also occurred throughout the region as demand surpassed supply.

Date	Deaths/ Injuries	Details
5/29/2006	0/4	An early season heat wave resulted in dozens of people suffering from heat related illnesses. High temperatures, in the low to mid 90's, sent people to the hospital. The official high temperatures for the day ranged from 88 to 93 degrees. Heat indices were in the mid 90's throughout most of the day. At least 20 people, from across the entire region, were admitted to area hospitals for heat illnesses. This number was likely much larger.
7/29/2006	0/0	--
8/1/2006	0/0	--
7/4/2010	0/0	--
7/17/2011	0/0	--
6/28/2012	0/0	--
7/1/2012	0/5	High temperatures climbed to around 100 degrees across much of southeast Michigan during the afternoon hours of June 28th, with heat indices climbing between 100 and 110 degrees. This led to an increase in heat related hospitalizations.
7/14/2013	0/6	A six-day heat wave impacted Southeast Michigan July 14th through the 19th with high temperatures ranging from the upper 80s to mid-90s. Heat Indices were in the 90s for the most part, but Detroit Metro area hospitals reported an increase of 173 heat related illnesses during this stretch.
6/30/2018	0/0	A five-day heat wave impacted Southeast Michigan June 30th through July 5th. High temperature increases ranged from 90-96 degrees. Heat-related emergency room hospitalizations spiked on July 1st and remained through the rest of the heat wave.

Additionally, several respondents from EMU's public survey reported facing extreme heat impacts resulting from a lack of or insufficient indoor climate regulation. Respondents raised concerns about older campus buildings that do not have air conditioning creating uncomfortable classroom and working environments.

Extent

Aside from the heat-induced health impacts, extreme heat extent can be defined with record highs and the NWS Heat Index. The record temperature at the University of Michigan monitoring station is 105°F, occurring in July 1934, which was likely into the extreme danger level (**Figure 4-24**). Heat index can make the air feel even warmer.

Hotter events than those of the past are possible, especially with expected temperature increases due to climate change. **Figure 4-28** shows the projected annual temperature increases in Michigan for 2040-2059, developed by GLISA and based on a high emissions scenario.[49] Based on the map, the University can expect a 4.25 to 5°F increase in annual average temperature. GLISA also projects summer temperature increases 5.25 to 5.5°F for the campus based on the same scenario.

In addition, impacts from urban heat island effects could increase due to any future increased development on and adjacent to the EMU campus. Such impacts from urban heat islands could be reduced through the increased use of mechanisms such as tree canopies and green roofs.

Probability

As noted by average and record highs, temperatures frequently reach into those listed on the NWS Heat Index Chart (80°F and above). With 13 reported extreme heat events in 19 years, Washtenaw County experiences a reported extreme heat event every one to two years.

When determining future probability, the historic frequency must be considered along with projected future conditions. According to

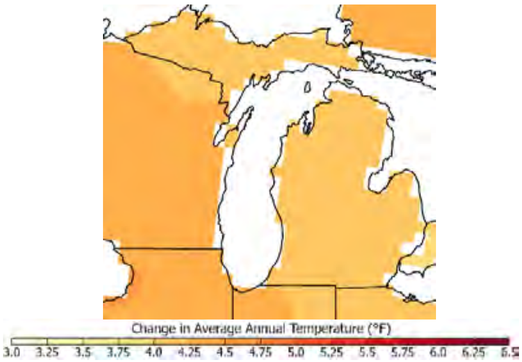

Figure 4-28 Projected Change in Average Temperature, 2040-2059

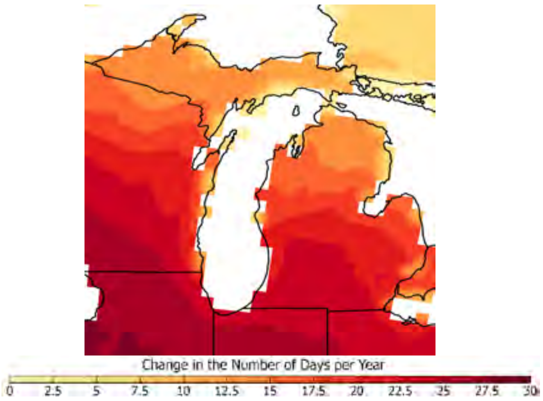

Figure 4-29 Projected Change in Days Over 90°F, 2040-2059

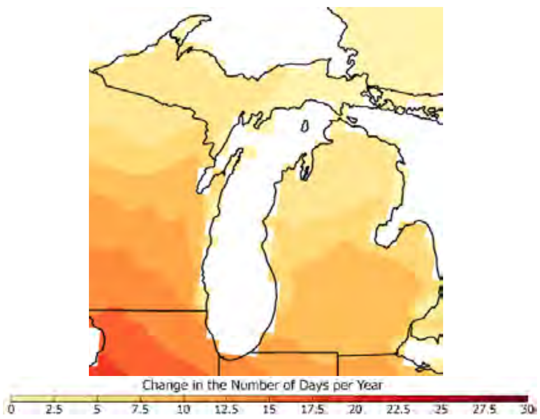

Figure 4-30 Projected Change in Days Over 100°F, 2040-2059

[49] Great Lakes Regional Climate Change Maps. (n.d.). GLISA. Retrieved August 17, 2023 from http://glisa.umich.edu/resources/great-lakes-regional-climate-change-maps.

data from GLISA[50], 20 to 30 additional days per year with temperatures over 90°F are expected to occur in the planning area from 2040-2059 (**Figure 4-29**)**.** Similarly, the number of days per year with temperatures over 95°F are projected to increase by 5 to 10 days (**Figure 4-30**). Based on historic events and projected conditions, the probability assigned to the extreme heat hazard is likely (between 50+ percent and 90 percent annual chance).

Vulnerability Assessment

The entire EMU main campus is vulnerable to extreme heat, including all current and future buildings, infrastructure, and populations.

On the Ypsilanti campus, buildings, roads, parking lots, and synthetic turf fields contribute to the urban heat island effect. Fields that are made of synthetic turf grass develop a heat island effect due to two factors: 1) the synthetic turf blades trap heat and do not transpire (release water vapor), as natural grass does, and 2) the infill used underneath the blades (typically black rubber), absorbs, and radiates heat. Typically, synthetic turf gets 35°F to 55°F hotter than natural turf.[51]

There are no associated dollar losses with the extreme heat hazard in the planning area. Future damages are expected to be negligible but are possible through indirect losses, such as power outages, for example. Extreme heat events generally have limited impact on buildings. However, in some rare cases extreme heat can cause structures to collapse or buckle. Heat can also cause pavement to expand and buckle.

Despite limited potential for damages, there are serious health risks to the population. Urban areas are exposed more acutely to the dangers of extreme heat due to the urban heat island effect. On campus, this would include built areas without shading, such as surface parking lots and clusters of buildings. Rynearson Stadium is also particularly vulnerable to extreme heat events, due to the use of turf grass and rubber fill, which captures and radiates heat, as well as the “bowl” shape of the stadium which limits air flow ties and breezes.

Certain groups may be more vulnerable to the effects of extreme heat. Groups particularly vulnerable to extreme heat include:[52]

- Older adults who do not adjust as quickly to changes in temperature. Older adults are also more likely to be on medications or have chronic illnesses that affect the body’s ability to regulate its temperature. Groups of older adults on campus may include those part of the University’s faculty or staff, or campus visitors.
- Infants and children, who rely on others to keep them cool and hydrated. Like older adults, children may visit campus for special events or field trips or as residents in family-oriented on-campus housing.
- Athletes, who may be more likely to exercise and become dehydrated during extreme heat events. The University houses a large number of athletes (varsity, club, and intramural teams), and well as students utilizing athletic facilities on-campus.

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[50] Great Lakes Regional Climate Change Maps. (n.d.). GLISA. Retrieved August 17, 2023 from http://glisa.umich.edu/resources/great-lakes-regional-climate-change-maps.
[51] Surface Temperature of Synthetic Turf. Penn State’s Center for Sports Surface Research. Retrieved from http://plantscience.psu.edu/research/centers/ssrc/documents/temperature.pdf.
[52] Natural Disasters and Severe weather – About extreme heat. (2017). Centers for Disease Control and Prevention. Retrieved August 17, 2023 from https://www.cdc.gov/disasters/extremeheat/heat_guide.html.

- Outdoor workers, such as maintenance and grounds keepers, who have more exposure to extreme heat and are more likely to become dehydrated.

Populations who may not have air conditioning available in offices or residence halls.

People are at risk for heat stroke or sun stroke, heat exhaustion, fatigue, and dehydration. Preparedness reduces the risks associated with this hazard. In cases of extreme heat:

- Stay indoors as much as possible to limit exposure (consider public buildings such as libraries, schools, movie theaters, or cooling centers if you do not have air conditioning);
- Limit alcoholic intake;
- Drink plenty of water, even if you do not feel thirsty;
- Do not leave children or pets in vehicles;
- Check on vulnerable populations;
- Arrange your day to avoid strenuous work during the warmest part of the day, if possible;
- Use an electric fan to vent hot air out or bring cool air in; and
- Wear loose-fitting clothing.

Aside from the heat-induced health impacts described above, extreme heat negatively impacts air quality by increasing the amount of ground-level ozone (or smog). Worsened air quality can aggravate existing respiratory illnesses, and long-term exposure can result in decreased lung function.[53] Extreme heat can degrade water quality by heating water bodies directly or heating runoff that drains into them.

Climate change will impact the frequency and intensity of extreme heat events. Extreme heat in urban areas, like Ypsilanti, can lead to dangerous conditions as these temperatures are exacerbated by urban heat island effects. Those without resources to use or install air-conditioning will be most impacted. This could be further impacted by potential increases in the cost of electricity.

Increases in the intensity and frequency of extreme heat events will exacerbate the life safety, health, and public health impacts described above. Ypsilanti should not only prepare for the current extent experienced for extreme high temperatures, but also for those projected due to climate change. In addition, impacts from urban heat islands could increase due to increased development and densification the city.

Hail

Description

Hail is precipitation in the form of irregular pellets of ice large enough to potentially cause damage. Hailstorms are a damaging outgrowth of severe thunderstorms. Early in the developmental stages of a hailstorm, ice crystals form within a low-pressure front due to the rapid rising of warm air into the upper atmosphere and the subsequent cooling of the air mass. Frozen droplets gradually accumulate on the ice crystals until they develop to a sufficient weight and fall as precipitation. Hail typically takes the form of spheres or irregularly shaped masses greater than 0.75 inches in diameter. The size of hailstones is a

[53] Ozone Basics. (2017). US EPA. Retrieved August 29, 2017 from https://www.epa.gov/ozone-pollution/ozone-basics#effects.

direct function of the size and severity of the storm. High velocity updraft winds are required to keep hail in suspension in thunderclouds. The strength of the updraft is a function of the intensity of heating at the Earth's surface. Higher temperature gradients relative to elevation above the surface result in increased suspension time and hailstone size.[54]

Hailstones can range significantly in size from 5 millimeters (mm) (approximately pea-sized) to greater than 100 mm (approximately melon-sized). Hailstones are categorized using the TORRO Hailstorm Intensity Scale (**Table 4-18**). Hailstone size descriptions are in **Table 4-19.**

Hailstorms are estimated to cause an average of $15 billion in damage to homes, crops, and cars each year in the US[55]. It damages buildings and homes by perforating holes in roofs and shingles, breaking windows and denting siding, and damages automobiles by denting panels and breaking windows. Hail rarely causes any deaths; however, several dozen people are injured each year in the United States.

Table 4-18: TORRO Hailstorm Intensity Scale (in millimeters)[56]

	Intensity Category	Typical Hail Diameter (mm)	Probable Kinetic Energy, J-m2	Typical Damage Impacts	Size Code
H0	Hard Hail	5	0-20	No damage	1
H1	Potentially Damaging	5-15	>20	Slight general damage to plants, crops	1-3
H2	Significant	10-20	>100	Significant damage to fruit, crops, vegetation	1-4
H3	Severe	20-30	>300	Severe damage to fruit and crops, damage to glass and plastic structures, paint and wood scored	2-5
H4	Severe	25-40	>500	Widespread glass damage, vehicle bodywork damage	3-6
H5	Destructive	30-50	>800	Wholesale destruction of glass, damage to tiled roofs, significant risk of injuries	4-7
H6	Destructive	40-60		Bodywork of grounded aircraft dented; brick walls pitted	5-8
H7	Destructive	50-75	--	Severe roof damage, risk of serious injuries	6-9
H8	Destructive	60-90	--	Severe damage to multiple roof types (including sheet and metal); damage aircraft bodywork	7-10
H9	Super Hailstorms	75-100	--	Extensive structural damage (including concrete and wooden walls). Risk of severe or even fatal injuries to persons caught in the open	8-10

[54] NOAA National Severe Storms Laboratory. (n.d.). Severe Weather 101- Hail. Retrieved August 15, 2023, from https://www.nssl.noaa.gov/education/svrwx101/hail/
[55] Wunderground (2020)U.S. Hailstone and Hailstorm Records, Retrieved August 16, 2023 from U.S. Hailstone and Hailstorm Records | Weather Underground (wunderground.com)
[56] The Tornado and Storm Research Organization. (n.d.) The TORRO Hailstorm Intensity Scale, Retrieved on August 15, 2023, from TORRO | Research ~ Hail ~ The H Scale

	Intensity Category	Typical Hail Diameter (mm)	Probable Kinetic Energy, J-m2	Typical Damage Impacts	Size Code
H10	Super Hailstorms	>100	--	Extensive structural damage (including destruction of wooden houses and damage to brick-built homes). Risk of severe or even fatal injuries to persons caught in the open	9-10

Table 4-19: Hail Size Code Descriptions[57]

Size Codes	Diameter (mm)	Relational Size
0	5-9	Pea
1	9-15	Mothball
2	16-20	Marble, grape
3	21-30	Walnut
4	31-40	Pigeon's egg > squash ball
5	41-50	Golf ball > Pullet's egg
6	51-60	Hen's egg
7	61-75	Tennis ball > cricket ball
8	76-90	Large orange > Soft ball
9	91-100	Grapefruit
10	>100	Melon

Location

Hailstorms frequently accompany thunderstorms, so their locations and spatial extents coincide. The entire campus is uniformly exposed to severe thunderstorms; therefore, all areas of the campus are equally exposed to hailstorms. According to the National Weather Service, the Eastern Michigan University campus is located in an area of the United States that receives an average of six days per year with hail events (see **Figure 4-31** below).[58]

[57] The Tornado and Storm Research Organization. (n.d.) The TORRO Hailstorm Intensity Scale, Retrieved on August 15, 2023, from TORRO | Research ~ Hail ~ The H Scale
[58] Storm Prediction Center WCW Page. (2016). NOAA's Storm Prediction Center. Retrieved August 15, 2023 from http://www.spc.noaa.gov/wcm/.

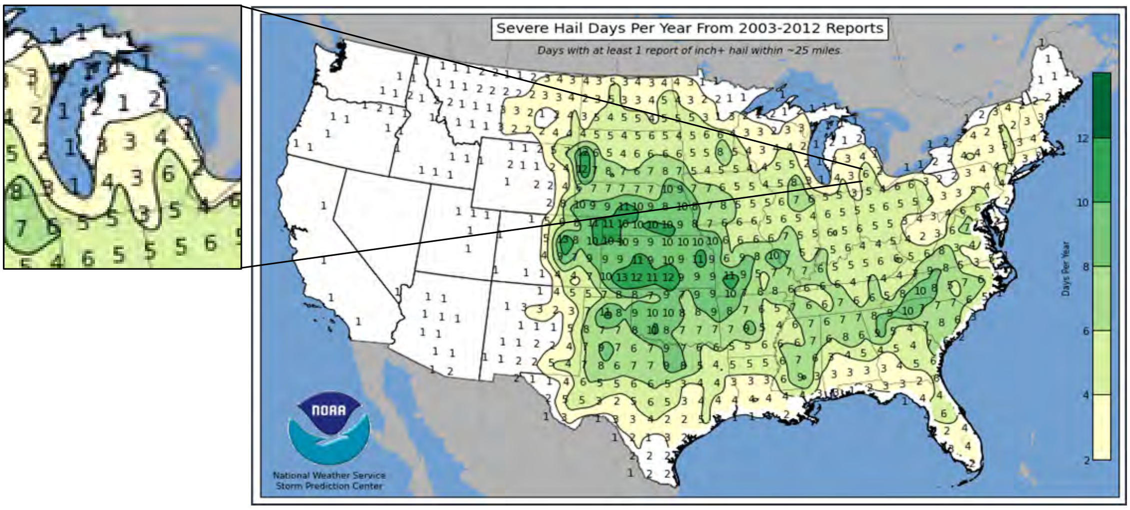

Figure 4-31: United States Average Number of Days per Year with Severe Hail Events

Previous Occurrences

The NCEI Storm Events Database reports hail information by county and, when the information is available, by city. Campus-specific information was not available. Of the 241 hail events reported for Washtenaw County between 1955 and 2021, 21 events occurred in the City of Ypsilanti, where the Eastern Michigan University campus is located. None of these events resulted in reported deaths and injuries and only one event in 2001 resulted in crop damages estimated at $20,000 (adjusted to 2023 dollars). However, it is likely that hail events and associated damages to private property were not reported to NCEI, especially during early years of reporting (only 3 of the 41 reported events occurred prior to 2000). Therefore, the number of events and resulting damages is likely higher than what is indicated. Detailed information on hail events reported in Ypsilanti are presented in **Table 4-20.**

Table 4-20: NCEI Historic Hail Events in Ypsilanti (1955-2023)

Date	Magnitude (inches)
6/24/1998	1.75
6/12/1999	0.88
10/13/1999	1.00
5/11/2000	0.75
7/29/2001	0.75
6/22/2002	0.75
5/9/2003	0.88
5/20/2004	1.75
5/20/2004	0.75
5/21/2004	0.75
5/21/2004	2.00
7/13/2004	1.00
9/22/2005	0.75

Date	Magnitude (inches)
3/31/2006	0.75
3/31/2006	0.75
6/19/2006	0.88
6/27/2010	0.75
7/3/2012	1.00
7/10/2013	0.75
5/12/2014	0.75
9/5/2014	0.75

Extent

Hail extent can be measured in terms of size, typically by diameter. According to the events reported in NCEI, the greatest extent hail reported in Ypsilanti was 1.75 inches (approximately 45 millimeters) on June 24, 1998, and on May 20, 2004. On the TORRO, scale, this size correlates to H5 or H6 (about the size of a golf ball) and can cause wholesale destruction of glass, damage to tiled roofs, and a significant risk of injuries. It should be noted that greater extent hail is possible on the Eastern Michigan University campus. For example, in Washtenaw County, the greatest extent hail reported was 2.75 inches, which occurred on two separate occasions. On the TORRO scale, hailstones this size (approximately 70 millimeters) correlates to H6 or H7 and can be roughly the size of a tennis ball. Hailstones this size are capable of causing severe damages to roofs, damages to aircraft body work and serious injuries.

The effect of climate change on hail extent in Ypsilanti is uncertain, as detailed below in the Probability section.

Probability

With 241 reported events in 68 years, Washtenaw County experiences an average of more than three hail events per year. As discussed above, it is likely that the number of events that occurred is higher than the number that are reported. As shown in the previous map, EMU is located in an area that experiences an average of six hail days annually.

When possible, climate variability should be considered when determining the probability of future hazard events. Trends in convective storm occurrences due to climate change are subject to greater uncertainty than temperature-related trends (such as extreme heat and cold events).[59] Because hail is an outgrowth of severe thunderstorms, trends in hail frequency and intensity are directly related to trends in thunderstorm frequency and intensity. Although studies are still being performed, a study cited by the National Climate Assessment indicates an increase in the occurrence of atmospheric conditions conducive to severe thunderstorm formation. For the Great Lakes Region spring season, the study indicates increases of 1.2 to 2.4 days per season with severe thunderstorm environments.[60] While it

[59] Walsh, J., et al. (2014). Ch. 2: Our Changing Climate. Climate Change Impacts in the United States: The Third National Climate Assessment. U.S. Global Change Research Program. Retrieved August 15, 2023 from http://nca2014.globalchange.gov/report/our-changing-climate/changes-storms.
[60] Diffenbaugh, N., et al. (2013). Robust Increases in Severe Thunderstorm Environments in Response to Greenhouse Forcing, PNAS

is difficult to quantify these trends in terms of future hail occurrences, they can be considered when determining future probability.

Considering the rate of historic occurrences, the likelihood of unreported or underreported events, and climate projections for convective storm conditions, a probability of “highly likely” was assigned to the hail hazard. (Greater than 90 percent annual probability).

Vulnerability Assessment

All current and future buildings, infrastructure, and populations are considered at risk to hail. No dollar losses are attributed to hail events on campus, but future losses are possible. Hail can cause damages to landscaping, roofs, building exteriors, and exposed glass and metal. In severe cases, hail has the potential to damage exposed infrastructure, such as roads, sidewalks, bridges, and above-ground utilities.

The National Risk Index (NRI) provides a hail risk index score, which indicates a county’s hail risk relative to the rest of the United States.[61] According to the index, Washtenaw County, where the University’s campus is located, has “Very Low” risk from hail as shown in **Figure 4-32.**

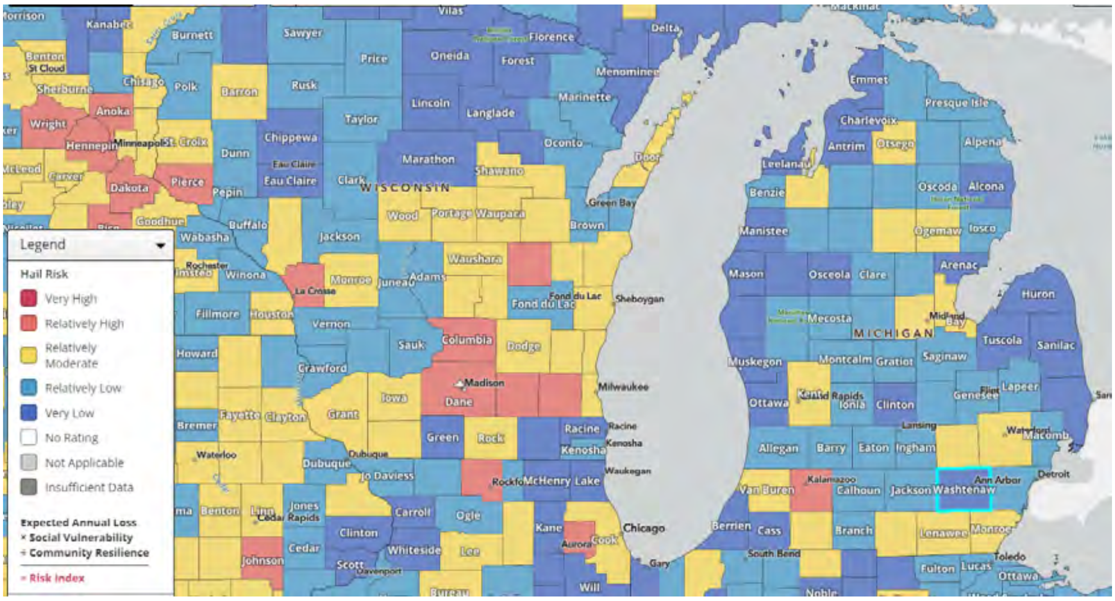

Figure 4-32: Hail Risk Index Results at a National Level

Severe hail can result in injuries and loss of life to persons caught in the open. EMU has many people, such as students, outdoors throughout the day, especially during class changes, that could be exposed to hail. Unhoused populations and populations living in substandard housing are more vulnerable to the impacts of hail events. In addition, income constrained homeowners may be less able to repair property damages incurred from hail. Hail can result in extensive property damages, including damage to cars, roofs, crops, and landscaping. University operations interruptions are possible if people need to seek shelter until a hail event has passed.

[61] Federal Emergency Management Agency (n.d.), National Risk Index, Retrieved August 16, 2023 from Map | National Risk Index (fema.gov)

Impacts on hail intensity (extent) due to climate change are uncertain. It is unknown if future climate conditions will result in different hailstone sizes on average. Research from the National Climate Assessment indicates a projected increase in the number of days with thunderstorm environments, which could lead to an increase in the number of hail occurrences in the planning area. [62] An increase in the frequency of events would increase the vulnerability of people, buildings, and infrastructure to the hail hazard.

Lightning

Description

Lightning is a discharge of electrical energy resulting from the buildup of positive and negative charges within a thunderstorm, creating a “bolt” when the buildup of charges becomes strong enough. This flash of light usually occurs within the clouds or between the clouds and the ground. A bolt of lightning can reach temperatures approaching 50,000 degrees Fahrenheit. Lightning rapidly heats the sky as it flashes but the surrounding air cools following the bolt. This rapid heating and cooling of the surrounding air causes the thunder, which often accompanies lightning strikes. While most often affiliated with thunderstorms, lightning may also strike outside of heavy rain and might occur as far as 10 miles away from any rainfall.

Lightning strikes occur in very small, localized areas. For example, they may strike a building, electrical transformer, or even a person. According to FEMA, lightning injures an average of 182 people and kills 33 people each year in the United States.[63] Direct lightning strikes can also cause significant damage to buildings, critical facilities, and infrastructure largely by igniting a fire. Lightning is also responsible for igniting wildfires that can result in widespread damages to property.

Location

Lightning occurs randomly. Therefore, it is impossible to predict where and with what frequency it will strike. The entire campus is uniformly exposed to lightning. Lightning density data compiled by Vaisala, Inc. with data from 2016 through 2021 shows the frequency of lightning flashes per square kilometer per year (see **Figure 4-33**). The campus area has an average of approximately 21 lightning events per square kilometer per year.[64]

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[62] Walsh, J., et al. (2014). Ch. 2: Our Changing Climate. Climate Change Impacts in the United States: The Third National Climate Assessment. U.S. Global Change Research Program. Retrieved August 15, 2023 from http://nca2014.globalchange.gov/report/our-changing-climate/changes-storms.

[63] Federal Emergency Management Agency. (n.d.) Thunderstorm, Impact. Retrieved on August 15, 2023 from https://community.fema.gov/ProtectiveActions/s/article/Thunderstorm-Lightning-and-Hail-Impact

[64] Vaisala Inc. (n.d.) Interactive Global Lightning Density Map, Retrieved on August 15, 2023 from Vaisala Lightning 2016-2022

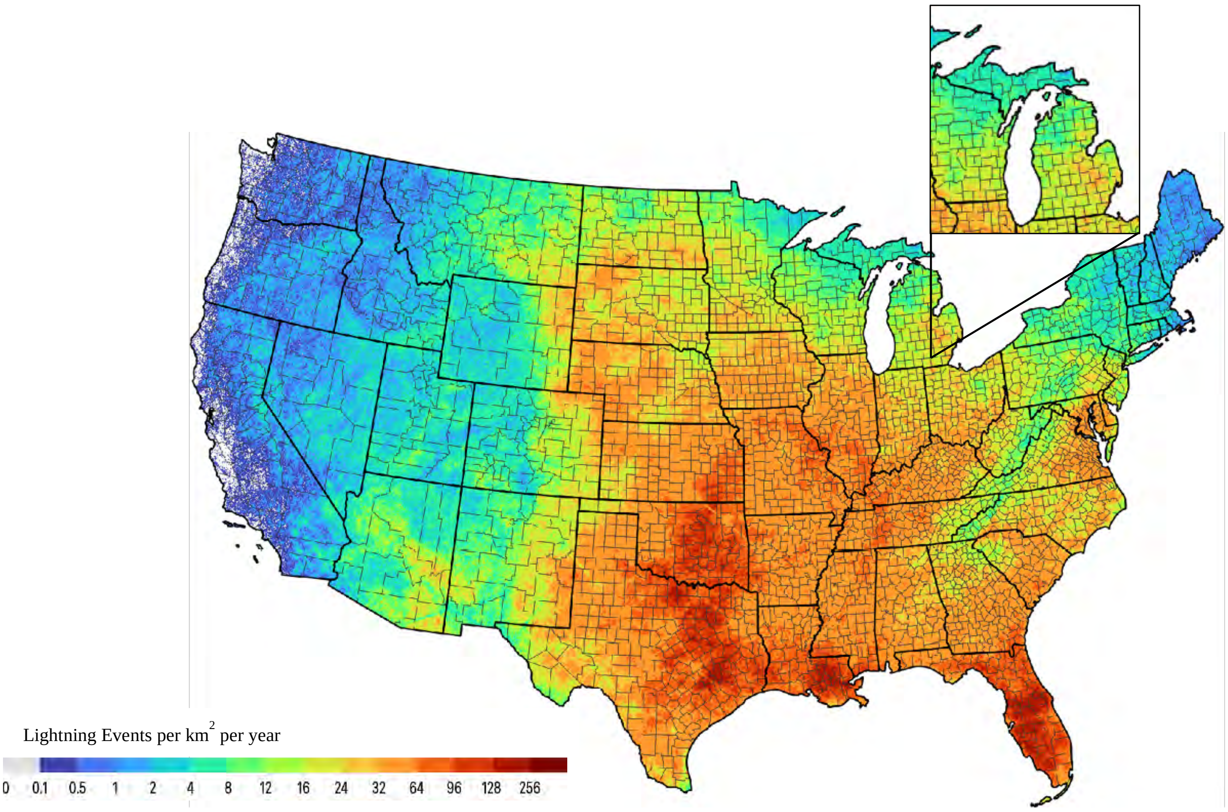

Figure 4-33: Vaisala, Inc Total Lightning Density (2016-2021)

Previous Occurrences

The NCEI Storm Events Database reports lightning information by county and, when the information is available, by city. Therefore, data specific to the campus was not available, and data for events reported in the Washtenaw County was used. It should be noted that additional lightning events have likely occurred that were not reported to NCEI; often only events with severe outcomes, such as injuries, deaths, or extensive damages, are reported. Therefore, the number of events and resulting damages are likely higher than what is indicated. It is known that lightning is an annual occurrence on campus.

Twenty-one lightning events were reported for the County between 1996 and 2023. These 21 events resulted in one death, four injuries, and over $3.4 million (2023 dollars) in property damages. The events resulting in property damages were primarily due to house fires. Additionally, two other lightning events caused damages to a school gymnasium building in Ypsilanti, and to a library and its contents in Dexter. One extreme storm event was reported to cause closure of the Eastern Michigan University campus for the second time ever in school history.

Detailed information on NCEI-reported lightning events that have caused significant injuries, deaths and property damage in Washtenaw County, and the City of Ypsilanti are presented in **Table 4-21.**

Table 4-21 NCEI Historic Lightning Events Reported for Washtenaw County

Date	Location	Deaths/ Injuries	Property Damage (2023 dollars)	Details
10/27/1997	Ypsilanti	0/0	$4,228	Lightning struck a house, blowing a hole in a wall.
5/31/1998	Ypsilanti	0/0	$37,468	Washtenaw county was on the trailing edge of a derecho. Power lines were downed in the Dexter area in Washtenaw County. Lightning triggered a house fire in Ypsilanti.
6/16/1998	Hudson Mills	0/0	$208,158	On Peach Mountain in northern Washtenaw County, the transmitting antenna for WUOM radio was struck by lightning. Both the transmission line to the antenna, and the antenna itself, had to be replaced. A residence in Livonia suffered significant damage after a lightning strike.
6/12/1999	Ypsilanti	0/0	$20,328	Lightning struck an apartment building and started a fire.
4/20/2000	Ann Arbor	0/2	-	Two 18-year-old men were struck by lightning and briefly hospitalized
12/11/2000	Ann Arbor	0/0	$2,170,945	A lightning strike ignited and destroyed large home just northwest of Ann Arbor in Washtenaw County. In Ypsilanti, 35mph gusts along with thunder and sleet closed Eastern Michigan University for the second time in history.
6/12/2001	Ypsilanti	0/0	$19,161	Lightning struck Edmunson Middle School in Ypsilanti Township, igniting the roof of the gymnasium.
9/19/2002	Ann Arbor	1/2	-	Three men were installing a roof at an apartment complex under construction when they were struck by lightning. Two of the men were injured, while the third was later pronounced dead.
9/3/2008	Dexter	0/0	$32,717	A lightning strike damaged part of the roof of the Dexter library and damaged most of the computers and radios at the fire station.

Extent

One method for measuring lightning extent is lightning density, or the number of lightning events per square kilometer per year. According to **Figure 4-34,** EMU's campus is in a part of Michigan that receives approximately between 16 to 24 lightning events per square kilometer per year. Lightning extent can also be measured in terms of casualties and damages incurred from an event. While this data is not available specifically for EMU, the greatest amount of damage reported from a single lightning event in Washtenaw County was

$2,170,945 when a lightning strike caused a house to catch on fire. A lightning strike in 2002 caused two injuries and a fatality. More severe events are possible.

Probability

With 21 significant lightning events reported over 26 years, it is known that lightning is a regular occurrence in the planning area. When using county information, data suggests approximately one significant event annually. Lightning flashes and strikes are an annual occurrence, though all events may not result in damage.

When possible, climate variability should be considered when determining the probability of future hazard events. Trends in convective storm occurrences due to climate change are subject to greater uncertainty than temperature-related trends (such as extreme heat and cold events).[65] Because lightning is affiliated with severe thunderstorms, trends in lightning frequency and intensity are related to trends in thunderstorm frequency and intensity. Although studies are still being performed, a study cited by the National Climate Assessment indicates an increase in the occurrence of atmospheric conditions conducive to severe thunderstorm formation. For the Great Lakes Region spring season, the study indicates an increase of 1.2 to 2.4 days per season with severe thunderstorm environments by 2070-2099.[66] While it is difficult to quantify these trends in terms of future lightning occurrences, they can be considered when determining future probability.

Considering the frequency of historic occurrences, the likelihood of unreported or underreported events, local input, and climate projections for convective storm conditions, a probability of highly likely (greater than 90 percent annual chance) was assigned.

Vulnerability Assessment

All current and future buildings, infrastructure, and populations are considered at risk to lightning on EMU's campus, including critical facilities.

The NRI provides a lightning risk index score, which indicates a county's lightning risk relative to the rest of the United States.[67] According to the index, Washtenaw County, where the University's campus is located, has "Relatively Moderate" risk from lightning as shown in **Figure 4-34.**

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[65] Walsh, J., et al. (2014). Ch. 2: Our Changing Climate. Climate Change Impacts in the United States: The Third National Climate Assessment. U.S. Global Change Research Program. Retrieved August 10, 2023 from http://nca2014.globalchange.gov/report/our-changing-climate/changes-storms

[66] Romps et al. (2014). Projected increase in lightning strikes in the United States due to global warming. Science Vol 346, Issue 6211

[67] Federal Emergency Management Agency (n.d.), National Risk Index, Retrieved August 16, 2023 from Map | National Risk Index (fema.gov)

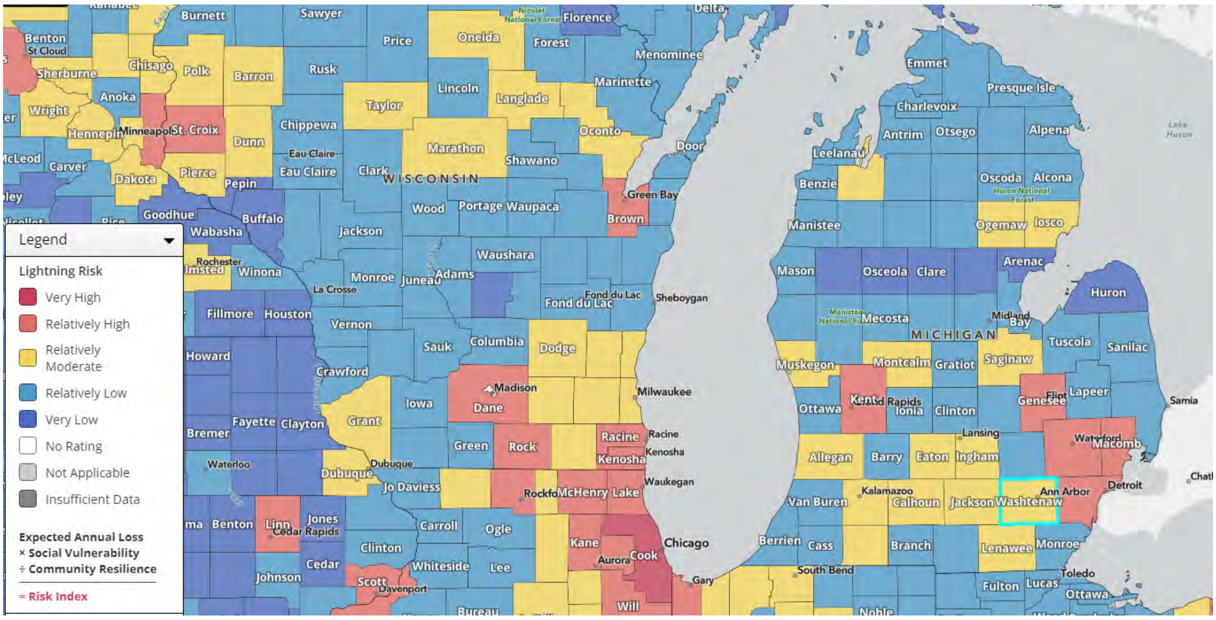

Figure 4-34: Lightning Risk Index Results at a National Level

Lightning may result in structure fires and loss of electrical equipment. Electrical systems, telecommunications equipment, and infrastructure exposed in open areas are especially vulnerable to lightning. In addition, falling limbs caused by lightning strikes to trees may damage buildings or vehicles.

Lightning is one of the leading causes of weather-related fatalities. From 2013 to 2023, lightning caused an average of 21 deaths per year in the U.S. [68] Most lightning deaths and injuries in the United States occur in the summer months, when lightning frequency and outdoor activities reach a peak. All current and future populations on campus are considered at risk to lightning. However, people who work outside or regularly engage in outdoor recreational activities are considered at a higher risk. EMU has many people, such as students, grounds workers, and athletes outdoors throughout the day, especially during class changes, that could be exposed to lightning. People engaged in outdoor activities during a lightning event can reduce vulnerability by taking appropriate precautions. If thunder is heard, people outdoors should seek shelter and wait 30 minutes after the last clap of thunder before leaving the shelter. When possible, coaches, referees, or lifeguards should protect the safety of those outside by stopping activities in a prompt manner so that participants and spectators can get to a safe place.[69]

Changes to lightning intensity (extent) and frequency due to climate change are uncertain. As described above, research cited by the National Climate Assessment indicates a projected increase in the number of days in which thunderstorm conditions are favorable. Similarly, another study found evidence linking warmer air temperatures to increased lightning strikes by about 12 percent per degree Celsius of warming (give or take 5 percent.[70] Between 2040 and 2059, the University can expect a 4.25 to 5°F increase in

[68] US Lightning Fatalities 2013-2023. National Weather Service. Retrieved August 15, 2023 from National Weather Service Lightning Fatalities in 2023: 9

[69] National Geographic (2005) Flash Facts About Lightning. Retrieved August 15 2023 from Flash Facts About Lightning (nationalgeographic.com)

[70] Diffenbaugh et. al. (2013) Robust increases in severe thunderstorm environmental in response to greenhouse forcing, PNAS.

annual average temperature. [71] An increase in the frequency of events would increase the vulnerability of populations, buildings, and infrastructure to the lightning hazard.

Severe Winter Weather

Description

A winter storm is an event in which varieties of precipitation are formed that only occur at low temperatures, such as snow, sleet, freezing rain, or ice. Snowstorms generally occur with the clash of different types of air masses, with differences in temperature, moisture, and pressure; specifically, when warm moist air interacts with cold dry air. Snowstorms that produce a lot of snow require an outside source of moisture, such as the Gulf of Mexico or the Atlantic Ocean.

Severe winter weather typically results in a winter weather watch, warning, and/or advisory. During a severe winter weather event, one or more of the following types of weather occur:

Winter Storm: A winter storm is generally defined as snow accumulation of at least 8+ inches in 12+ hours or 6+ inches in 6 to 9 hours, and can be in combination with rain, freezing rain, sleet, wind, blowing snow, or cold.

Heavy Snow: A heavy snowstorm is any winter storm that produces 6 inches or more of snow within a 48-hour period or less.

Blizzard: A blizzard is a severe snowstorm with winds greater than 35 mph and visibility of less than a 1/4 mile for more than 3 hours.

Frost/Freeze: Frost forms during freezing temperatures when the ground surface cools to a temperature colder than the dewpoint of adjacent air. When water vapor in the air above the ground surface condenses, it freezes due to low temperatures. Sustained temperatures below freezing are common during winter months in the planning area. The University, combined with paralleled city and county resources, are generally well prepared to manage severe winter weather (see the *Extreme Cold/Wind Chill* profile for hazards relating to temperatures well below freezing). However, frost and freeze events can be detrimental when occurring outside of the expected winter season, such as early in the fall or late in the spring. These events can catch motorists off guard with slick road conditions, or damage crops and landscaping.

Ice Storm, Sleet, and Freezing Rain: An ice storm is defined as a storm with significant amounts of freezing rain and is a result of warm air in between two layers of cold air. With warmer air above, falling precipitation in the form of snow melts, then becomes either super-cooled (liquid below the melting point of water) or re-freezes. An ice storm typically has a coating of at least ¼ inch of ice but may be up to ½ inch if winds are less than 15 miles per hour.

In the former case, super-cooled droplets can freeze on impact (freezing rain), while in the latter case, the re-frozen water particles are ice pellets (or sleet). Sleet is defined as partially frozen raindrops or refrozen snowflakes that form into small ice pellets before reaching the ground. They typically bounce when they hit the ground and do not stick to the surface. However, it does accumulate like snow, posing similar problems and has the potential to

[71] Great Lakes Regional Climate Change Maps. (n.d.). GLISA. Retrieved August 17, 2023 from http://glisa.umich.edu/resources/great-lakes-regional-climate-change-maps.

accumulate into a layer of ice on surfaces. Freezing rain, conversely, usually sticks to the ground, creating a sheet of ice on the roadways and other surfaces. Generally, in Michigan, an ice storm is considered severe if there is an accumulation of ¼ inch or more of ice.

Winter storms are defined differently in various parts of the country relevant to their standard weather. Two inches of snow may create serious disruptions to traffic in areas where snowfall is not expected; however, this may be considered a light dusting in regions where snowfall is typical. Therefore, there are multiple ways in which to measure a winter storm, based on snowfall, temperatures, wind speeds, societal impact, etc. The University lies within the Detroit/Pontiac, MI NWS Forecast Office, which defines regional standards for severe winter weather events. [72]

On the southern portion of Michigan's lower peninsula, the winter risk season starts in late November and runs through early April. However, it should be noted severe winter weather is possible outside of this window, and that mild snowfall and cold temperatures may also occur outside of the winter weather risk season.[73]

As the climate changes, winter precipitation is also expected to change. With warmer temperatures, it is more likely that rain will fall in place of snow, and mixed winter precipitation (such as freezing rain) will become more likely.[74]

In addition to precipitation associated with severe winter storms, extreme cold events, especially those caused by the combined effects of wind and cold temperatures, can occur during a severe winter storm. However, extreme cold events have been included as a separate hazard as they are not always associated with winter storms.

Location

The entire campus is uniformly exposed to severe winter weather hazards.

Previous Occurrences

The NCEI Storm Events Database records winter-related weather events by county; data specific to the Eastern Michigan University campus or the City of Ypsilanti is not available. Therefore, all winter weather events reported for Washtenaw County are included. According to NCEI, there has been a total of 64 severe winter weather events in Washtenaw County since 1996. In total, these events resulted in 1 death and over $16.2 million in property damages (2023 dollars). Summary details for these events are included in **Table 4-22.** As severe winter weather is a common occurrence during the planning area's winter months, it is likely that events have gone unreported and/or damages have been underreported.

Table 4-22: Previous Severe Winter Weather Occurrences in Washtenaw County

Event Type	Number of Occurrences	Deaths/Injuries	Property Damage (2023 dollars)
Blizzard	1	0/0	-
Frost/Freeze	2	0/0	$1,799,504

[72] National Weather Service (n.d.). Winter Watch, Warning and Advisory Definitions, Retrieved on 24 August, 2023 from Winter Watch, Warning and Advisory Definitions (weather.gov)
[73] Michigan Hazard Mitigation Plan. (2019). Michigan Emergency Management and Homeland Security Division, Michigan Department of State Police.
[74] GLISA. (n.d.). Historical Climatology: Ann Arbor. Retrieved September 8, 2023 from http://glisa.umich.edu/media/files/AnnArborMI_Climatology.pdf.

Event Type	Number of Occurrences	Deaths/Injuries	Property Damage (2023 dollars)
Heavy Snow	33	0/0	-
Ice Storm	3	0/1	$6,996,675
Winter Storm	20	0/0	$6,955,644
Winter Weather	5	1/0	$457,379

The 64 severe winter storm incidents reported in NCEI were reviewed for this plan. Significant notable events are summarized in **Table 4-23.**

Table 4-23: Significant Severe Winter Weather Events in Washtenaw County

Incident Date	Incident Type	Injuries/ Deaths	Damages (2023 Dollars)	Description
3/13/1997	Ice Storm	0/0	$6,342,014	A powerful ice storm caused several falling trees damaging cars and houses throughout the area and resulted in power outages to over 425,000 homes.
12/11/2000	Winter Storm	0/0	-	A powerful storm caused near blizzard like conditions in several regions of Washtenaw County. 35 mph gusts with thunder and sleet caused Eastern Michigan University to close for only the second time ever.
1/31/2002	Ice Storm	1/0	$93,015	Prolonged winter weather in southeast Michigan caused heavy snowfall, freezing rain, and snow accumulation. A woman in Ypsilanti was injured when a tree limb fell and broke her leg. The accumulation of snow and ice on the roads and highways led to dozens of accidents and fatalities across the region.
1/14/2007	Ice Storm	0/0	$561,647	4-6 inches of snow accumulated on surfaces across the central and northern sections of the county. Numerous tree branches and power lines were downed in the area. Several instances of property damage were caused by the events.
12/11/2007	Winter Weather	0/1	-	2-4 inches of mixed precipitation and snowfall fell in several parts of Lower Southeast Michigan. School districts began sending their students home early due to deteriorating roads. A 16-year-old boy was killed in a road accident caused by icy roads.
4/14/2018	Winter Storm	0/0	$6,955,944	Heavy rain, snow, sleet, and freezing rain causing a total of 2-3 inches of snow accumulation caused widespread tree damages and power outages. Nearly 500,000 customers reported power outages due to the events.

Winter weather is a common occurrence at the University. The University has a system in place to communicate closures with students via text messages and email. The University sends cancellation notices by 5:30 am for morning classes and 12:00 pm for evening classes.

Further, several respondents in the public survey indicated being affected by winter weather on the University campus in the past. Instances include falling on ice/slick on sidewalks, difficulty accessing parking lots due to snowfall accumulation, and classes not being cancelled leading to dangerous commuting situations for commuter students.

Extent

Severe winter weather extent can be measured in several ways, including snowfall accumulations or damages. The closest NOAA weather monitoring station to EMU is located at the University of Michigan in Ann Arbor. The record snowfall at the University of Michigan weather station was 60 inches occurring in 1931.[75]The most damages reported during a single winter-related weather event in Washtenaw County was during the winter storm of 2018, which reported over $6.9 million in property damages (total, not campus-specific). It should be noted that more extreme winter weather events are possible for the University's campus.

Probability

Some type of severe winter weather is expected to impact the campus every year. It is only a matter of how severe and how many such events might occur in a particular year that is difficult to predict in advance. Based on a reported 64 events in 26 years, Washtenaw County has historically experienced nearly 2.5 severe winter weather events per year. In addition, historic climate data shows that snowfall (December-February) in the Great Lakes region where the planning area is situated is increasing over time, and the frequency of heavy precipitation events is also increasing. [76]

When determining future probability, the historic frequency must be considered along with projected future conditions. It is difficult to quantify the impact climate change will have on the future occurrence of severe winter weather events. According to a report from the Graham Sustainability Institute at the University of Michigan, winter precipitation in Michigan will increase between 5 percent and 20 percent by 2030, and between 5 percent and 25 percent by 2100. In addition, the frequency of heavy precipitation events (24-hour and multi-day) will continue to increase, which could lead to an increase in the number of severe winter weather events. Although warmer temperatures may lead to more rainfall in place of snowfall, precipitation could be more likely fall as freezing rain.[77] Although the study is focused on Ann Arbor, the results will be similarly applicable to the neighboring City of Ypsilanti.

Based on historic occurrences and future projections, the probability assigned to the severe winter weather hazard is highly likely (greater than 90 percent annual chance).

[75] NCDC. (2023). *Climate Data Online.* NOAA. Retrieved on August 23, 2023 from Climate Data Online (CDO) - The National Climatic Data Center's (NCDC) Climate Data Online (CDO) provides free access to NCDC's archive of historical weather and climate data in addition to station history information. | National Climatic Data Center (NCDC) (noaa.gov)
[76] GLISA. (n.d.) Snow in the Great Lakes: Past, Present, and Future, retrieved on August 24, 2023 from Snow in the Great Lakes: Past, Present, and the Future | GLISA (umich.edu)
[77] Graham Sustainability Institute, University of Michigan – Great Lakes Adaptation Assessment for Cities . (n.d.) Climate Change in Ann Arbor Summary of Projected Changes in Climate and Associated Impacts

Vulnerability Assessment

All current and future buildings, infrastructure, and populations are considered at risk to severe winter weather.

The NRI provides a winter weather risk index score, which indicates a county's winter weather risk relative to the rest of the United States.[78] According to the index, Washtenaw County, where the University's campus is located, has "Relatively Moderate" risk from winter weather as shown in **Figure 4-35.**

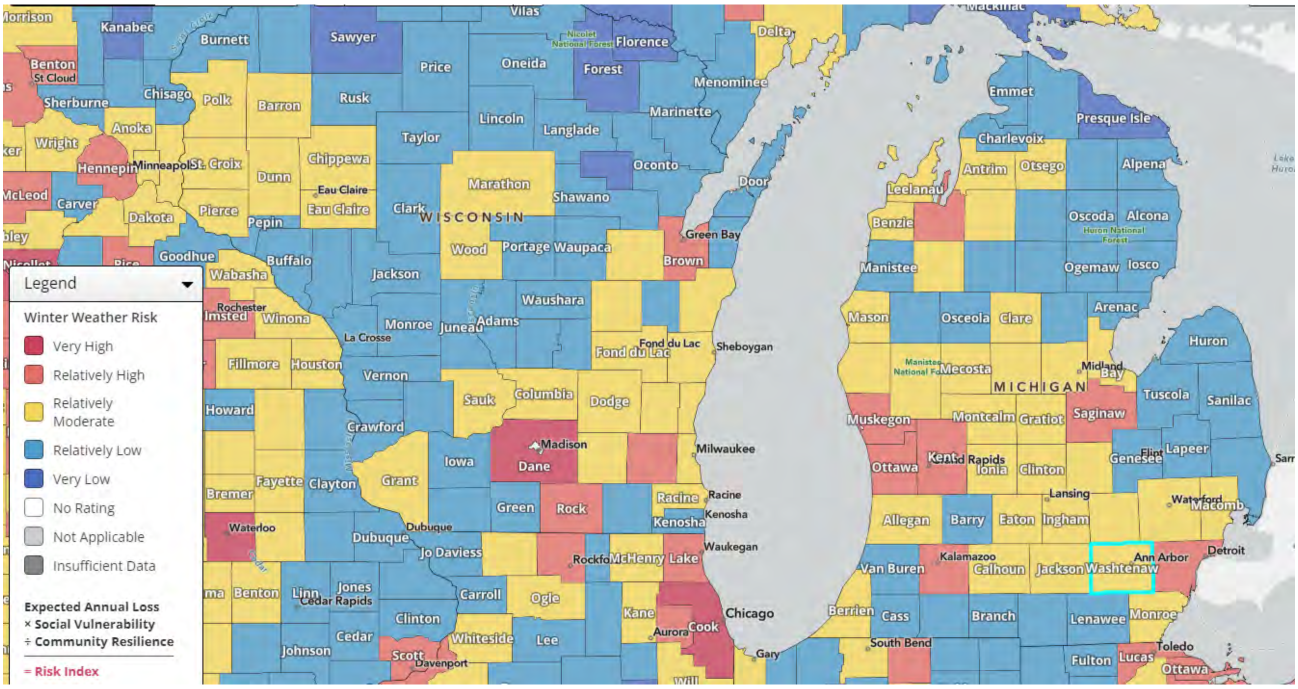

Figure 4-35: Winter Weather Risk Index Results at a National Level

Downed trees and branches can cause damage to buildings and other structures. The weight caused by heavy snowfall accumulation can cause roofs to collapse. Snowfall load can be particularly damaging to air-supported structures causing them to collapse. The EMU campus has one air-supported dome that serves as the University's Indoor Athletic Practice Facility.

In addition, ice dams can cause leaks and water damage to buildings. Ice dams occur when the bottom layer of snow or ice accumulated on a roof melts due to heat from the building, and runs off into eaves, where it refreezes. The refrozen water causes an ice dam.

Winter precipitation and subsequent salting cause significant damage to roads and sidewalks. Ypsilanti is mostly made up of collector roads but also has several major roadways. The city shares responsibility of maintaining its roads with Washtenaw County, while the university maintains its parking lots and streets. [79] Snow and ice accumulations can damage communication infrastructure and power lines. Resulting power outages can last for several days.

[78] Federal Emergency Management Agency (n.d.), National Risk Index, Retrieved August 21, 2023 from Map | National Risk Index (fema.gov)
[79] Multi-Hazard Mitigation Plan, (2013), Emergency Management Office, Eastern Michigan University

Health hazards related to walking and snow removal are frequent and life-threatening. Falls, particularly to the elderly, can result in serious injury including fractures, broken bones, and shattered hips. Middle-aged and older adults are susceptible to heart attacks from shoveling snow. In addition, falling ice can become a hazard when quick warming causes ice to break and slide off building roofs and overhangs.

Dangerous driving conditions frequently occur during and shortly after severe winter storms. While vehicular accidents are often caused by the driver's lapse in judgment, the weather and its impact on roads are also a major factor. Blowing snow, whiteout conditions, ice, and slush create slippery pavement making vehicle travel less safe during and immediately following winter storms. This is a particular concern on a campus with high pedestrian traffic. Transit systems may be unable to operate safely during severe winter storms due to roadway conditions. This may limit operations and the ability of students and staff to reach resources. Additionally, critical staff may be unable to reach campus due to roadway conditions.

Severe winter weather can result in the need to cancel classes and events, or close airports and other businesses. In extreme cases, sheltering and evacuations may be required, especially if prolonged power outages are expected.

Power outages and/or inaccessible roads can result in limited access to food, basic supplies, and an adequate heat source. Young children and the elderly are especially at risk. Further, if the University healthcare or similar facilities housing vulnerable populations lose power, inhabitants may need to be evacuated to a different location to receive proper care until utility services can restore power. Impacts due to power outages are covered under the *Technological Hazards* section of the Risk Assessment.

Exposure during winter weather, including students and visitors not properly dressed to withstand the cold, can result in hypothermia or frostbite. Socially vulnerable populations may be most susceptible to negative consequences of severe winter weather. Households with inadequate heating sources, or those that cannot afford heating costs, may be more likely to use alternative heat sources, which presents increased fire and/or carbon monoxide threats. The unhoused may face exposure risks. Income-constrained individuals may feel pressure to report to work and commute in unsafe travel conditions. Individuals without paid leave who are unable to commute (e.g., unsafe, public transit not running) may experience income loss.

Climate change impact could have mixed impacts on winter weather on the Ypsilanti area. The frequency of heavy precipitation events (24-hour and multi-day) will continue to increase, which could lead to an increase in the number of severe winter weather events. The transition from snowfall to more freezing rain as temperatures warm could result in increased icy road conditions or refreezing of rain. [80]

[80] GLISA. (n.d.) Snow in the Great Lakes: Past, Present, and Future, retrieved on August 24, 2023 from Snow in the Great Lakes: Past, Present, and the Future | GLISA (umich.edu)

Severe Winds

Description

There are several types of wind hazards that affect the planning area. These include high or strong wind events and thunderstorm wind events (including straight line winds). Tornadoes are also wind events that have the potential to impact the University, which are listed as a separate hazard due to their impacts and hazard potential.

High Wind definitions can vary by region. In general, high wind events are those events greater than normal averages and have damage potential. Wind events are common throughout the United States. However, the severity varies depending on location. **Figure 4-36** below shows wind zones in the U.S. based on ASCE 7-98 criteria.[81] These zones reflect the number and strength of extreme windstorms. According to the map, EMU is located in Wind Zone IV, which includes winds speeds up to 250 miles per hour.

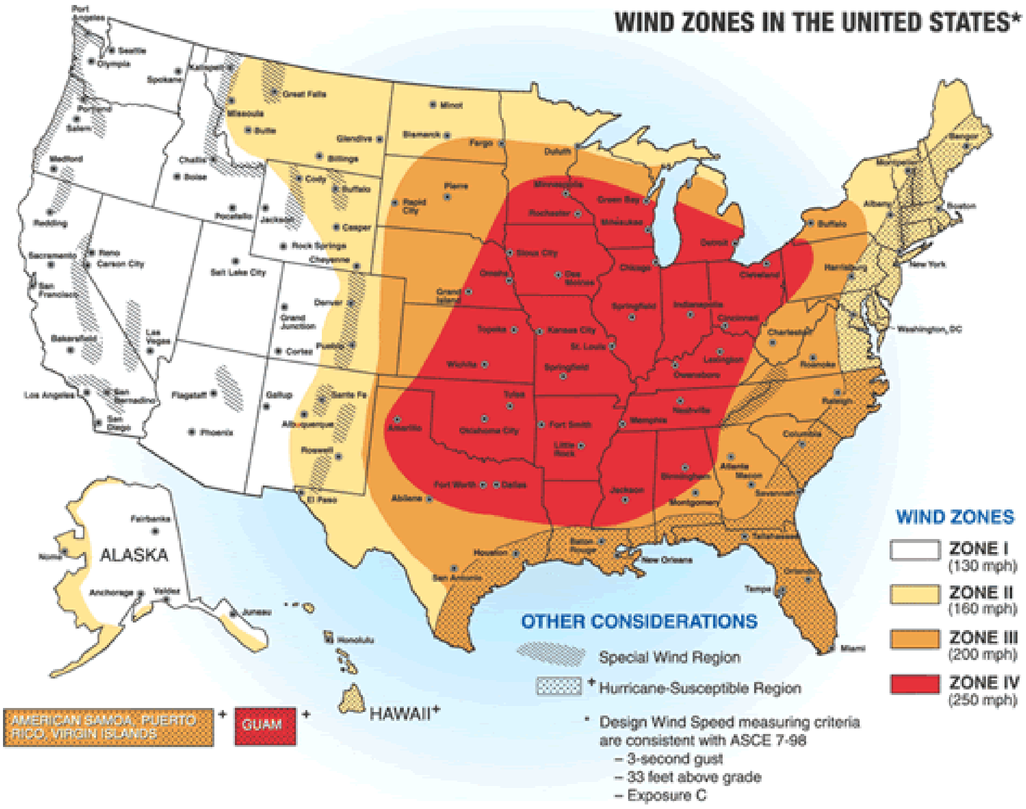

Figure 4-36: ASCE 7-98 U.S. Wind Zones

The National Weather Service Center can issue a high wind advisory or warning. A wind advisory is issued when conditions are favorable for the development of high winds over all or part of the forecast area, but the occurrence is still uncertain. The criteria of a wind advisory are sustained winds of 31 to 39 mph and/or gusts 46 to 57 mph for any duration. A high wind warning is issued when sustained winds from 40mph or higher are expected for at

[81] National Institute of Standards and Technology. (2011) Wind Zone Map. Retrieved August 21, 2023, from [Wind Zone Map (nist.gov)]

least one hour or any wind gusts are expected to reach 58 mph or more.[82] The definitions vary from state to state. Areas that frequently experience these high winds will not always issue the advisory or warning. A Beaufort Wind Scale may also be used to describe wind severity as shown in **Table 4-24** below.

Table 4-24: The Beaufort Wind Scale[83]

Beaufort Number	Wind (Knots)	WMO Classification	Appearance of Wind Effects	
			On the Water	On Land
0	Less than 1	Calm	Sea surface smooth and mirror-like	Calm, smoke rises vertically
1	1-3	Light Air	Scaly ripples, no foam crests	Smoke drift indicates wind direction, still wind vanes
2	4-6	Light Breeze	Small wavelets, crests glassy, no breaking	Wind felt on face, leaves rustle, vanes begin to move
3	7-10	Gentle Breeze	Large wavelets, crests begin to break, scattered whitecaps	Leaves and small twigs constantly moving, light flags extended
4	11-16	Moderate Breeze	Small waves 1-4 ft. becoming longer, numerous whitecaps	Dust, leaves, and loose paper lifted; small tree branches move
5	17-21	Fresh Breeze	Moderate waves 4-8 ft. taking longer form, many whitecaps, some spray	Small trees in leaf begin to sway
6	22-27	Strong Breeze	Larger waves 8-13 ft., whitecaps common, more spray	Larger tree branches moving, whistling in wires
7	28-33	Near Gale	Sea heaps up, waves 13-19 ft., white foam streaks off breakers	Whole trees moving, resistance felt walking against wind
8	34-40	Gale	Moderately high (18-25 ft.) waves of greater length, edges of crests begin to break into spindrift, foam blown in streaks	Twigs breaking off trees, generally impedes progress
9	41-47	Strong Gale	High waves (23-32 ft.), sea begins to roll, dense streaks of foam, spray may reduce visibility	Slight structural damage occurs, slate blows off roofs
10	48-55	Storm	Very high waves (29-41 ft.) with overhanging crests, sea white with densely blown foam, heavy rolling, lowered visibility	Seldom experienced on land, trees broken or uprooted, "considerable structural damage"
11	56-63	Violent Storm	Exceptionally high (37-52 ft.) waves, foam patches cover sea, visibility more reduced	-

[82] National Weather Service (n.d.). Watch/Warning/Advisory Definitions retrieved on August 21, 2023 from Watch/Warning/Advisory Definitions (weather.gov)

[83] National Oceanographic and Atmospheric Association (n.d.). Beaufort Wind Scale, retrieved on August 20, 2023 from Beaufort Wind Scale (noaa.gov)

Beaufort Number	Wind (Knots)	WMO Classification	Appearance of Wind Effects	
			On the Water	On Land
12	64+	Hurricane	Air filled with foam, waves over 45 ft., sea completely white with driving spray, visibility greatly reduced	-

Thunderstorms are associated with high wind because wind is typically one component of thunderstorms. Thunderstorms are dangerous because of their ability to generate tornadoes, hailstorms, strong winds, flash flooding, and damaging lightning. While thunderstorms can occur in all regions of the United States, they are most common in the central and southern states because atmospheric conditions in those regions are ideal for generating these powerful storms. In Michigan, thunderstorms are most common in the summer months.

Three conditions need to occur for a thunderstorm to form. First, it needs moisture to form clouds and rain. Second, it needs unstable air, such as warm air that can rise rapidly (this is often referred to as the "engine" of the storm). Third, thunderstorms need lift, which comes in the form of cold or warm fronts, sea breezes, mountains, or the sun's heat. When these conditions occur simultaneously, air masses of varying temperatures meet, and a thunderstorm is formed. These storm events can occur singularly, in lines, or in clusters. Further, they can move through an area very quickly or linger for several hours.

Straight-line winds, which in extreme cases have the potential to cause wind gusts that exceed 100 miles per hour, are responsible for most thunderstorm wind damage. One type of straight-line wind, the downburst, can cause damage equivalent to a strong tornado and can be extremely dangerous to aviation.

According to the National Weather Service, more than 100,000 thunderstorms occur in the United States each year, though only about 10 percent of these storms are classified as "severe." A severe thunderstorm occurs when the storm produces one of three elements: 1) Hail of three-quarters of an inch; 2) Tornado; 3) Winds of at least 58 miles per hour. [84]

Location

The entire university campus is uniformly exposed to severe wind hazards.

Previous Occurrences

The NCEI Storm Events Database reports wind event information by county and, when the information is available, by city. The information is reported under three categories: Thunderstorm Wind, High Wind and Strong Wind. Events specific to the Eastern Michigan University's Ypsilanti campus were not available; therefore, events reported for Washtenaw County were used as an indicator. There were 501 wind events reported for Washtenaw County between 1957 and 2023. These events resulted in 3 deaths and 13 injuries in Washtenaw County. However, none of the deaths and injuries were reported to occur on EMU's campus or within the City of Ypsilanti. Twenty-eight events were reported in the City of Ypsilanti, all of which were thunderstorm wind events. Reported damages from events in Ypsilanti totaled $184,234 (adjusted to 2023 dollars). It is likely that wind events and damages to private property were not reported to NCEI. Therefore, the number of events

[84] NOAA National Severe Storms Laboratory (n.d.) Severe Weather 101, Thunderstorm Basics. Retrieved on August 21, 2023 from Severe Weather 101: Thunderstorm Basics (noaa.gov)

and resulting damages is likely higher than what is indicated. Information on notable events is described in **Table 4-25.**

Table 4-25: Significant NCEI Thunderstorm Wind Events in Washtenaw County

Date	Location	Property Damages (2023 dollars)	Deaths/ Injuries	Details
6/1/1967	Washtenaw County	-	1/0	-
5/31/1991	Washtenaw County	-	1/0	-
3/28/1998	Ypsilanti	$62,447	0/0	Thunderstorms deroofed a house and damaged the roofs of several houses in Ypsilanti Township. Many trees were downed, several onto vehicles
7/21/1998	Ann Arbor, Ypsilanti	$9,367,115	0/0	Intense thunderstorms impacted the densely populated Ann Arbor – Ypsilanti area where a strong wind-gust measuring over 75mph blew two hangars off their foundations in the Ann Arbor municipal airport. Falling trees damaged several homes and vehicles in Ypsilanti, and several traffic signals came crashing down. Cleanup efforts took 5 weeks to complete. 600,000 homes and businesses lost power.
5/9/2000	Ypsilanti	$15,789	0/0	Ypsilanti was severely affected by supercell thunderstorms in southeast Michigan that downed several hundred trees, damaged a home, sliced a camper van in half, crushed a garage and car, deroofed a fire station, and destroyed a church steeple.
5/18/2000	Salem	$3,497	1/9	Thunderstorms accompanied by lightning caused fire damage to a home in Saline. Lightning struck a steel superstructure in a construction site injuring nine workers there. A thunderstorm gust blew down a large tree at a golf course in Salem killing a golfer.
4/12/2001	Washtenaw (Zone)	$57,483	0/1	A high wind event caused one injury and over $57,000 in damages
3/9/2002	Washtenaw (Zone)	$18,603	0/1	A high wind event caused one injury and over $18,000 in damages
4/20/2003	Ypsilanti	-	0/0	A strong line of thunderstorms damaged several trees and powerlines in the Great Lakes Region. An estimated 10,000 homes and businesses in Southeast Michigan lost power.
7/4/2003	Ypsilanti	-	0/0	A thunderstorm affecting several parts of southeast Michigan left 170,000 customers in the region without power.
6/9/2005	Ypsilanti	$85,122	0/0	Trees and power lines were brought down on the south side of Ypsilanti. Tree

Date	Location	Property Damages (2023 dollars)	Deaths/ Injuries	Details
				damage was heavy along Hawkins, First and Harriet streets. A telephone pole on Armstrong Street was snapped.
6/22/2011	Ypsilanti	$14,258	0/0	Severe thunderstorms uprooted a large tree that fell onto a house.
7/1/2014	Ypsilanti	-	0/0	Thunderstorms and damaging winds caused extensive damage taking down several trees and powerlines in several parts of Washtenaw County. The storms were classified as a derecho by the Storm Prediction Center.
9/5/2014	Ypsilanti	-	0/0	Severe storms caused nearly 400,000 homes and businesses in Southeast Michigan to lose power.

August 24, 2023, Thunderstorms and Severe Winds

Rapidly developing thunderstorms in central and southwest lower Michigan quickly became severe and led to an east-west line of severe thunderstorms in southeast Michigan. Strong winds reported to be between 60-80 mph caused extensive tree damages and power outages. The event also resulted in 7 tornadoes in the region, the highest number of tornadoes to ever occur during a single day in August. Initial reports include 1 fatality and over 500,000 customers without power in Southeast Michigan.

Extent

Thunderstorm wind extent is measured in terms of wind speed. Per NCEI, the greatest sustained wind reported in the Washtenaw County was 80 knots, or 92 miles per hour, during a January 1990 thunderstorm event. However, stronger winds are possible. Extent can also be measured in terms of damage. Wind events have resulted in 3 deaths and at least 13 injuries in Washtenaw County caused by humans being impacted by falling trees and debris. The greatest amount of property damage reported from a single wind event in Washtenaw County was over $9.3 million (2023) in July 1998. However, costlier events are possible.

Probability

With 501 significant wind events having been reported over 66 years, it is known that wind is a regular occurrence in the planning area. It is likely that NCEI data is not inclusive of all events that have impacted the campus. Thunderstorms occur multiple times throughout the year, though all events may not result in damage.

Figure 4-37 illustrates thunderstorm hazard severity based on the annual average number of days with a thunderstorm event. According to the map, the University's Ypsilanti campus experiences between 27-36 thunderstorm days per year on average.

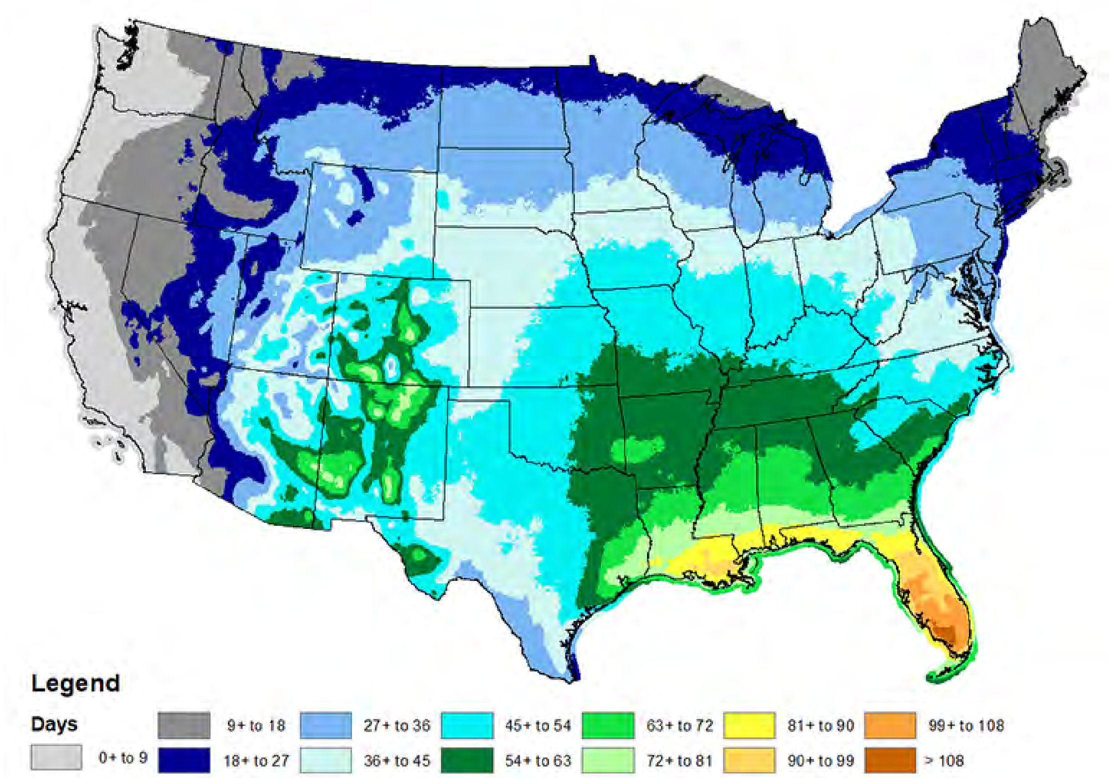

Figure 4-37: Annual Mean Thunderstorm Days (1993-2018) [85]

When possible, climate variability should be considered when determining the probability of future hazard events. Trends in convective storm occurrences due to climate change are subject to greater uncertainty than temperature-related trends (such as extreme heat and cold events).[86] Because wind events in Ypsilanti are affiliated with severe thunderstorms, trends in wind event frequency and intensity are related to trends in thunderstorm frequency and intensity. As previously stated, the Great Lakes Region spring season, is projected to experience increases of 1.2 to 2.4 days per season with severe thunderstorm environments.[87] While it is difficult to quantify these trends in terms of future wind event occurrences, they can be considered when determining future probability.

Considering the frequency of historic occurrences, the likelihood of unreported or underreported events, and climate projections for convective storm conditions, a probability of highly likely (greater than 90 percent annual chance) was assigned to the severe wind hazard.

Vulnerability Assessment

All current and future structures, including critical facilities, infrastructure, and populations on EMU's campus are considered at risk to severe wind. The entire campus is vulnerable to

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[85] National Oceanic and Atmospheric Administration. (2023). Thunderstorms, Retrieved on August 21, 2023 from [Thunderstorms | National Oceanic and Atmospheric Administration (noaa.gov)]

[86] Walsh, J., et al. (2014). Ch. 2: Our Changing Climate. Climate Change Impacts in the United States: The Third National Climate Assessment. U.S. Global Change Research Program. Retrieved August 21, 2023 from http://nca2014.globalchange.gov/report/our-changing-climate/changes-storms

[87] Diffenbaugh et. al. (2013) Robust increases in severe thunderstorm environmental in response to greenhouse forcing, PNAS.

severe storms due to the topography and movement of weather fronts through the area; all current and future populations, infrastructure, and building, including critical facilities, are considered at risk to severe winds.

The NRI provides a strong wind risk index score, which indicates a county's strong wind risk relative to the rest of the United States.[88] According to the index, Washtenaw County, where the University's campus is located, has "Very High" risk from strong wind as shown in **Figure 4-38.**

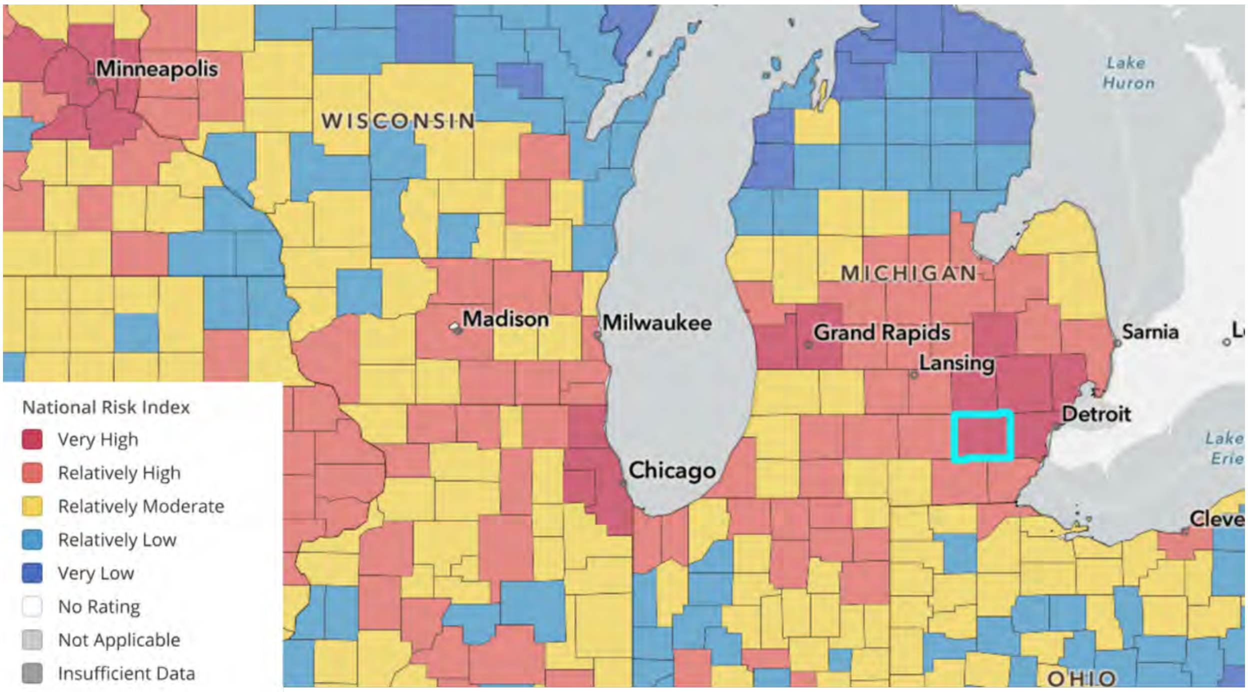

Figure 4-38: Strong Wind Risk Index Results at a National Level

Severe wind has the potential to blow shingles, siding, awnings, and other features off buildings. Falling trees and tree limbs can damage structures. Objects picked up by wind can be hurled through the air, damaging structures, and breaking windows when contact is made. In some cases, structures can be blown off foundations. For example, severe winds blew two airport hangars off their foundation in the Ann Arbor municipal airport in Washtenaw County in July 1998. In addition, mobile or modular units (such as those installed for temporary uses) are considered at a higher risk to severe wind. Severe winds can also impact air supported structures and cause them to collapse. EMU's campus has one air supported dome that serves as its indoor sports practice facility that would be vulnerable to such an event. Research suggests that air-supported structures can typically withstand winds up to 120 mph.[89] The highest recorded wind event in the region is 92 mph, however more severe wind events are possible on campus and could potentially impact the indoor sports practice facility or other critical facilities on campus.

[88] Federal Emergency Management Agency (n.d.), National Risk Index, Retrieved August 21, 2023 from Map | National Risk Index (fema.gov)
[89] National Research Council Canada. (1971). Air-Supported Structures, Retrieved on September 13, 2023 from CBD-137. Air-Supported Structures - NRC-CNRC (archive.org)

Severe winds can down communications infrastructure, utility poles, and above ground power lines. Downed tree limbs, debris, and utility lines can block roads and impede staff and student travel to and from campus.

In addition, severe winds can result in serious life safety impacts. People outside during severe wind events may be struck by falling trees and limbs, or by objects falling off buildings or being hurled through the air. The campus may have several people, such as students, outdoors throughout the day, especially during class changes, that can be exposed to severe winds. People engaged in outdoor activities during a wind event should reduce vulnerability by taking appropriate precautions. The University advises students and staff to follow the guidelines issued by the National Weather Service in the event of a severe thunderstorm. The guidelines are listed in the University's Emergency Response Procedures handbook.[90]

In the event that winds of 75 miles per hour or greater are confirmed anywhere in Washtenaw County, the county's siren warning system will deploy. As shown in **Figure 4-39**, warning sirens throughout Washtenaw County provide total siren coverage for EMU's campus. When a siren is heard, people outdoors must immediately seek shelter indoors in a sturdy building and stay away from windows. [91]

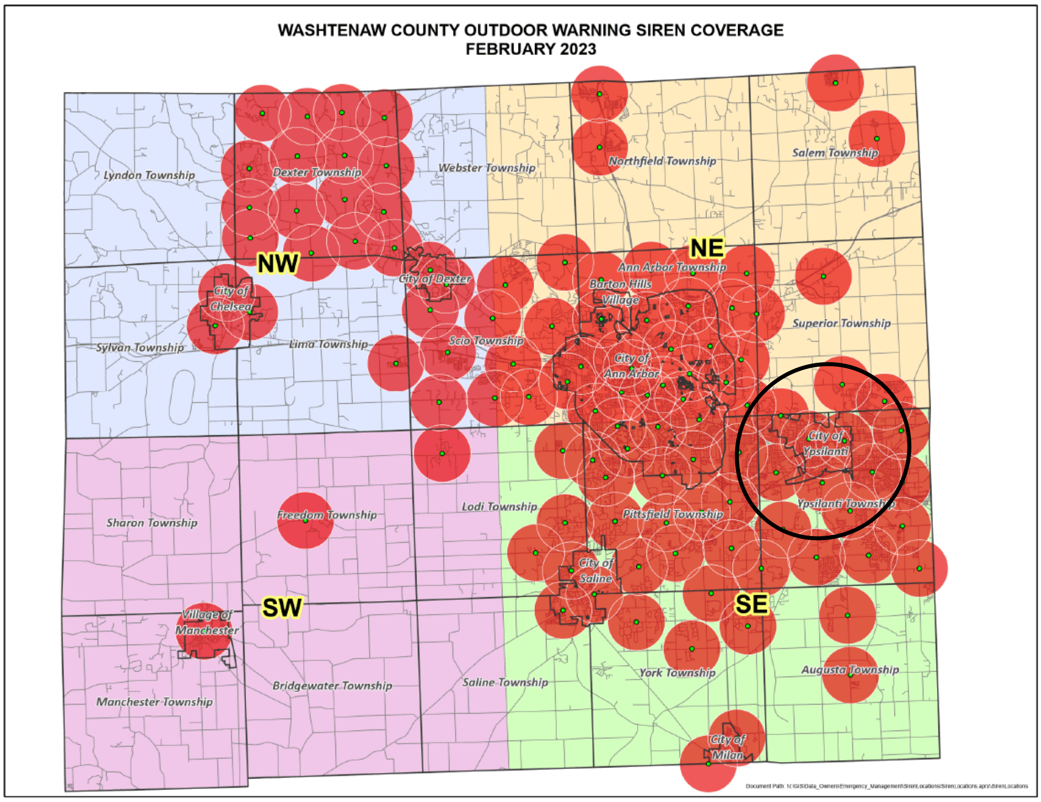

Figure 4-39: Washtenaw County Siren Warning System Coverage[92]

[90] Eastern Michigan University. (2023). Emergency Response Procedures, A Guide for Faculty, Staff, Students and Visitors

[91] Sherrif's Office Washtenaw County. (n.d.). Emergency Management, Tornadoes/ Thunderstorms, Retrieved on August 22, 2023 from Tornadoes / Thunderstorms | Washtenaw County, MI

[92] Sherrif's Office Washtenaw County. (2023). Washtenaw County Outdoor Warning Siren System, Retrieved on August 21, 2023 from Washtenaw County Outdoor Warning Siren System | Washtenaw County, MI

Changes to severe wind intensity (extent) and frequency due to climate change are uncertain, and research is ongoing. As described above, research cited by the National Climate Assessment indicates a projected increase in the number of days in which conditions for thunderstorms are favorable, which could lead to an increase in the frequency of thunderstorm wind events on campus.

Tornadoes

Description

A tornado is a violent windstorm characterized by a twisting, funnel-shaped cloud extending to the ground. Tornadoes are most often generated by thunderstorm activity (but sometimes result from hurricanes and other tropical storms) when cool, dry air intersects and overrides a layer of warm, moist air forcing the warm air to rise rapidly. The damage caused by a tornado is a result of the high wind velocity and wind-blown debris, also accompanied by lightning or large hail. According to the National Weather Service, tornado wind speeds normally range from 40 miles per hour to more than 300 miles per hour. The most violent tornadoes have rotating winds of 250 miles per hour or more and are capable of causing extreme destruction. Tornadoes can turn normally harmless objects into deadly missiles.

Each year about 1,200 tornadoes are reported in the U.S.[93] According to the NOAA Storm Prediction Center (SPC), the highest concentration of tornadoes in the United States has been in Oklahoma, Texas, Kansas and Florida. The Great Plains region of the Central United States favors the development of the largest and most dangerous tornadoes (earning the designation of “Tornado Alley”). Counties in Texas and Colorado experienced the greatest number of tornadoes in all the U.S. states. **Figure 4-40** shows tornado activity in the United States based on the number of recorded tornadoes per county from 1950 to 2022.[94] According to the map, Washtenaw County, where EMU’s campus is located, experienced 21 – 40 recorded tornadoes over the 72-year period.

[93] NOAA National Severe Storms Laboratory. (n.d). *Severe Weather 101 – Tornadoes.* NOAA. Retrieved on September, 2023 from Severe Weather 101: Tornado Basics (noaa.gov).
[94] National Weather Service Storm Prediction Center. (2022). *Total Number of Tornadoes per County 1950 – 2022.* NOAA. Retrieved on September 5, 2023 from tornadoes-by-county.png (1612×997) (noaa.gov)

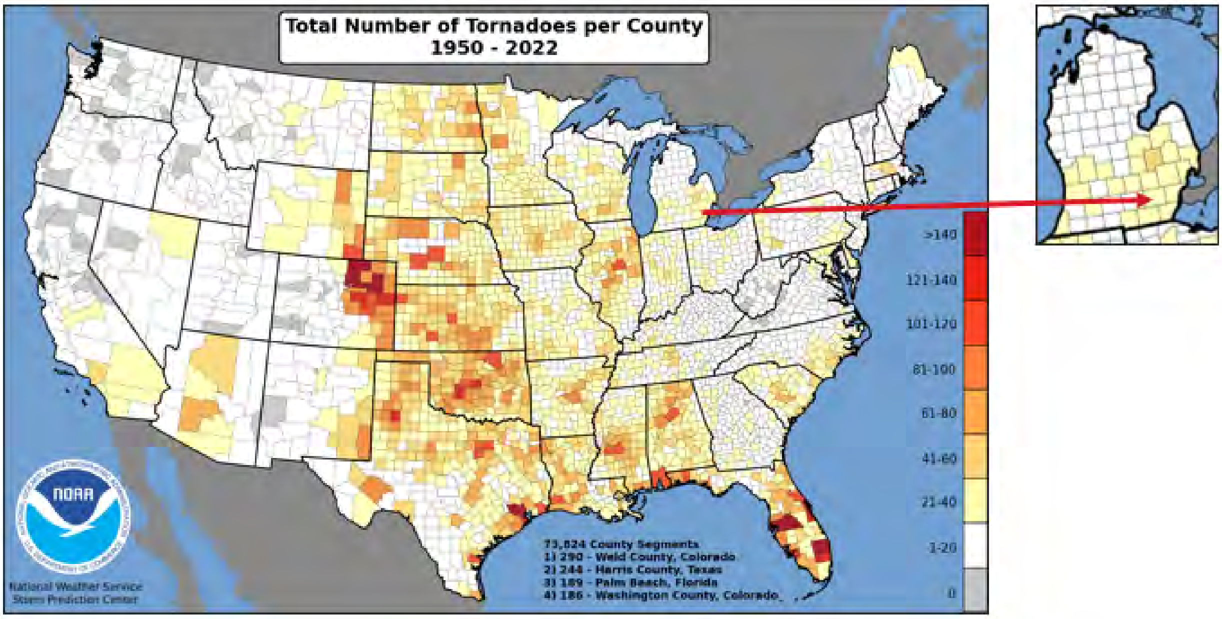

Figure 4-40: U.S. Tornado Occurrences by County

Tornadoes are most likely to form in the late afternoon and early evening. Most tornadoes are a few dozen yards wide and touchdown briefly, but even small short-lived tornadoes can inflict tremendous damage. Highly destructive tornadoes may carve out a path over a mile wide and several miles long.

The destruction caused by tornadoes ranges from light to inconceivable depending on the intensity, size and duration of the storm. Typically, tornadoes cause the greatest damage to structures of light construction, including residential dwellings (particularly mobile homes). Tornadic magnitude is reported according to the Fujita and Enhanced Fujita Scales. Tornado magnitudes prior to 2005 were determined using the traditional version of the Fujita Scale, **Table 4-26**. The Enhanced Fujita Scale, used after 2005 (**Table 4-27**), identifies six different categories of tornadoes, EF0 through EF5. Tornado magnitudes that were determined in 2005 and later were determined using the Enhanced Fujita Scale.

Table 4-26: Fujita Scale (effective prior to 2005)

F-Scale Number	Intensity	Wind Speed	Type of Damage Done
F0	GALE TORNADO	40–72 MPH	Some damage to chimneys; breaks branches off trees; pushes over shallow-rooted trees; damages to sign boards.
F1	MODERATE TORNADO	73–112 MPH	The lower limit is the beginning of hurricane wind speed; peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos pushed off the roads; attached garages may be destroyed.
F2	SIGNIFICANT TORNADO	113–157 MPH	Considerable damage. Roofs torn off frame houses; mobile homes demolished; boxcars pushed over; large trees snapped or uprooted; light object missiles generated.

F-Scale Number	Intensity	Wind Speed	Type of Damage Done
F3	SEVERE TORNADO	158–206 MPH	Roof and some walls torn off well-constructed houses; trains overturned; most trees in forest uprooted.
F4	DEVASTATING TORNADO	207–260 MPH	Well-constructed houses leveled; structures with weak foundations blown off some distance; cars thrown and large missiles generated.
F5	INCREDIBLE TORNADO	261–318 MPH	Strong frame houses lifted off foundations and carried considerable distances to disintegrate; automobile sized missiles fly through the air in excess of 100 meters; trees debarked; steel re-enforced concrete structures badly damaged.
F6	INCONCEIVABLE TORNADO	319–379 MPH	These winds are very unlikely. The small area of damage they might produce would probably not be recognizable along with the mess produced by F4 and F5 wind that would surround the F6 winds. Missiles, such as cars and refrigerators would do serious secondary damage that could not be directly identified as F6 damage. If this level is ever achieved, evidence for it might only be found in some manner of ground swirl pattern, for it may never be identifiable through engineering studies.

Table 4-27: The Enhanced Fujita Scale (effective 2005 and later)

EF-Scale Number	Intensity Phrase	3 Second Gust	Type of Damage Done
EF0	GALE	65–85 MPH	Some damage to chimneys; breaks branches off trees; pushes over shallow-rooted trees; damages to sign boards.
EF1	MODERATE	86–110 MPH	The lower limit is the beginning of hurricane wind speed; peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos pushed off the roads; attached garages may be destroyed.
EF2	SIGNIFICANT	111–135 MPH	Considerable damage. Roofs torn off frame houses; mobile homes demolished; boxcars pushed over; large trees snapped or uprooted; light object missiles generated.
EF3	SEVERE	136–165 MPH	Roof and some walls torn off well-constructed houses; trains overturned; most trees in forest uprooted.
EF4	DEVASTATING	166–200 MPH	Well-constructed houses leveled; structures with weak foundations blown off some distance; cars thrown and large missiles generated.
EF5	INCREDIBLE	Over 200 MPH	Strong frame houses lifted off foundations and carried considerable distances to disintegrate; automobile sized missiles fly through the air in excess of 100 meters; trees debarked; steel re-enforced concrete structures badly damaged.

Tornado damage may include crop and property damage, power outages, environmental degradation, injury, and death. Tornadoes are known to blow off roofs, move cars and tractor trailers, and demolish homes. Typically, tornadoes cause the greatest damage to structures of light construction, such as residential homes.

In 1999, FEMA conducted an extensive damage survey of residential and non-residential buildings in Oklahoma and Kansas following an outbreak of tornadoes on May 3, 1999, which killed 49 people. The assessment found:

- The failure for many residential structures occurred where the framing wasn't secured to the foundation, or when nails were used as the primary connectors between the roof structure and the walls. A home in Kansas, for example, was lifted from its foundation. The addition of nuts to the foundation anchor bolts (connected to the wood framing) may have been all that was needed to prevent this from occurring.
- Roof geometry played a significant role in a building's performance.
- Failure of garage doors, commercial overhead doors, residential entry doors or large windows caused a significant number of catastrophic building failures.
- Manufactured homes on permanent foundations were found to perform better than those that were not on solid foundation walls.

In the Midwest, peak tornado season is typically June or July.[95] The State Hazard Mitigation plan reports an annual average of 18 tornado events, 3.6 deaths, and 49.6 injuries in Michigan.

Location

Tornadoes have the potential to strike anywhere. They are more common in open spaces (such as the plains in Tornado Alley). Tornadoes are rarer in areas where there are lots of hills or mountains. Once a touchdown occurs, it may only affect a small area or travel for miles, leaving substantial destruction in its path. Further, it is impossible to predict where and with what magnitude a tornado will strike. Therefore, it is assumed that all of EMU's campus is uniformly exposed to tornadoes.

Previous Occurrences

The NCEI Storm Events Database reports tornado information by county and, when the information is available, by city or by coordinate location. Between 1950 and January 2023, 28 tornado events were reported for Washtenaw County. From the 28 events, there was 1 reported fatality and 12 reported injuries. Significant tornado events are summarized in **Table 4-28**.

Table 4-28: NCEI Significant Tornado Events in Washtenaw County

Date	Magnitude	Deaths/ Injuries	Damages (2023 dollars)	Event Details
6/8/1953	F3	1/5	$318,016	-
7/4/1969	F3	0/4	$23,103,733	-
5/25/1975	F2	0/1	$157,617	-

[95] Michael Ostego. (April 2018). *Tornado Basics.* The Michigan Weather Center. Retrieved on September 6, 2023 from [Tornado Basics – The Michigan Weather Center (michigan-weather-center.org)](michigan-weather-center.org).

Date	Magnitude	Deaths/ Injuries	Damages (2023 dollars)	Event Details
6/13/1994	F2	0/2	$11,453,969	There was heavy tree damage over a 16-mile-long path about one mile wide. Damages included downed power lines and poles, vehicle damage, roof damage and barns destroyed. Two modular homes were destroyed, and major damage was reported for at least five homes. A small airplane and hangar were destroyed.
9/30/2006	F0	0/0	-	Tornado path was 0.2 miles long and 25 yards wide. It was very brief and managed to dislodge soil. This event occurred at the Francis School of Public Health Building at the University of Michigan. Reported damages were minimal.
3/15/2012	EF3	0/0	$16,610,806	A National Weather Service Storm Survey confirmed an EF-3 tornado touched down near Dexter, MI with maximum wind speeds of 135-140 mph. The path length was 7.6 miles with a maximum width of 800 yards. In total, 20 homes were severely damaged, with some damage to at least 200 homes.

In addition, tornado touchdown points and paths from 1950 – 2022 were mapped for Washtenaw County from NOAA's Severe Report Database as shown in **Figure 4-41**.[96] No tornadoes were shown to directly impact EMU's campus, however tornado paths can be over a mile wide. It is possible that less extreme events were not reported.

[96] Storm Prediction Center. (2023). *SVRGIS*. NOAA. Retrieved from Storm Prediction Center Severe Weather GIS (SVRGIS) Page (noaa.gov) on April 19, 2023.

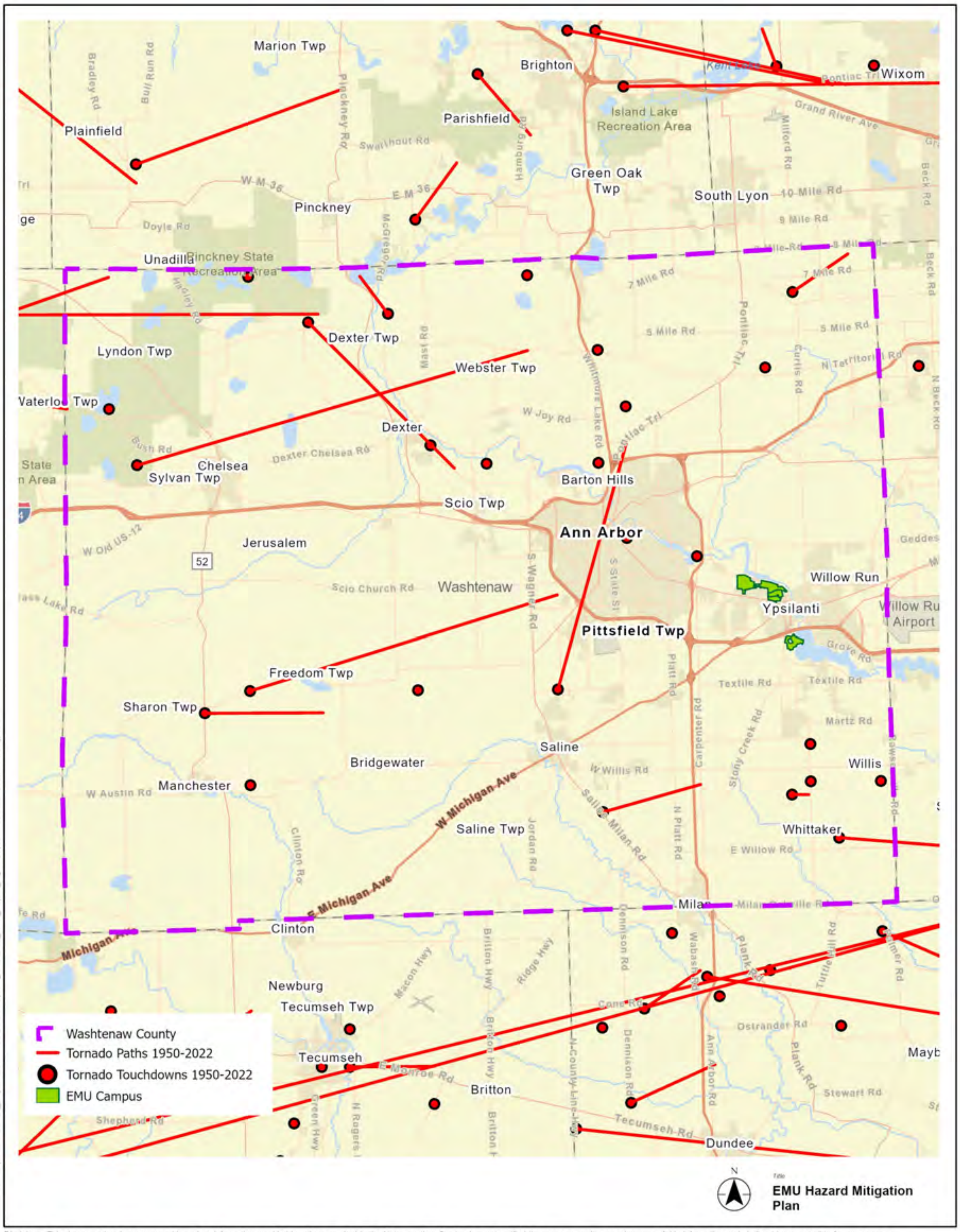

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Figure 4-41: Tornado Paths and Touchdowns 1950 – 2022

August 24, 2023 Tornadoes

During the development of the risk assessment, 7 tornadoes occurred in Michigan in a single day with 6 tornadoes occurring in Southeast Michigan.[97] This set a record for the most tornadoes in a single day during the month of August. Initial reports include 1 fatality and over 500,000 customers without power in southern Michigan. While no tornadoes were reported in Washtenaw County, the 6 tornadoes in Southeast Michigan were in counties surrounding Washtenaw County. The tornado locations are shown in **Figure 4-42**.[98]

Figure 4-42: August 24, 2023, Tornado Locations

Extent

No tornadoes have been reported to directly impact EMU's campus. However, several severe tornadoes have impacted Washtenaw County. Three F3 (158 – 206 MPH) tornadoes have been reported in 1953, 1969, and 1982. An EF3 (136 – 165 MPH) tornado was reported in 2012.

Extent can also be measured in casualties and damages. The 1953 F3 tornado resulted in 1 death and 5 injuries. When inflated to 2023 dollars, the tornado caused $23,103,733 in damages. More severe events are possible. A single tornado event has the potential to be devastating to the campus and population.

Probability

With 28 reported tornado events in 69 years, Washtenaw County, which includes EMU, experiences a tornado approximately every 2 – 3 years. It is possible that other, unrecorded tornadoes have occurred. Being in the Midwest, the University is in a region with high potential for tornadoes.

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[97] Detroit/Pontiac, MI Weather Forecast Office. (2023). *August 24, 2023 Evening Tornadoes & Severe Weather Event.* National Weather Service. Retrieved on September 6, 2023 from August 24, 2023 Evening Tornadoes & Severe Weather Event

[98] Kayla Clarke. (August 2023). *7 tornadoes touched down in Michigan: Here's where, when.* Click On Detroit. Retrieved on September 6, 2023 from 7 tornadoes touched down in Michigan: Here's where, when (clickondetroit.com)

When possible, climate variability should be considered when determining the probability of future hazard events. Trends in convective storm occurrences due to climate change are subject to greater uncertainty than temperature-related trends (such as extreme heat and cold events).[99] Because tornado events are affiliated with severe thunderstorms, trends in tornado event frequency and intensity are related to trends in thunderstorm frequency and intensity. As previously stated, the planning area is projected to experience an increase of 1.2 to 2.4 days per season with severe thunderstorm environments.[100] While it is difficult to quantify these trends in terms of future tornado event occurrences, they can be considered when determining future probability. Considering the above, a probability of possible (10 percent to 50 percent annual chance) was assigned.

Vulnerability Assessment

The entire campus is vulnerable to tornadoes. The potential for loss of life and property damage are significant given the area's built environment. All current and future buildings, infrastructure, and populations are considered at-risk to tornadoes, including critical facilities.

Buildings located above-ground in the path of a tornado can suffer extensive damage and/or complete destruction. Although some buildings adjacent to a tornado's path can stand with little or no damage, debris hurled by the wind makes all buildings vulnerable to damage. Although all buildings are vulnerable to tornadoes, three types of structures are more likely to suffer damage:

- Mobile homes or units;
- Structures on crawlspaces (more susceptible to lift); and
- Buildings with large spans, such as airplane hangars, gymnasiums, and factories.

Schools and universities, such as EMU, are of a particular concern to the tornado hazard for at least two reasons:

- They have large numbers of people present, either during school or for use as a storm shelter location.
- They have large span areas (open areas with high ceilings), such as gyms, atriums, and theaters.

Tornadoes can occur without warning, and reaction time may be short. Injuries or loss of life can result when people out in the open are in or near a tornado's path; exposed individuals can be picked by tornado winds or struck by debris. People inside structures that are impacted by tornadoes may suffer injuries or death if trapped in a collapsed building or struck by flying or falling objects. Motorists should not attempt to drive during a tornado event. The Centers for Disease Control recommend that any person in the path of a tornado find shelter or a tornado safe room immediately. Sheltering in a basement or under a sturdy object is recommended when a tornado safe room is not an option. Head injuries are a common cause of death from tornadoes; therefore, individuals should attempt to protect their heads during tornado events. Respondents from the public survey and students participating in an outreach activities noted a lack of available sheltering locations or basements available for sheltering, or indicated they did not know where to go during a tornado event.

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[99] Walsh, J., et al. (2014). Ch. 2: Our Changing Climate. Climate Change Impacts in the United States: The Third National Climate Assessment. U.S. Global Change Research Program. Retrieved August 21, 2023 from http://nca2014.globalchange.gov/report/our-changing-climate/changes-storms

[100] Diffenbaugh et. al. (2013) Robust increases in severe thunderstorm environmental in response to greenhouse forcing, PNAS.

EMU is particularly vulnerable to tornadoes given the large number of students and employees present on campus at any given moment. A parallel can be drawn to the University of Alabama, which in April 2011 experienced an EF4 tornado that resulted in 36 fatalities, including several students and University employees. Due to damages and loss of life, the University cancelled the rest of the school year and delayed graduation.

Above-ground utilities and infrastructure are also vulnerable to tornadoes. Above-ground infrastructure in the path of a tornado can suffer extensive damage and/or complete destruction. Damages to certain exposed infrastructure, such as pipelines or septic tanks, can result in hazardous materials spills and leaks. Transportation infrastructure may be damaged from tornadoes or blocked by debris. Substantial damages to infrastructure could cause a reduction in university operations and/or cancelation of classes and events.

In the event that winds of 75 miles per hour or greater are confirmed anywhere in Washtenaw County, the county's siren warning system will deploy. As shown in **Figure 4-39** in the ***Severe Winds Profile***, warning sirens throughout Washtenaw County provide total siren coverage for EMU's campus.

Tornado events can disproportionally impact certain socially vulnerable populations. Individuals living in manufactured homes or in housing built prior to modern building codes are at higher risk to tornadoes. This could include students, faculty, and staff living off campus. To reduce the threat of tornado events, manufactured homes should be properly anchored. Emergency procedures to be conducted during an event should be established ahead of time and exercised, ensuring that messaging and signage is provided in multiple languages. Tornados can have devasting impacts with little warning time available; therefore, populations who are not able to quickly respond to warnings, such as those who are mobility challenged, non-English speakers, blind/sight impaired, or deaf/hard of hearing may have difficulty seeking shelter in a timely manner.

There is still some uncertainty as to the specific link between tornadoes and changing climatic conditions, and more research is needed to understand the full impact of climate change on tornadic activity. Due to the small scale of tornado events, observation and modeling can be challenging. Because tornadoes are usually generated from thunderstorms, trends in tornado frequency and intensity are related to trends in thunderstorm frequency and intensity. Although studies are still being performed, a recent study cited by the National Climate Assessment indicates an increase in the occurrence of atmospheric conditions conducive to severe thunderstorm formation in the United States.

Another study cited by the *Fourth National Climate Assessment* highlighted that the number of days with a tornado in the US have decreased; however, the number of days with multiple tornadoes has increased. This has resulted in increased variability in annual and monthly tornado trends, as well as increasing variability in the start of tornado season. Additionally, a study published by Northern Illinois University, in partnership with the NOAA, indicates that what is commonly referred to as "tornado alley" (e.g., Texas and the Great Plains) is shifting east, and that the frequency of tornadoes in the Southeast and Midwest regions is increasing.[101] **Figure 4-43** illustrates the study's findings of observed tornado trends over 40 years. From the map, EMU is in the area showing increasing tornado environment trends.

[101] NIU Newsroom. (October 2018). *Study: U.S. Tornado frequency shifting eastward from great Plains.* Northern Illinois University. Retrieved on September 6, 2023 from [Study: U.S. tornado frequency shifting eastward from Great Plains | NIU Newsroom].

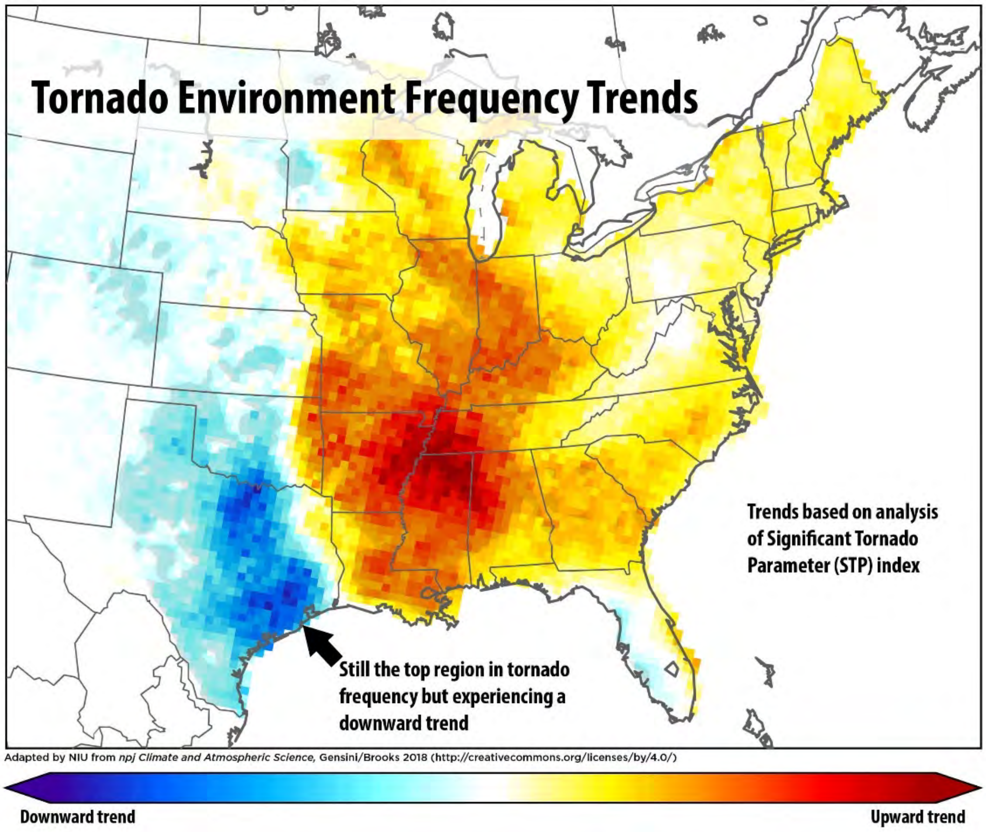

Figure 4-43: U.S. Tornado Frequency Shifting Eastward

Natural Hazards – Geological Hazards

Earthquakes

Description

Earthquakes are scientifically defined as the sudden release of strain (or displacement of rock) in the earth's crust, resulting in waves of shaking that radiate outward from the earthquake source. They may result from crustal strain, volcanism, landslides or the collapse of caverns. Earthquakes can occur underwater or on land. Earthquakes can affect hundreds of thousands of square miles. Their intensity ranges from very minor (shaking not detected by humans without instruments) to very violent (catastrophic in nature). Damages follow this intensity ranging from minor to catastrophic. Earthquakes also occur without warning, resulting in deaths and injuries.

To understand the nature of earthquakes, the composition of the earth must be explored. The earth is made up of four major layers and several sub layers (**Figure 4-44**)[102] a solid inner core, a liquid outer core, a semi-molten mantle, and the rocky crust (the thin outermost layer of the earth). The upper portion of the mantle combined with the crust forms the

[102] BBC. (n.d.). *Plate Tectonics*. Retrieved on August 30, 2023 from [Plate Tectonics guide for KS3 geography students - BBC Bitesize]

lithosphere. This area is susceptible to fractures and is referred to as a shell. The lithosphere breaks up into large slabs, known as tectonic plates. This area is where earthquakes occur.

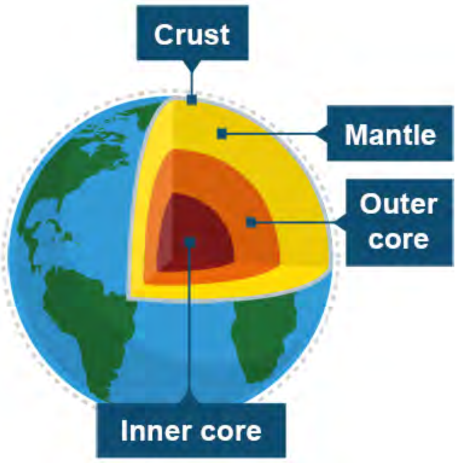

Figure 4-44: Earth's Sub Layers

There are approximately twelve major plates and several dozen more minor plates on the earth's crust, as shown in **Figure 4-45**. Plates are regions of the crust that continually move over the mantle. Areas where these plates meet, grind past each other, dive under each other, or spread apart, are called plate boundaries. Most earthquakes are caused by the release of stresses accumulated due to the sudden displacement of rock along opposing plates in the Earth's crust. The location below the earth's surface where the earthquake starts is known as the hypocenter or focus. The point on the earth's surface directly above the focus is the epicenter. The areas bordering the Pacific Plate, also known as the "Pacific Ring of Fire", are at a particularly high risk since most of the largest earthquake events of the last century have occurred in that region.

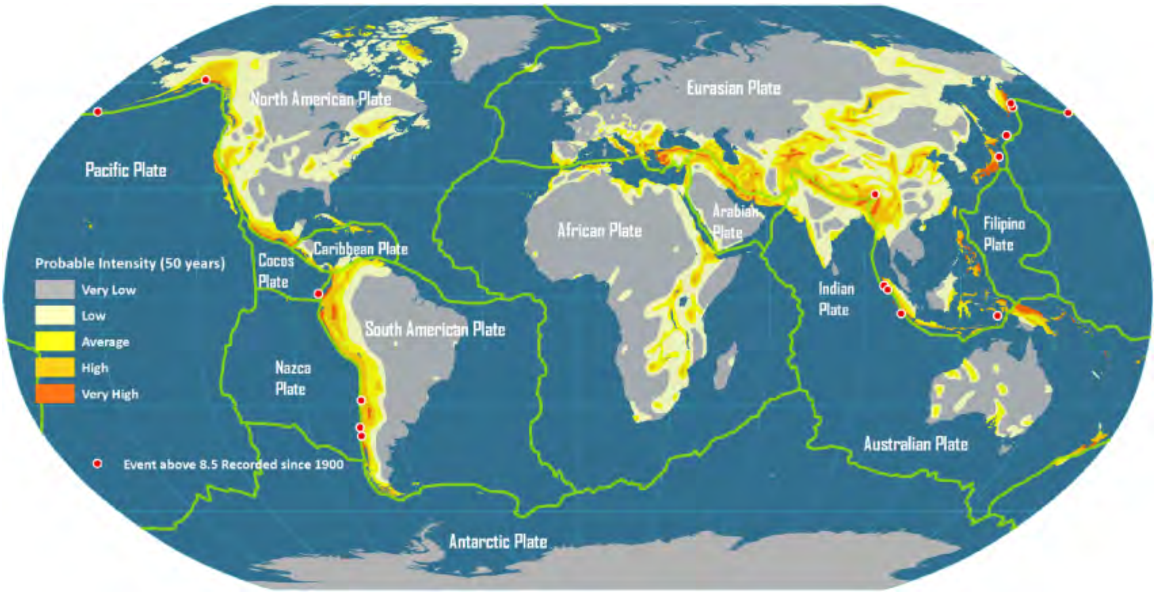

Figure 4-45: Global Plate Tectonics and Seismic Activity[103]

[103] Rodrigue, J.P. (2017). *Global Plate Tectonics and Seismic Activity.* Hofstra University. Retrieved from https://people.hofstra.edu/geotrans/eng/ch9en/conc9en/plate_tectonics.html

While earthquakes typically occur along plate boundaries, they can affect hundreds of thousands of square miles, causing damage to property (measured in the tens of billions of dollars), resulting in loss of life and injury to hundreds of thousands of persons, and disrupting the social and economic functioning of the affected area.

Most property damage and earthquake-related deaths are caused by the failure and collapse of structures due to ground shaking. The level of damage depends upon the amplitude and duration of the shaking, which are directly related to the earthquake size, distance from the fault, site, and regional geology. Other damaging earthquake effects include landslides, the down-slope movement of soil and rock (mountain regions and along hillsides), and liquefaction, in which ground soil loses the ability to resist shear and flows much like quicksand. In the case of liquefaction, anything relying on the substrata for support can shift, tilt, rupture, or collapse.

The greatest earthquake threat in the United States is along tectonic plate boundaries and seismic fault lines located in the central and western states; however, the Eastern United States does face moderate risk to less frequent, less intense earthquake events. **Figure 4-46** shows relative seismic risk for the United States.

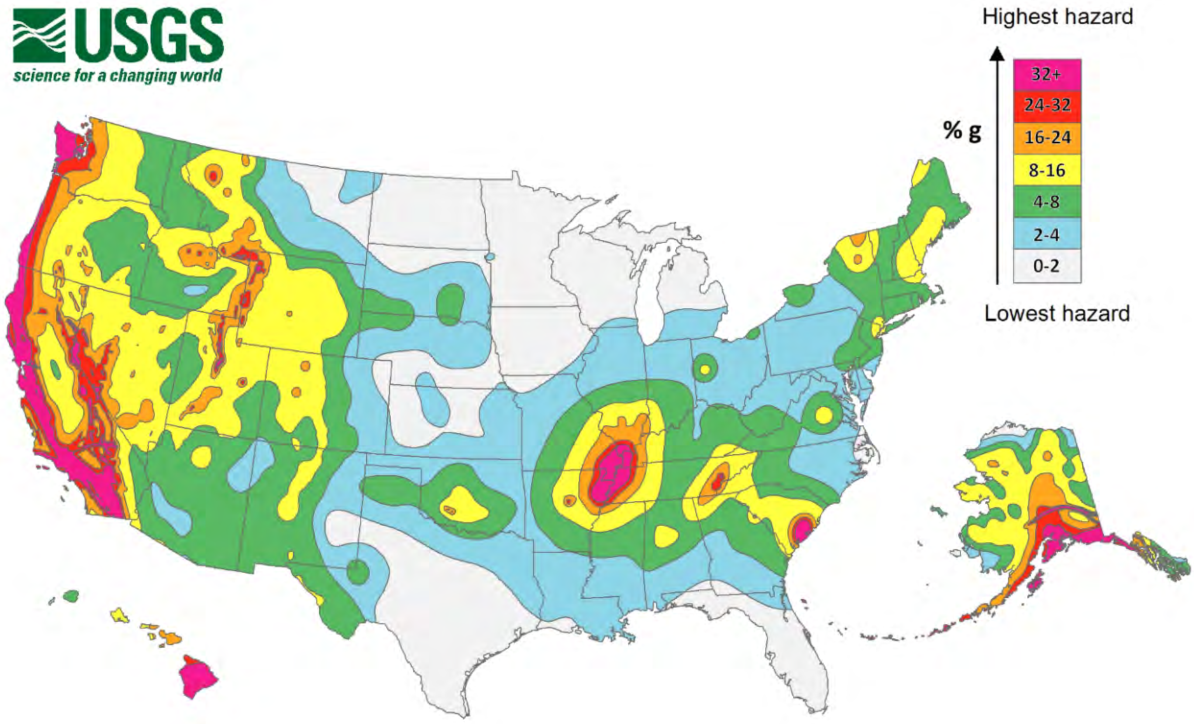

Figure 4-46: United States Earthquake Hazard Map

Source: United States Geological Survey

Earthquake magnitude is measured using the Richter Scale, an open-ended logarithmic scale that describes the energy release of an earthquake through a measure of shock wave amplitude (**Table 4-29**).[104] Each unit increase in magnitude on the Richter Scale corresponds to a 10-fold increase in wave amplitude, or a 32-fold increase in energy. Beginning in 2002, the USGS began using Moment Magnitude as the preferred measure of

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[104] Spence, W. et al. (1989). Measuring the size of an earthquake. U.S. Geological Survey. Retrieved August 17, 2017 from https://earthquake.usgs.gov/learn/topics/measure.php.

magnitude for all USGS earthquakes greater than magnitude 3.5. This was primarily due to the fact the Richter Scale has an upper bound, so large earthquakes were difficult to measure. Moment Magnitude also has a scale, but no instrument is used to measure it. Instead, factors such as the distance the earthquake travels, the area of the fault, and land that was displaced (also known as “slip”) are used to measure moment magnitude. **Table 4-30** shows the Moment Magnitude Scale.

Table 4-29: Richter Scale

Richter Magnitudes	Earthquake Effects
<3.5	Generally, not felt, but recorded.
3.5 - 5.4	Often felt, but rarely causes damage.
5.4 - 6.0	At most slight damage to well-designed buildings. Can cause major damage to poorly constructed buildings over small regions.
6.1 - 6.9	Can be destructive in areas up to about 100 kilometers across where people live.
7.0 - 7.9	Major earthquake. Can cause serious damage over larger areas.
8 or >	Great earthquake. Can cause serious damage in areas several hundred kilometers across.

Source: Federal Emergency Management Agency

Table 4-30: Moment Magnitude Scale

Scale Values	Earthquake Effects
<3.5	Very weak; unlikely to be felt
3.5 - 5.4	Generally, felt; rarely causes damage
5.4 - 6.0	Will not cause damage to well-designed buildings; will damage poorly designed ones
6.1 - 6.9	Considered a “major earthquake” that causes a lot of damage
7.0 - 7.9	Large and destructive earthquake that can destroy large cities
8 or >	Large and destructive earthquake that can destroy large cities

Source: Federal Emergency Management Agency

Intensity is most commonly measured using the Modified Mercalli Intensity (MMI) Scale based on direct and indirect measurements of seismic effects. The scale levels are typically described using roman numerals, ranging from “I” corresponding to imperceptible (instrumental) events to “XII” for catastrophic (total destruction). A detailed description of the Modified Mercalli Intensity Scale of earthquake intensity and its correspondence to the Richter Scale is given in **Table 4-31**.

Table 4-32 compares the Richter scale magnitudes and MMI magnitudes for several well-known historic earthquakes in the U.S.

Table 4-31: Modified Mercalli Intensity Scale for Earthquakes

Scale	Intensity	Description Of Effects	Corresponding Richter Magnitude
I	INSTRUMENTAL	Detected only on seismographs.	
II	FEEBLE	Some people feel it.	< 4.2
III	SLIGHT	Felt by people resting; like a truck rumbling by.	
IV	MODERATE	Felt by people walking.	
V	SLIGHTLY STRONG	Sleepers awake; church bells ring.	< 4.8
VI	STRONG	Trees sway; suspended objects swing, objects fall off shelves.	< 5.4
VII	VERY STRONG	Mild alarm; walls crack; plaster falls.	< 6.1
VIII	DESTRUCTIVE	Moving cars uncontrollable; masonry fractures, poorly constructed buildings damaged.	
IX	RUINOUS	Some houses collapse; ground cracks; pipes break open.	< 6.9
X	DISASTROUS	Ground cracks profusely; many buildings destroyed; liquefaction and landslides widespread.	< 7.3
XI	VERY DISASTROUS	Most buildings and bridges collapse; roads, railways, pipes, and cables destroyed; general triggering of other hazards.	< 8.1
XII	CATASTROPHIC	Total destruction; trees fall; ground rises and falls in waves.	> 8.1

Table 4-32: Richter vs. Moment Magnitude Values

Earthquake	Richter Scale	Moment Magnitude
New Madrid, MO 1812	8.7	8.1
San Francisco, CA 1906	8.3	7.7
Prince William, AK 1964	8.4	9.2
Northridge, CA 1994	6.4	6.7

Location

An earthquake event would impact the entire planning area. Earthquakes can be felt and cause damage hundreds of miles from a fault. There are earthquake faults and earthquake risk areas that help define locations. There are no known active faults on EMU's campus. The Grenville Front is a dormant regional fault zone that crosses underneath Washtenaw County and is not believed to be a major concern.

The New Madrid Fault (New Madrid and Wabash Valley seismic zones) are the most significant seismic zones to threaten the University. **Figure 4-47** shows a USGS map of the New Madrid and Wabash Valley seismic zones and shows earthquakes as circles. While campus is not shown in the map extent, these are the major seismic zones nearest to the University, which is approximately 400 miles northeast of the zone. Yellow circles indicate earthquakes that occurred from 1974 to 2014 with magnitudes larger than 2.5 located using modern instruments (University of Memphis).

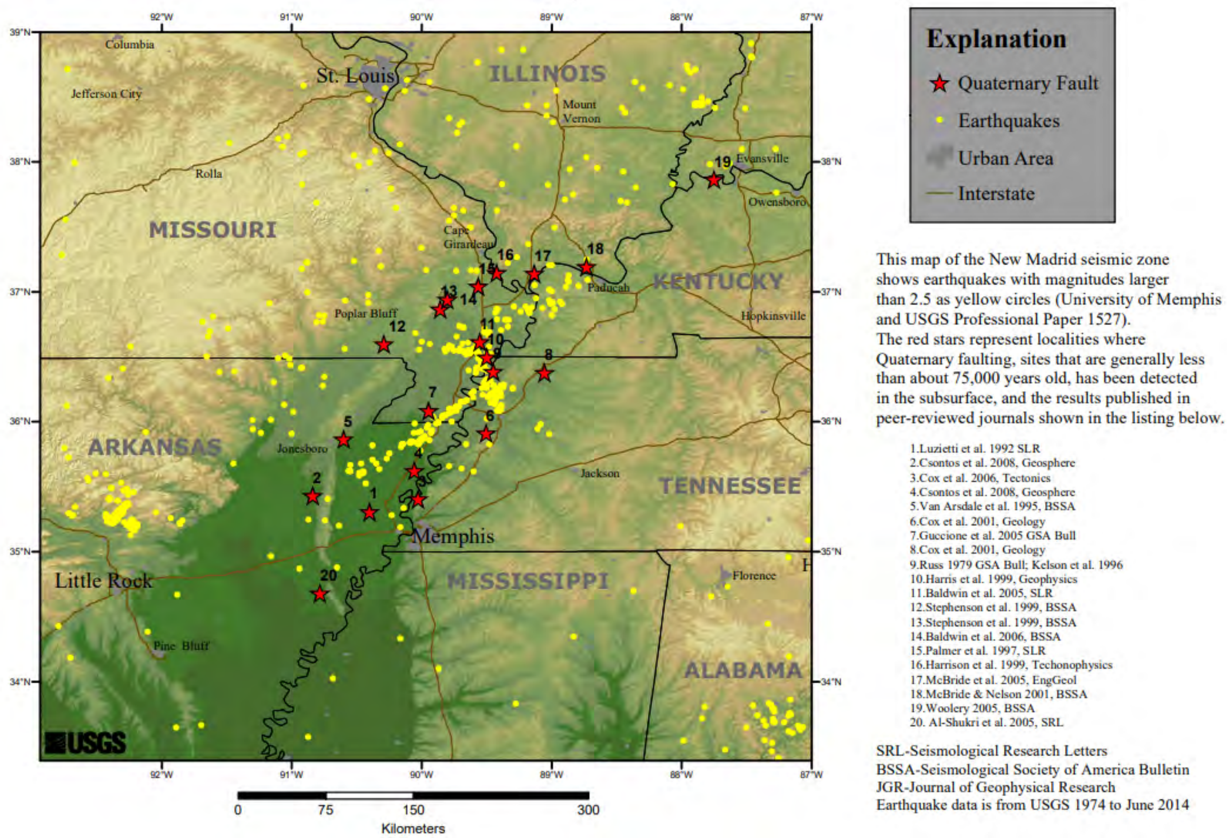

Figure 4-47: New Madrid Seismic Zone

Another seismic zone that presents a potential threat to EMU is the Charlevoix-Kamouraska Seismic Zone (CSZ) in Quebec, Canada. The CSZ is one of the most seismically active regions in Canada and runs along the St. Lawrence River (**Figure 4-48**).[105] The CSZ is approximately 400 miles northeast of the University's campus.

[105] Maurice Lamontagne, Mario Beauchemin, Thierry Toutin. (October 2004). *Earthquakes of the Charlevoix Seismic Zone, Québec*. Natural Resources Canada. Retrieved on October 6, 2023 from [Earthquakes of the Charlevoix Seismic Zone, Québec | CSEG RECORDER].

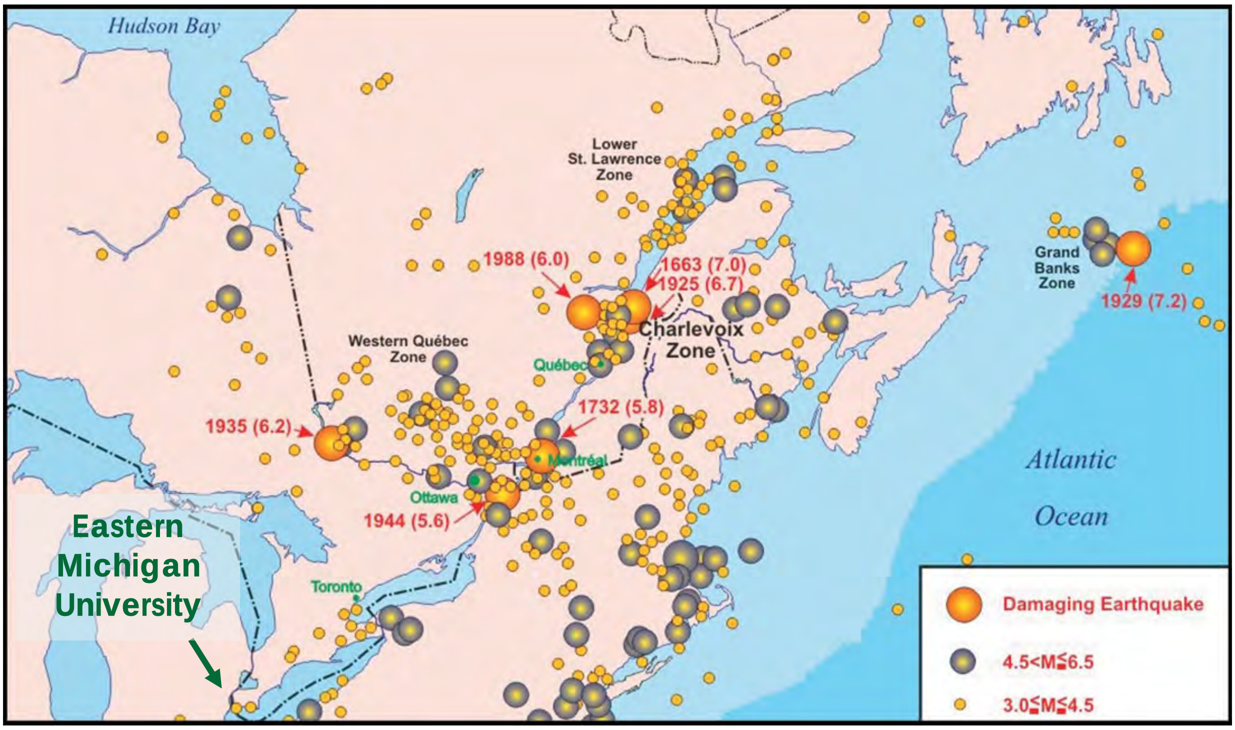

Figure 4-48: CSZ Seismic Zone

In 2015, a 4.2 magnitude earthquake occurred 12 miles southeast of Kalamazoo, MI (approximately 100 miles west of EMU's campus), leading researchers to discover a fault that runs between Kalamazoo and Coldwater, MI. The earthquake was felt throughout Michigan based on a survey completed by the U.S. Geological Study as shown in **Figure 4-49.**[106]

[106] Julie Mack. (May 2015). *Michigan earthquake: 'Big deal' for a couple reasons, U.S, Geological Survey scientist says.* M Live. Retrieved on October 6, 2023 from [Michigan earthquake: 'Big deal' for a couple reasons, U.S. Geological Survey scientist says - mlive.com](#).

Figure 4-49: USGS survey results of experienced tremors from 2015 Kalamazoo earthquake

Earthquake science continues to evolve; it is possible that there are additional faults located under or near EMU's campus. It is also possible for faults thought to be dormant to become active.

Previous Occurrences

EMU's campus has a limited recorded history of earthquakes. Based on reviewed sources, the area has experienced between 10 to 15 earthquakes since the 1880s. However, it is possible additional earthquakes have been felt on campus but were not documented as the University was not the primary impact area. **Table 4-33** shows earthquakes recorded in the Ypsilanti area between 1638 and 1985, as reported by NCEI.[107] Three earthquakes were reported; associated damages, deaths, or injuries were not reported.

Table 4-33: NCEI Reported Earthquakes in Ypsilanti 1638 - 1985

Year	Magnitude	Modified Mercalli Intensity (MMI)
1943	-	3
1947	-	3
1980	5.1	2

[107] NOAA. *U.S. Earthquake Intensity Database (1638 – 1985).* Retrieved on September 1, 2023 from [U.S. Earthquake Intensity Database | NCEI (noaa.gov)].

Several earthquakes occurring in Quebec's CSZ have been felt in Ypsilanti (and therefore likely on campus), including one in 1925 (6.7 magnitude) and another in 1935 (6.1 magnitude). The 1935 earthquake, called the Timiskaming Quake, had an MMI of VI at its epicenter, and an MMI of III in Ypsilanti (**Figure 4-50**).[108] Other earthquakes along CSZ that were likely felt in the planning area include ones in 1663 (magnitude 7.0), 1732 (5.8), 1944 (magnitude 5.6), and 1988 (magnitude 6.0). The locations of these earthquakes are shown in the figure of the CSZ, above.

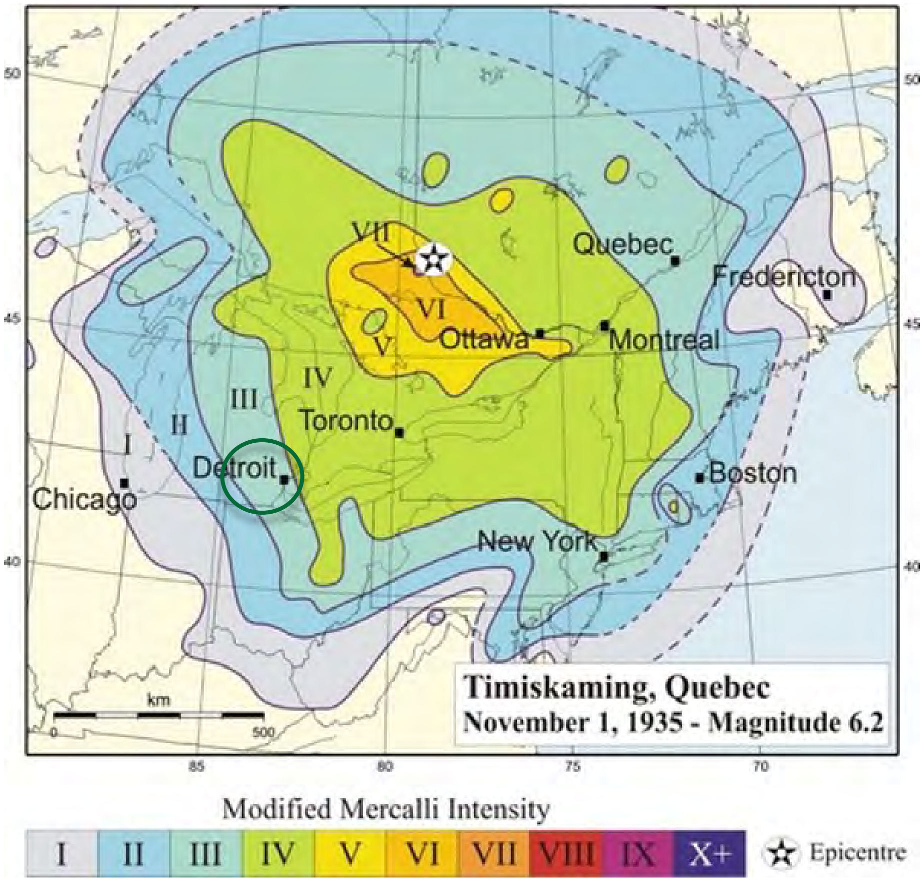

Figure 4-50: 1935 Timiskaming Earthquake Map

More recently, a series of lower magnitude earthquakes have occurred in the region, including:[109]

[108] Government of Canada. (2021). *The 1935 Magnitude 6.1 Timiskaming Earthquake*. Earthquakes Canada. Retrieved on September 1, 2023 from The 1935 Magnitude 6.1 Timiskaming earthquake (rncan.gc.ca)
[109] USGS. (2023). *Search Earthquake Catalog.* Retrieved on October 6, 2023 from Search Earthquake Catalog (usgs.gov)

- **August 21, 2020:** A 3.2 magnitude earthquake was detected in Detroit Beach Michigan. The earthquake was felt as I – II scale in Ypsilanti on the MMI scale (some people feel it). (See **Figure 4-51**)

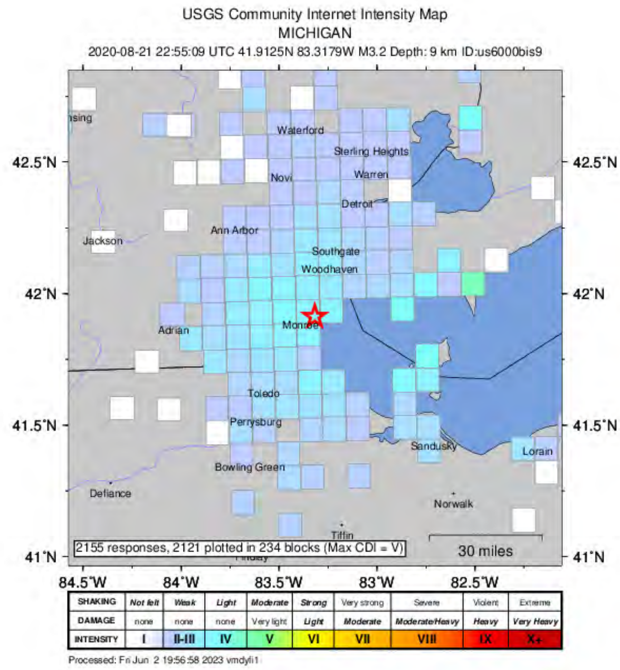

Figure 4-51: Detroit Beach Earthquake Location and Shake Map

- **June 10, 2019:** A 4.2 magnitude earthquake was detected in Lake Erie, half a mile from Eastlake (near Cleveland). Little damage was reported, including items falling off shelves.

- **April 19, 2018:** A 3.6 magnitude earthquake was reported near Amherstburg, Canada, just east of the Detroit River. The earthquake was felt as a II-III in Ypsilanti on the MMI scale (weak shaking, no damage) (see **Figure 4-52**).

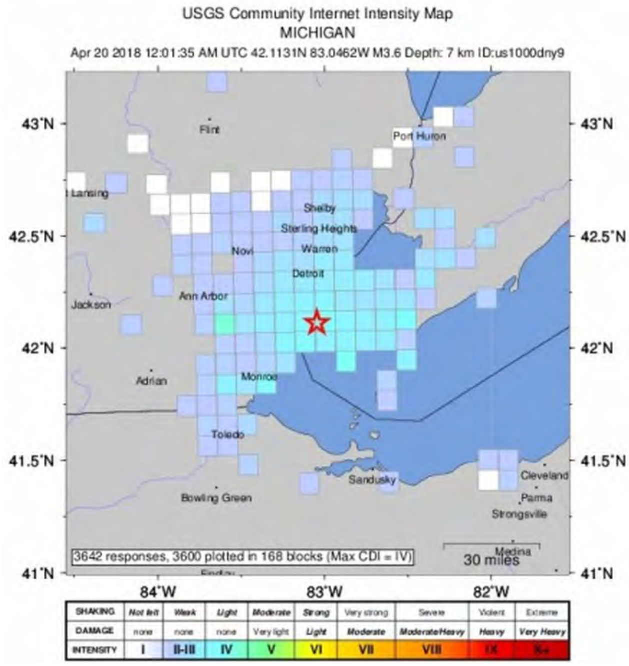

Figure 4-52: Amherstburg Earthquake Location and Shake Map

- **June 30, 2015:** A magnitude 3.3 earthquake was reported near Battle Creek, MI, approximately 90 miles west of the University's campus. No damages were reported.

- **May 2, 2015:** A 4.2 magnitude earthquake occurred near Kalamazoo, According to **Figure 4-53,** the intensity of the earthquake on the EMU campus was a II-IV on the MMI, equating to weak/light shaking and no damages.

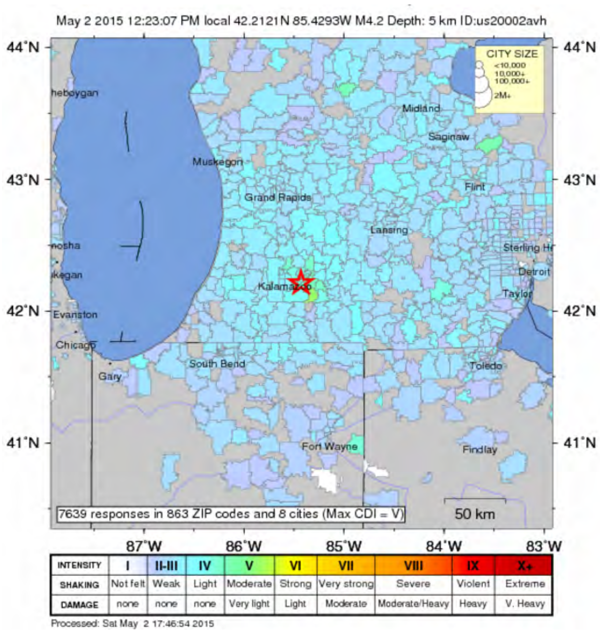

Figure 4-53: 2015 Kalamazoo Earthquake Location and Shake Map

- **April 18, 2008**: A 5.2 magnitude earthquake occurred in southern Illinois. According to **Figure 4-54** the intensity of the quake in the Ypsilanti area was an I-III on the MMI, resulting in weak shaking and no damages.

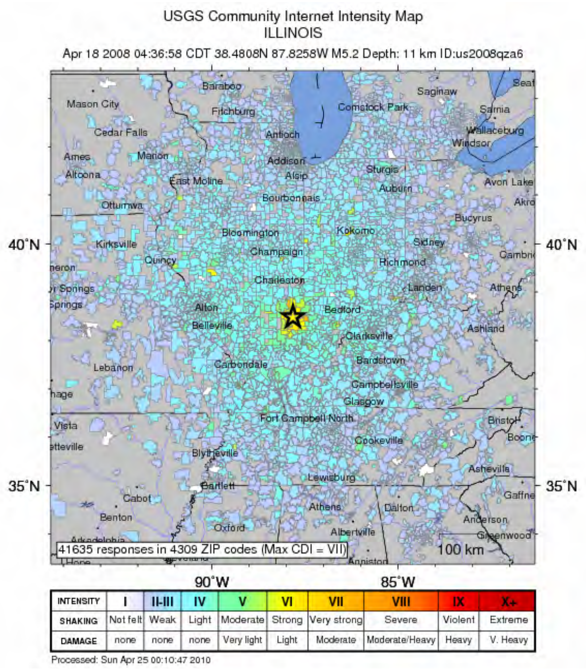

Figure 4-54: 2008 Illinois Earthquake Location

It is possible other earthquakes occurring in nearby locations were felt at EMU but were not well-recorded due to lack of damages or shaking.

Extent

There are several ways to measure the extent of an earthquake including intensity experienced. Earthquake extent is difficult to determine given the University's limited recorded history of earthquake events. From past events, the strongest intensity earthquake felt in the Ypsilanti area was a IV (Moderate; felt by people walking) on the Modified Mercalli Scale. Greater extent events are possible, but in general, damaging earthquakes are not common in the planning area.

Probability

The probability of significant, damaging earthquake events affecting EMU's campus is unlikely. In fact, earthquakes in general are difficult to estimate. Only 10 to15 earthquakes have been recorded as being felt in the planning area over several hundred years; earthquakes are not regular occurrences for the University. However, the presence of two major seismic zones near the region suggest an increased likelihood. In addition, the campus and the surrounding region are composed of bedrock, which is better able to carry seismic energy than sandy soils, such as those on the west coast. This means earthquakes hundreds of miles away could still be felt in the area. Therefore, the probability assigned to this hazard is possible (10 to 50 percent annual probability).

Vulnerability Assessment

Earthquakes are considered a lower priority hazard on campus. However, all current and future buildings, infrastructure, and populations on the Ypsilanti campus are considered at-risk to earthquakes, including critical facilities. Earthquake risk on campus may be more significant than is currently assumed. While a catastrophic event is not likely, earthquakes that can be felt, and potentially result in light to moderate damage are feasible given the surrounding hazard areas.

The USGS has produced seismic hazard maps used for projecting the ground shaking that may be exceeded with a 2 percent probability in 50 years (or a 2,500-year return period). This long-term model was last updated in 2018 and is what is typically used for national seismic safety regulations and design standards.[110] **Figure 4-55** shows this model with EMU's campus mapped over top.

[110] Wang, Z., & Ormsbee, L. (2005). Comparison between probabilistic seismic hazard analysis and flood frequency analysis. *Eos, Transactions American Geophysical Union*, *86*(5), 45-52.

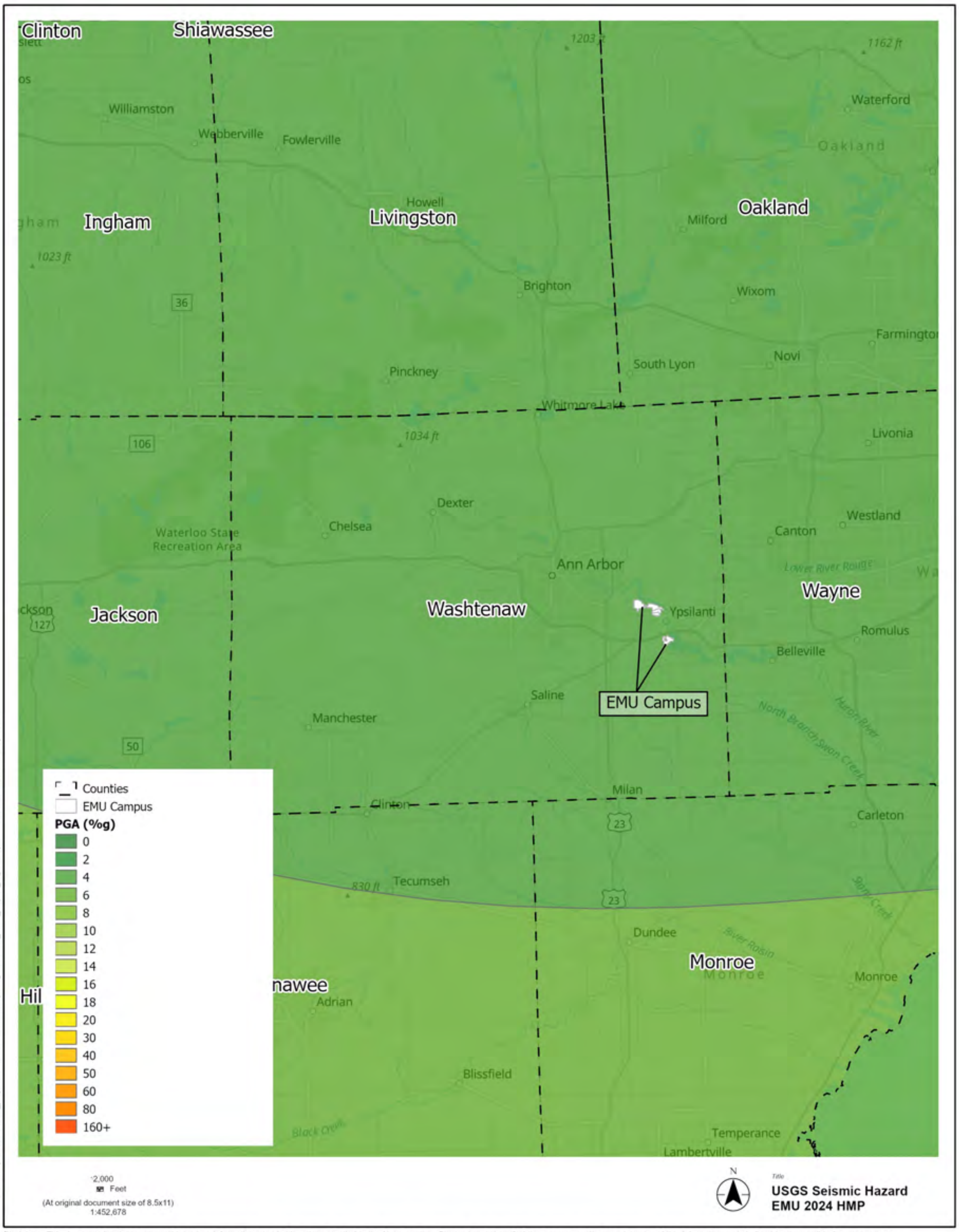

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Figure 4-55: EMU's Campus Overlaid on USGS Seismic Hazard Long-Term Model

Three separate levels of risk were established based on the PGA values. Low earthquake risk was assigned to areas with a PGA equal to or less than 10%g, medium earthquake risk was assigned to areas with a PGA between 11-30%g, and high earthquake risk was assigned to areas with a PGA greater than 30%g. All of EMU's campus is in a low-risk area with a peak ground acceleration (PGA) less than 10%g in the USGS's seismic hazard long-term model.

Although a catastrophic event is unlikely, it is still possible that an earthquake could result in damages to buildings and critical facilities at EMU. All current and future buildings, including critical facilities, are considered at risk from earthquakes. At EMU, it is possible for earthquakes to cause structural damage, fallen shelves, and toppled furniture. Fires caused by ruptured pipes or downed power lines have the potential to cause structure fires.

In the event of an earthquake, there is potential for minor damages to infrastructure, including all pipes, roads, bridges, railroads, dams, and utility poles. During earthquakes, underground infrastructure, such as water and sewer systems and natural gas pipelines, is especially vulnerable. In addition, in the event that a dam is damaged during an earthquake, there is potential for dam failure or an energy shortage (in the case of hydroelectric dams).

It can be assumed that all existing future populations are at risk from the earthquake hazard. While a devastating earthquake is unlikely, injuries are possible if earthquake shaking causes items to fall off shelves or walls. Damages to structures or infrastructure could have impacts on the population. For instance, downed power lines could result in power outages. Evacuations are unlikely for an earthquake event, but individuals should take cover under a heavy, sturdy object (such as a desk or table) in the event of an earthquake.

Earthquakes that are strong enough to damage infrastructure may have public health impacts, such as contaminated water supply, fires from natural gas leaks, or prolonged power outages (which can especially impact public health when combined with extreme temperatures). Such an earthquake is unlikely at EMU, but possible.

In the event of a serious earthquake, vulnerable populations may be susceptible to negative consequences resulting from the event. Individuals living in older housing (prior to modern building codes), substandard housing, or housing not built to code the greatest risk to structural damage from an earthquake. Individuals or families in high-density living situations such as residence halls and apartments may struggle to safely navigate damaged structures or evacuate quickly after an earthquake should a structural fire break out as a result of the hazard. Households experiencing economic constraints may lack the necessary funds to repair damages. However, damage-causing events are unlikely in the planning area. Populations with limited access to telephone and internet services may experience delays in receiving and acting upon alerts and information in the aftermath of an earthquake, and the earthquake may also disrupt these communication mechanisms. Additionally, those who do not speak English well may experience further difficulty receiving and comprehending hazard incident or preparedness information. Climate Change is not considered to have a significant impact on earthquakes in the region.

Technological Hazards – Industrial and Infrastructure Hazards

Hazardous Materials Incidents

Description

Hazardous materials can be found in many forms and quantities that can potentially cause death; serious injury; long-lasting health effects; and damage to buildings, homes, and other property in varying degrees. Such materials are routinely used and stored in many homes and businesses and are also shipped daily on the nation's highways, railroads, waterways, and pipelines. This subsection on the hazardous material hazard is intended to provide a general overview of the hazard, and the threshold for identifying fixed and mobile sources of hazardous materials is limited to general information on rail, highway, and local- and FEMA-identified fixed hazardous materials sites determined to be of greatest significance as appropriate for the purposes of this plan.

Hazardous materials (HAZMAT) incidents can apply to fixed facilities as well as mobile, transportation-related accidents in the air, by rail, on the nation's highways, and on the water. The Bureau of Transportation Statistics has reported the total HAZMAT incidents related to transportation systems each year from 1975 to 2022.[111] An average of approximately 16,000 HAZMAT incidents occurred each year. There was an average of 1,092 air related, 14,098 highway related, 815 rail related, 29 water related, and 10 other HAZMAT incidents.

In essence, HAZMAT incidents consist of solid, liquid, and/or gaseous contaminants that are released from fixed or mobile containers, whether by accident or by design as with an intentional terrorist attack. A HAZMAT incident can last hours to days, while some chemicals can be corrosive or otherwise damaging over longer periods of time. In addition to the primary release, explosions and/or fires can result from a release, and contaminants can be extended beyond the initial area by persons, vehicles, water, wind, and possibly wildlife as well.

HAZMAT incidents can also occur as a result of or in tandem with natural hazard events, such as floods, tornadoes, and earthquakes. In the case of Hurricane Floyd in September 1999, communities along the Eastern United States were faced with flooded junkyards, disturbed cemeteries, deceased livestock, floating propane tanks, uncontrolled fertilizer spills, and a variety of other environmental pollutants that caused widespread toxicological concern.

Hazardous material incidents can include the spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping, or disposing into the environment of a hazardous material, but exclude: (1) any release which results in exposure to poisons solely within the workplace with respect to claims which such persons may assert against the employer of such persons; (2) emissions from the engine exhaust of a motor vehicle, rolling stock, aircraft, vessel or pipeline pumping station engine; (3) release of

[111] Bureau of Transportation Statistics. (2023). *Hazardous Materials Fatalities, Injuries, Accidents, and Property Damage Data*. USDOT. Retrieved from [Hazardous Materials Fatalities, Injuries, Accidents, and Property Damage Data | Bureau of Transportation Statistics (bts.gov)] on October 2, 2023.

source, byproduct, or special nuclear material from a nuclear incident; and (4) the normal application of fertilizer.

Location

As a result of the 1986 Emergency Planning and Community Right to Know Act (EPCRA), the Environmental Protection Agency provides public information on hazardous materials. One facet of this program is to collect information from industrial facilities on the release and transfer of certain toxic agents. This information is then reported in the Toxic Release Inventory (TRI). TRI sites indicate where such activity is occurring. There are 27 TRI sites located in Washtenaw County, two of which are located adjacent to EMU's campus (Marsh Plating Corp. and Electronics for Imaging Inc.).[112] TRI sites in Washtenaw County are shown in **Figure 4-56**.

[112] EPA. (n.d.) *TRI Toxics Tracker.* Retrieved on April 26, 2023 from TRI Toxics Tracker (epa.gov).

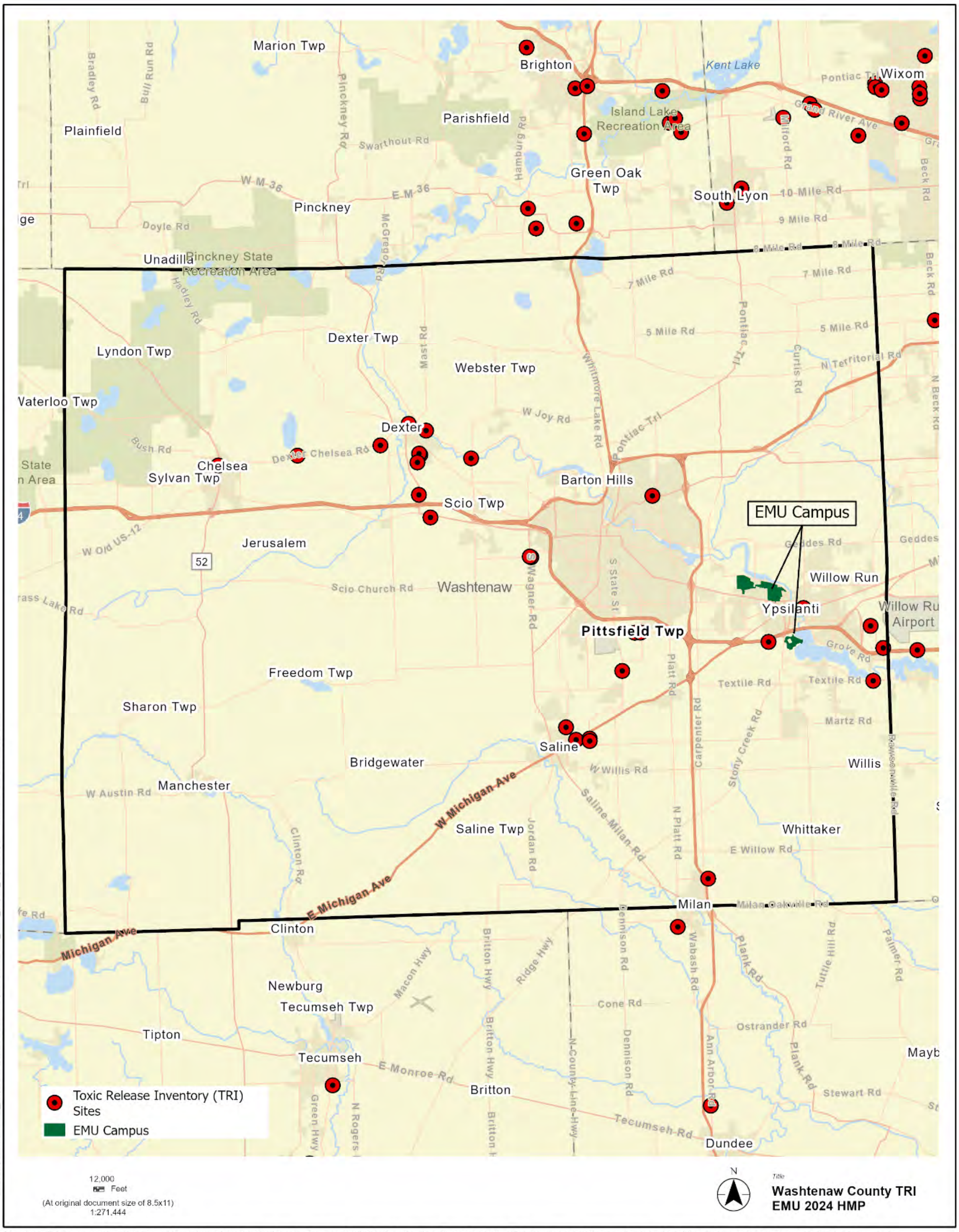

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Figure 4-56: Washtenaw County TRI Sites

Buildings on the EMU campus were identified as containing hazardous materials. The buildings were rated for hazardous materials on a scale of high, medium, and low. The ratings were provided by EMU Steering Committee and are shown in **Figure 4-57.**

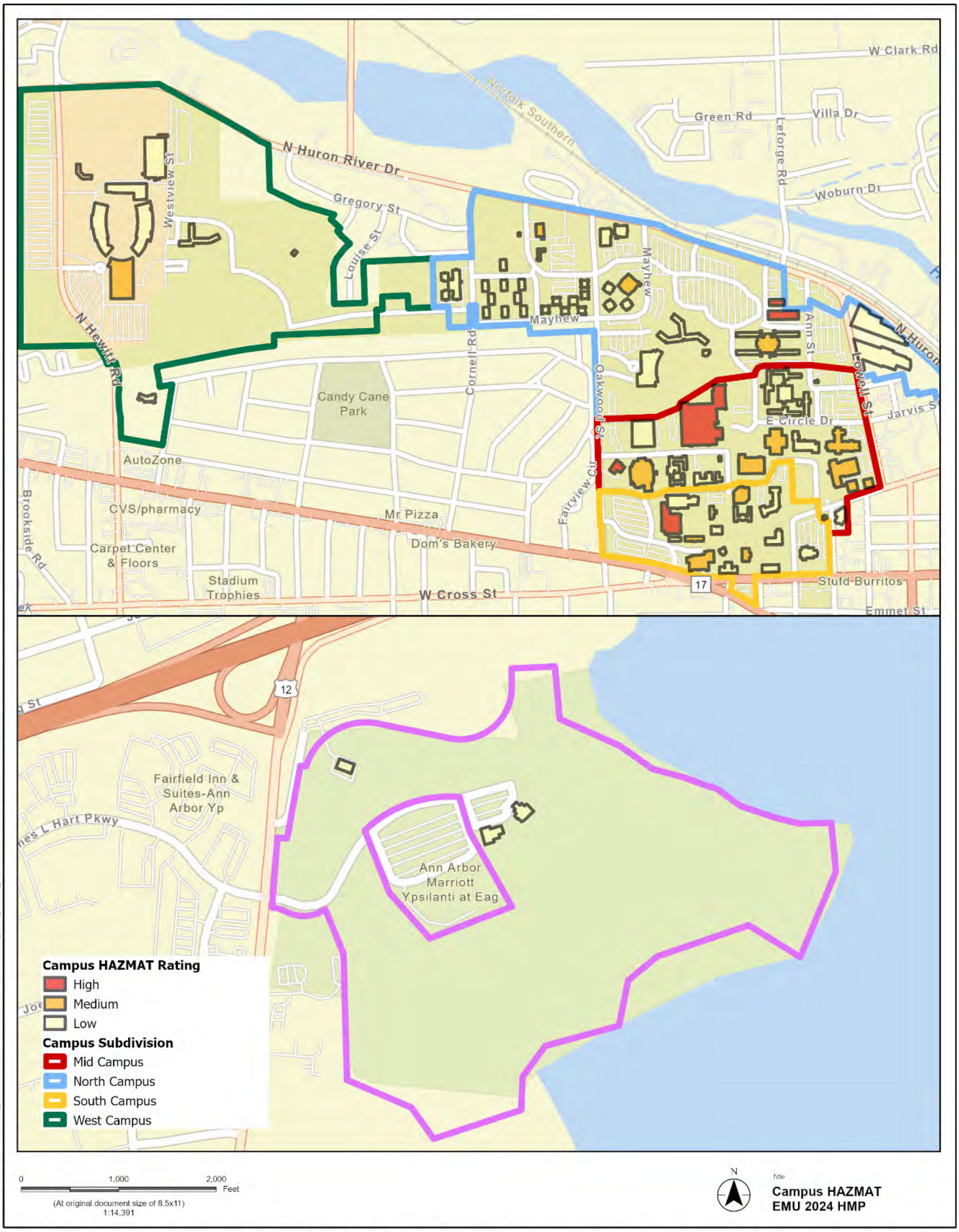

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Figure 4-57: EMU Campus HAZMAT Present

In addition to fixed sites, corridors along major roads, highways, and railroads within or adjacent to campus are at an elevated risk for HAZMAT incidents due to the transport of hazardous materials. These areas are analyzed further in this hazard's *Vulnerability Assessment*.

Previous Occurrences

The EPA provides facility reports for TRI sites. There are two TRI sites located adjacent to EMU's campus (Marsh Plating Corp. and Electronics for Imaging Inc.).[113] The releases by the TRI Sites are presented by year in **Table 4-34** and **Table 4-35**. Damages, deaths, and injuries are not reported in EPA facility reports. The University has not reported any impacts from offsite TRI releases.

Table 4-34: EPA-Reported Chemical Releases Electronics for Imaging Inc.

Year	Sum of Releases (lb)
2012	731
2013	55
2014	99
2015	7,959
2016	781
2017	1,095
2018	1
2019	1
2020	1
2021	1
Total	**10,724**

Table 4-35: EPA-Reported Chemical Releases Marsh Plating Corp.

Year	Sum of Releases (lb)
2012	27,473
2013	18,128
2014	14,992
2015	17,418
2016	21,700
2017	19,242
2018	24,956
2019	18,487
2020	12,590
2021	15,453
Total	**190,429**

[113] EPA. (n.d.) *TRI Toxics Tracker.* Retrieved on April 26, 2023 from TRI Toxics Tracker (epa.gov).

The U.S. Department of Transportation Pipeline and Hazardous Materials Safety Administration (PHMSA) lists historical transportation HAZMAT occurrences throughout the nation. A "serious incident" is a hazardous materials incident that involves:

- a fatality or major injury caused by the release of a hazardous material,
- the evacuation of 25 or more persons as a result of release of a hazardous material or exposure to fire,
- a release or exposure to fire which results in the closure of a major transportation artery,
- the alteration of an aircraft flight plan or operation,
- the release of radioactive materials from Type B packaging,
- the release of over 11.9 gallons or 88.2 pounds of a severe marine pollutant, or
- the release of a bulk quantity (over 199 gallons or 882 pounds) of a hazardous material.

However, prior to 2002, a hazardous materials "serious incident" was defined as follows:

- a fatality or major injury due to a hazardous material,
- closure of a major transportation artery or facility or evacuation of six or more persons due to the presence of hazardous material, or
- a vehicle accident or derailment resulting in the release of a hazardous material.

Since 1975, 277 incidents have been reported in Ypsilanti.[114] Of the 277 incidents, 5 have been reported as serious incidents. The releases are summarized by mode of transportation in **Table 4-36**. The 5 serious incidents are summarized in **Table 4-37.**

Table 4-36: PHMSA Reported Releases by Transportation Mode

Mode of Transportation	Number of Incidents
Air	48
Highway	229
Total	**277**

Table 4-37: Serious PHMSA Reported Incidents in Ypsilanti

Date Of Incident	Quantity Released (LGA)	Commodity Long Name	Injuries/ Deaths	Damages (2023 dollars)	Mode Of Transportation
7/3/1976	8,120	GASOLINE INCLUDES GASOLINE MIXED WITH ETHYL ALCOHOL, WITH NOT	0/0	$0	Highway

[114] U.S Department of Transportation. (2023). *PHMSA Portal*. Retrieved on September 25, 2023 from Oracle BI Interactive Dashboards - Hazmat Incident Report Search (dot.gov)

Date Of Incident	Quantity Released (LGA)	Commodity Long Name	Injuries/ Deaths	Damages (2023 dollars)	Mode Of Transportation
		MORE THAN 10% ALCOHOL			
2/8/1977	475	PETROLEUM OIL	0/0	$0	Highway
12/13/2011	160	CORROSIVE LIQUID, BASIC, INORGANIC, N.O.S.	0/0	$7,129	Highway
12/23/2019	280	CORROSIVE LIQUID, ACIDIC, INORGANIC, N.O.S.	0/0	$8,441	Highway
3/29/2022	150	FLUOROSILICIC ACID	0/0	$6,180	Highway

In addition to the incidents listed above, the City of Ann Arbor which neighbors Ypsilanti has a slow-moving dioxane plume that continues to threaten Ann Arbor's water supply despite the original use being inactive. There are concerns that the plume will eventually pollute the city's main drinking water source, the Huron River, which is regularly tested for dioxane. This is discussed in the *Water Contamination* profile.

Extent

The extent of hazardous materials incidents can be defined in terms of amount of material released. According to the EPA, the largest fixed-site chemical release at a TRI site proximate to campus was 24,956 pounds of Zinc compounds in 2018. Further, according to USDOT PHMSA, the largest mobile hazardous materials incident reported in the planning area was 8,120 liquid gallons released on the roadway in 1976. It should be noted that larger events are possible.

Probability

Probability of HAZMAT incidents is difficult to determine without a report of incidents that have specifically impacted the campus, but probability can be gleaned from occurrences reported for the area. With 277 events recorded in over 47 years, Ypsilanti has experienced approximately 6 PHSMA-reported HAZMAT incidents per year. HAZMAT risk is also elevated by the presence of two TRI sites adjacent to campus. Further, the presence of hazardous materials in buildings on campus contributes to an elevated probability. However, most events are generally cleaned up and remediated quickly. Therefore, a probability of likely (50+ to 90 percent annual chance) was assigned to this hazard. However, a catastrophic event is less likely. University officials are mindful of this possibility and take precautions to prevent such an event from occurring. On campus, the Department of Public Safety manages Environmental Health and Safety (EHS) for the University. The primary objective of EHS is to assist the campus community in complying with safety, health, and environmental regulations. EHS has established a variety of safety programs related to

HAZMAT including Hazard Communication, Security of Hazardous Materials in Transport, and various lab safety programs.[115]

Vulnerability Assessment

Although historical evidence, existing Toxic Release Inventory sites, and existing hazardous waste sites indicate that the University is susceptible to hazardous materials events, there are few reports of damage.

Most hazardous materials incidents that occur are contained and suppressed before damaging any property or threatening lives. However, they can have a significant negative impact. Such events can cause deaths, completely shut down facilities for 30 days or more, and cause more than 50 percent of affected properties to be destroyed or suffer major damage. During a hazardous materials incident, solid, liquid, and/or gaseous contaminants may be released from fixed or mobile containers. Weather conditions will directly affect how the hazard develops. Certain chemicals may travel through the air or water, affecting a much larger area than the point of the incident itself. Non-compliance with fire and building codes, as well as failure to maintain existing fire and containment features, can substantially increase the damage from a hazardous materials release. The duration of a hazardous materials incident can range from hours to days. Warning time is minimal to none.

In order to conduct the vulnerability assessment for this hazard, GIS analysis was used for fixed and mobile areas. In both scenarios, two sizes of buffers—500 and 2,500 meters—were used. These areas are assumed to respect the different levels of effect: immediate (primary) and secondary. Primary and secondary impact sites were selected based on guidance from FEMA 426, Reference Manual to Mitigate Potential Terrorist Attacks Against Buildings and engineering judgment. For the fixed-site analysis, geo-referenced TRI sites along with buffers, were used for analysis. EMU's campus buildings are shown in relation to the primary and secondary TRI impact areas in **Figure 4-58**.

[115] Environmental Health & Safety. (n.d.) *Programs We Provide.* Department of Public Safety. Retrieved on October 3, 2023 from Eastern Michigan University: Environmental Health & Safety (emich.edu).

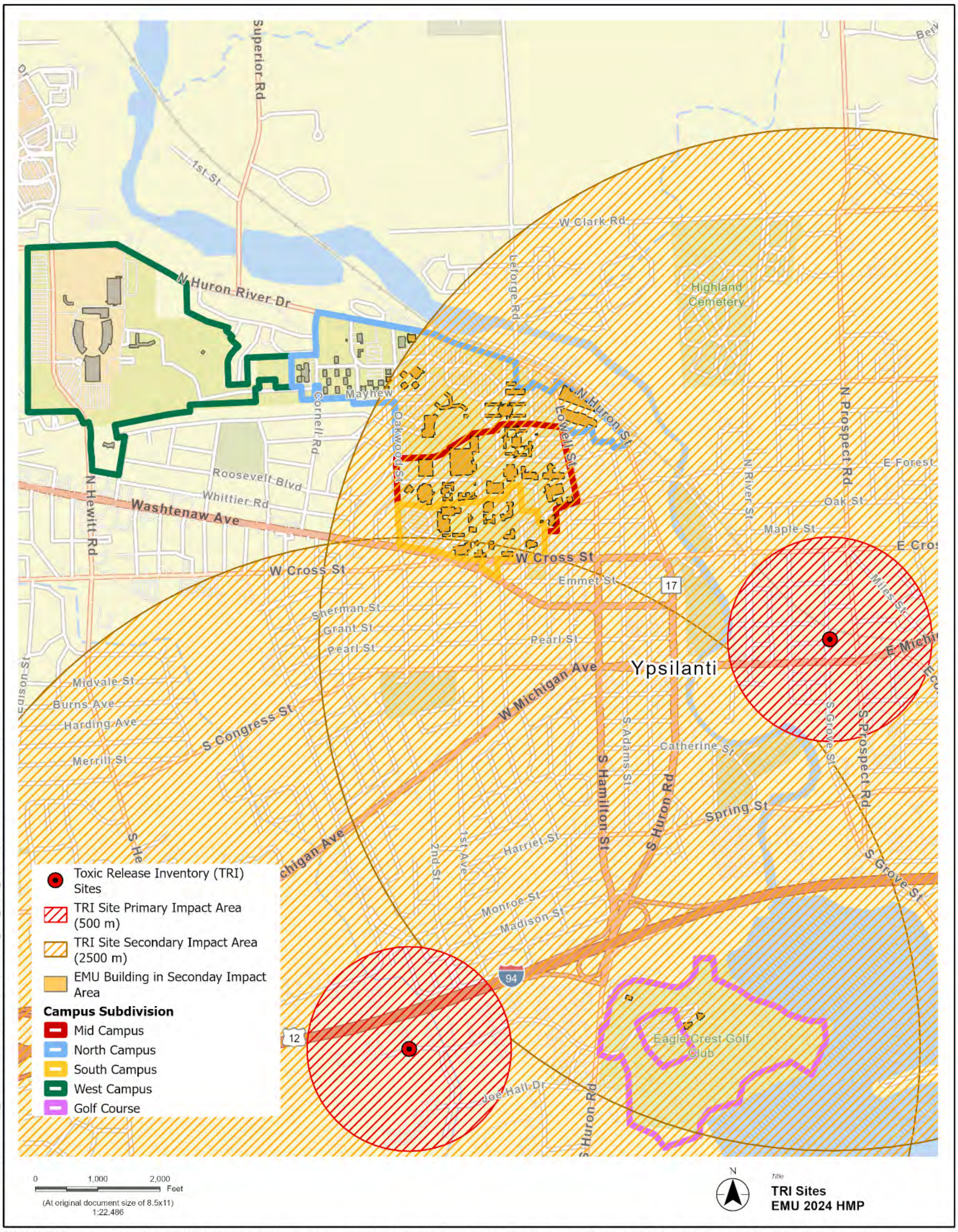

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Figure 4-58: TRI Fixed Site Impact Area on EMU's Campus

There are no buildings within fixed-site primary impact areas of the two TRI sites in proximity of EMU's Campus. A majority of campus buildings are located in the secondary impact areas. Fifty-nine of 86 buildings on EMU's campus are in the secondary impact areas. Of the 59 buildings located in the secondary impact areas, 29 of the buildings are critical facilities.

The critical facilities in the secondary impact areas are presented in **Table 4-38**. Additionally, several of the buildings in the secondary impact areas have a high hazardous material rating by the University due to the presence of hazardous materials in the buildings. These buildings are presented in **Table 4-39**.

Table 4-38: Critical Facilities in Secondary TRI Buffer

Building Name	Subdivision	Category	HazMat	Historical Marker	Critical IT	Statement of Value
Best Residence Hall	Mid Campus	Residence/Apartments	Low	Not Specified	No	$11,911,051
Buell Residence Hall	Mid Campus	Residence/Apartments	Low	Not Specified	No	$11,957,807
Coatings Research Institute	Mid Campus	Non-Residential	Medium	Not Specified	No	$15,462,664
Crossroads Marketplace/DPS	North Campus	Non-Residential	Medium	Not Specified	Yes	$11,956,582
Downing Residence Hall	Mid Campus	Residence/Apartments	Low	Not Specified	No	$20,198,474
Eastern Eateries	North Campus	Residence/Apartments	Medium	Not Specified	Yes	$12,433,141
Energy Center	Mid Campus	Non-Residential	High	Not Specified	No	$54,830,030
Hill Residence Hall	North Campus	Residence/Apartments	Low	Not Specified	No	$15,824,970
Hoyt Tower	North Campus	Residence/Apartments	Low	Not Specified	No	$15,824,970
Lakeview Residence Hall	North Campus	-	Low	Not Specified	No	-
Mark Jefferson Science Building	South Campus	Classrooms	High	Not Specified	No	$104,589,835
Marshall Building	South Campus	Classrooms	Medium	Not Specified	Yes	$17,274,121
Munson-Brown Hall	Mid Campus	Residence/Apartments	Low	Not Specified	No	$27,730,869
Phelps Residence Hall	North Campus	Residence/Apartments	Low	Not Specified	No	$12,433,141
Physical Plant	North Campus	Non-Residential	High	Not Specified	No	$4,094,243
Physical Plant Garage Building	North Campus	Non-Residential	High	Not Specified	No	$2,228,269
Pierce Hall	South Campus	Non-Residential	Low	Historic	Yes	$10,829,106
Pittman Residence Hall	North Campus	Residence/Apartments	Low	Not Specified	No	$15,824,970
Pray-Harrold Classroom Building	Mid Campus	Classrooms	Medium	Not Specified	Yes	$54,768,841

Building Name	Subdivision	Category	HazMat	Historical Marker	Critical IT	Statement of Value
Putnam Residence Hall	North Campus	Residence/Apartments	Low	Not Specified	No	$12,433,141
Sellers Residence Hall	North Campus	Residence/Apartments	Low	Not Specified	No	$12,433,141
Sill Hall	Mid Campus	Classrooms	Medium	Not Specified	No	$58,183,062
Student Center	North Campus	Meetings/Special Events	Low	Not Specified	No	$49,296,888
The Commons	Mid Campus	Non-Residential	Low	Not Specified	Yes	$8,781,556
Tri Sig House	Mid Campus	Residence/Apartments	Low	Historical Register	No	$258,163
Village Residence Hall B	North Campus	Residence/Apartments	Low	Not Specified	No	$4,576,539
Village Residence Hall C	North Campus	Residence/Apartments	Low	Not Specified	No	$4,576,539
Walton Residence Hall	North Campus	Residence/Apartments	Low	Not Specified	No	$12,433,141
Wise Residence Hall	Mid Campus	Residence/Apartments	Low	Not Specified	No	$18,367,751

Table 4-39: High HAZMAT Presence Buildings in Secondary TRI Buffer

Building Name	Subdivision	Category	HazMat	Historical Marker	Critical Facility	Critical IT	Statement of Value
Energy Center	Mid Campus	Non-Residential	High	Not Specified	Yes	No	$54,830,030
Mark Jefferson Science Building	South Campus	Classrooms	High	Not Specified	Yes	No	$104,589,835
Physical Plant	North Campus	Non-Residential	High	Not Specified	Yes	No	$4,094,243
Physical Plant Garage Building	North Campus	Non-Residential	High	Not Specified	Yes	No	$2,228,269

Building Name	Subdivision	Category	HazMat	Historical Marker	Critical Facility	Critical IT	Statement of Value
Warner Gym, Bowen Fieldhouse, Rec-IM, and Jones Pool Complex	Mid Campus	-	High	Not Specified	No	No	$88,797,785

For the mobile (transportation) analysis, major roads (interstate highways, U.S. highways, and state highways) and railroads, where hazardous materials are primarily transported that could adversely impact people and buildings, were used for the GIS buffer analysis. The same size primary and secondary impact buffers—500 and 2,500 meters—were used, based on guidance from FEMA 426, Reference Manual to Mitigate Potential Terrorist Attacks Against Buildings and engineering judgment. For the mobile assessment, Interstate 94, Washtenaw Avenue, Hamilton Street, Huron Road, and the Norfolk Southern railroad, along with buffers, were used for analysis. **Figure 4-59** shows EMU's buildings in relation to the primary and secondary impact buffers from major roadways.

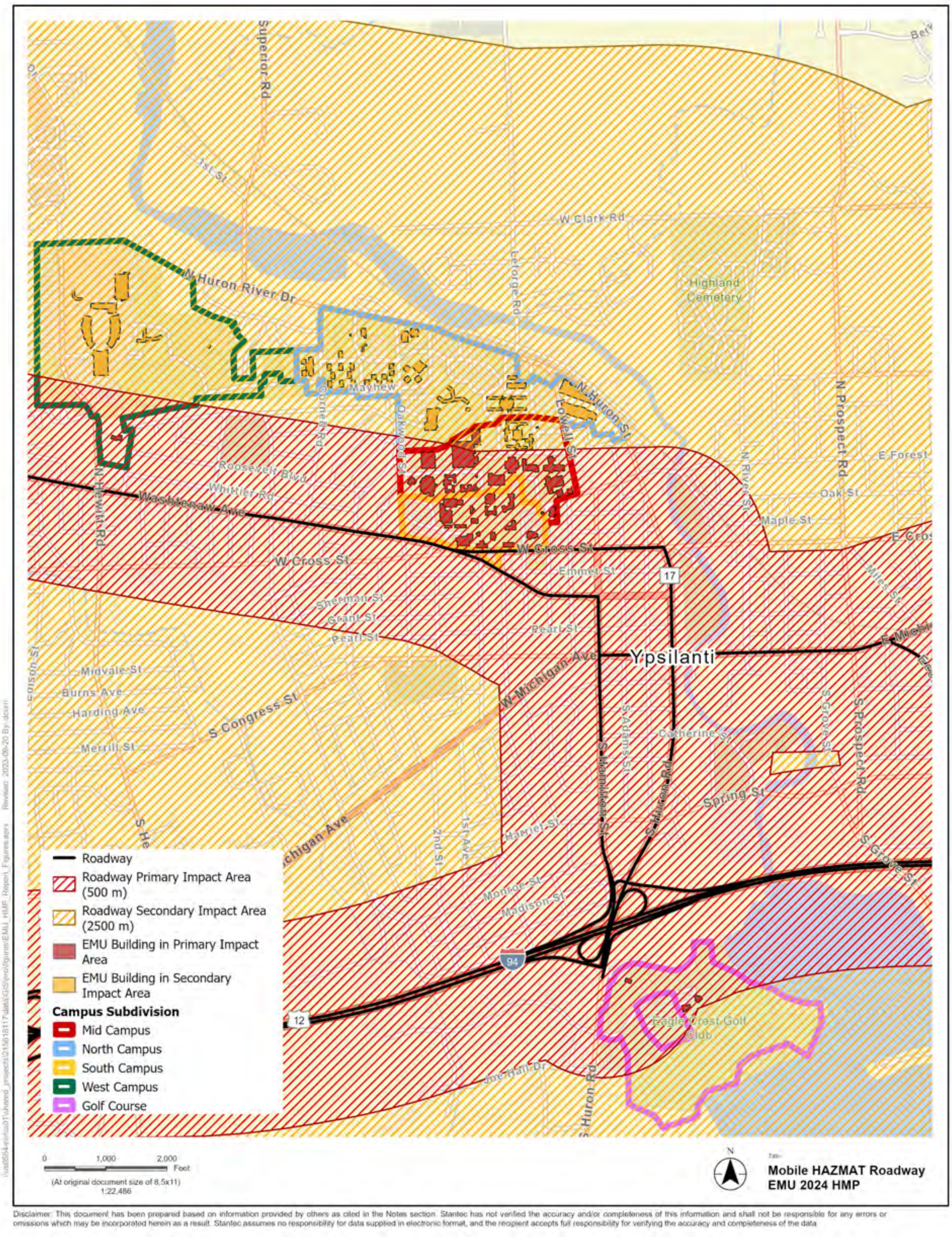

Figure 4-59: Mobile Hazmat Exposure - Roadways

Overall, all EMU buildings fall into the primary or secondary impact buffer for mobile HAZMAT exposure. Thirty-five buildings are in the primary impact buffer. Critical facilities in the primary impact buffer are shown in **Table 4-40.** Additionally, several of the buildings in the primary impact area have a high hazardous material rating by the University due to the presence of hazardous materials in the buildings. These buildings are presented in **Table 4-41**.

Table 4-40: EMU Critical Facilities in Primary HAZMAT buffer – Roadways

Building Name	Subdivision	Category	HazMat	Historical Marker	Critical IT	Statement of Value
Coatings Research Institute	Mid Campus	Non-Residential	Medium	Not Specified	No	$15,462,664
Energy Center	Mid Campus	Non-Residential	High	Not Specified	No	$54,830,030
Mark Jefferson Science Building	South Campus	Classrooms	High	Not Specified	No	$104,589,835
Marshall Building	South Campus	Classrooms	Medium	Not Specified	Yes	$17,274,121
Munson-Brown Hall	Mid Campus	Residence/Apartments	Low	Not Specified	No	$27,730,869
Pierce Hall	South Campus	Non-Residential	Low	Historic	Yes	$10,829,106
Pray-Harrold Classroom Building	Mid Campus	Classrooms	Medium	Not Specified	Yes	$54,768,841
Sill Hall	Mid Campus	Classrooms	Medium	Not Specified	No	$58,183,062
Tri Sig House	Mid Campus	Residence/Apartments	Low	Historical Register	No	$258,163

Table 4-41: High HAZMAT Presence Buildings in Primary HAZMAT Buffer – Roadways

Building Name	Subdivision	Category	HazMat	Historical Marker	Critical Facility	Critical IT	Statement of Value
Energy Center	Mid Campus	Non-Residential	High	Not Specified	Yes	No	$54,830,030
Mark Jefferson Science Building	South Campus	Classrooms	High	Not Specified	Yes	No	$104,589,835
Warner Gym, Bowen Fieldhouse, Rec-IM, and Jones Pool Complex	Mid Campus	-	High	Not Specified	No	No	$88,797,785

51 buildings are in the secondary impact buffer. Critical buildings in the secondary impact buffer are shown in **Table 4-42.** Additionally, several of the buildings in the secondary impact area have a high hazardous material rating by the University due to the presence of hazardous materials in the buildings. These buildings are presented in **Table 4-43.**

Table 4-42: EMU Critical Facilities in Secondary HAZMAT buffer – Roadways

Building Name	Subdivision	Category	HazMat	Historical Marker	Critical IT	Statement of Value
Best Residence Hall	Mid Campus	Residence/Apartments	Low	Not Specified	No	$11,911,051
Buell Residence Hall	Mid Campus	Residence/Apartments	Low	Not Specified	No	$11,957,807
Cornell Courts Apartments A	North Campus	Residence/Apartments	Low	Not Specified	No	$2,599,155
Cornell Courts Apartments B	North Campus	Residence/Apartments	Low	Not Specified	No	$2,599,155
Cornell Courts Apartments C	North Campus	Residence/Apartments	Low	Not Specified	No	$2,599,155
Cornell Courts Apartments D	North Campus	Residence/Apartments	Low	Not Specified	No	$2,599,155
Cornell Courts Apartments E	North Campus	Residence/Apartments	Low	Not Specified	No	$2,599,155
Cornell Courts Apartments F	North Campus	Residence/Apartments	Low	Not Specified	No	$2,599,155
Cornell Courts Apartments G	North Campus	Residence/Apartments	Low	Not Specified	No	$2,807,921
Cornell Courts Apartments H	North Campus	Residence/Apartments	Low	Not Specified	No	$2,807,921
Cornell Courts Apartments K	North Campus	Residence/Apartments	Low	Not Specified	No	$2,807,921
Crossroads Marketplace/DPS	North Campus	Non-Residential	Medium	Not Specified	Yes	$11,956,582
Downing Residence Hall	Mid Campus	Residence/Apartments	Low	Not Specified	No	$20,198,474
Eastern Eateries	North Campus	Residence/Apartments	Medium	Not Specified	Yes	$12,433,141
George Gervin GameAbove Center	West Campus	Meetings/Special Events	Medium	Not Specified	No	$43,865,403
Hill Residence Hall	North Campus	Residence/Apartments	Low	Not Specified	No	$15,824,970
Hoyt Tower	North Campus	Residence/Apartments	Low	Not Specified	No	$15,824,970
Lakeview Residence Hall	North Campus	-	Low	Not Specified	No	-
Phelps Residence Hall	North Campus	Residence/Apartments	Low	Not Specified	No	$12,433,141
Physical Plant	North Campus	Non-Residential	High	Not Specified	No	$4,094,243
Physical Plant Garage Building	North Campus	Non-Residential	High	Not Specified	No	$2,228,269

Building Name	Subdivision	Category	HazMat	Historical Marker	Critical IT	Statement of Value
Pittman Residence Hall	North Campus	Residence/Apartments	Low	Not Specified	No	$15,824,970
Putnam Residence Hall	North Campus	Residence/Apartments	Low	Not Specified	No	$12,433,141
Rynearson Football Stadium	West Campus	Sports/Fitness	Low	Not Specified	No	$9,950,061
Sellers Residence Hall	North Campus	Residence/Apartments	Low	Not Specified	No	$12,433,141
Student Center	North Campus	Meetings/Special Events	Low	Not Specified	No	$49,296,888
The Commons	Mid Campus	Non-Residential	Low	Not Specified	Yes	$8,781,556
Village Residence Hall A	North Campus	Residence/Apartments	Low	Not Specified	No	$4,576,539
Village Residence Hall B	North Campus	Residence/Apartments	Low	Not Specified	No	$4,576,539
Village Residence Hall C	North Campus	Residence/Apartments	Low	Not Specified	No	$4,576,539
Village Residence Hall Commons	North Campus	Residence/Apartments	Low	Not Specified	No	$4,576,539
Village Residence Hall D	North Campus	Residence/Apartments	Low	Not Specified	No	$4,576,539
Village Residence Hall E	North Campus	Residence/Apartments	Low	Not Specified	No	$4,576,539
Village Residence Hall F	North Campus	Residence/Apartments	Low	Not Specified	No	$4,576,539
Walton Residence Hall	North Campus	Residence/Apartments	Low	Not Specified	No	$12,433,141
Wellness Center	North Campus	-	Low	Not Specified	No	$9,406,653
Westview Residence Hall	West Campus	-	Low	Not Specified	No	-
Wise Residence Hall	Mid Campus	Residence/Apartments	Low	Not Specified	No	$18,367,751

Table 4-43: High HAZMAT Presence Buildings in Secondary HAZMAT Buffer - Roadways

Building Name	Subdivision	Category	HazMat	Historical Marker	Critical Facility	Critical IT	Statement of Value
Physical Plant	North Campus	Non-Residential	High	Not Specified	Yes	No	$4,094,243
Physical Plant Garage Building	North Campus	Non-Residential	High	Not Specified	Yes	No	$2,228,269

Figure 4-60 shows EMU's buildings in relation to the primary and secondary impact buffers from major railroads.

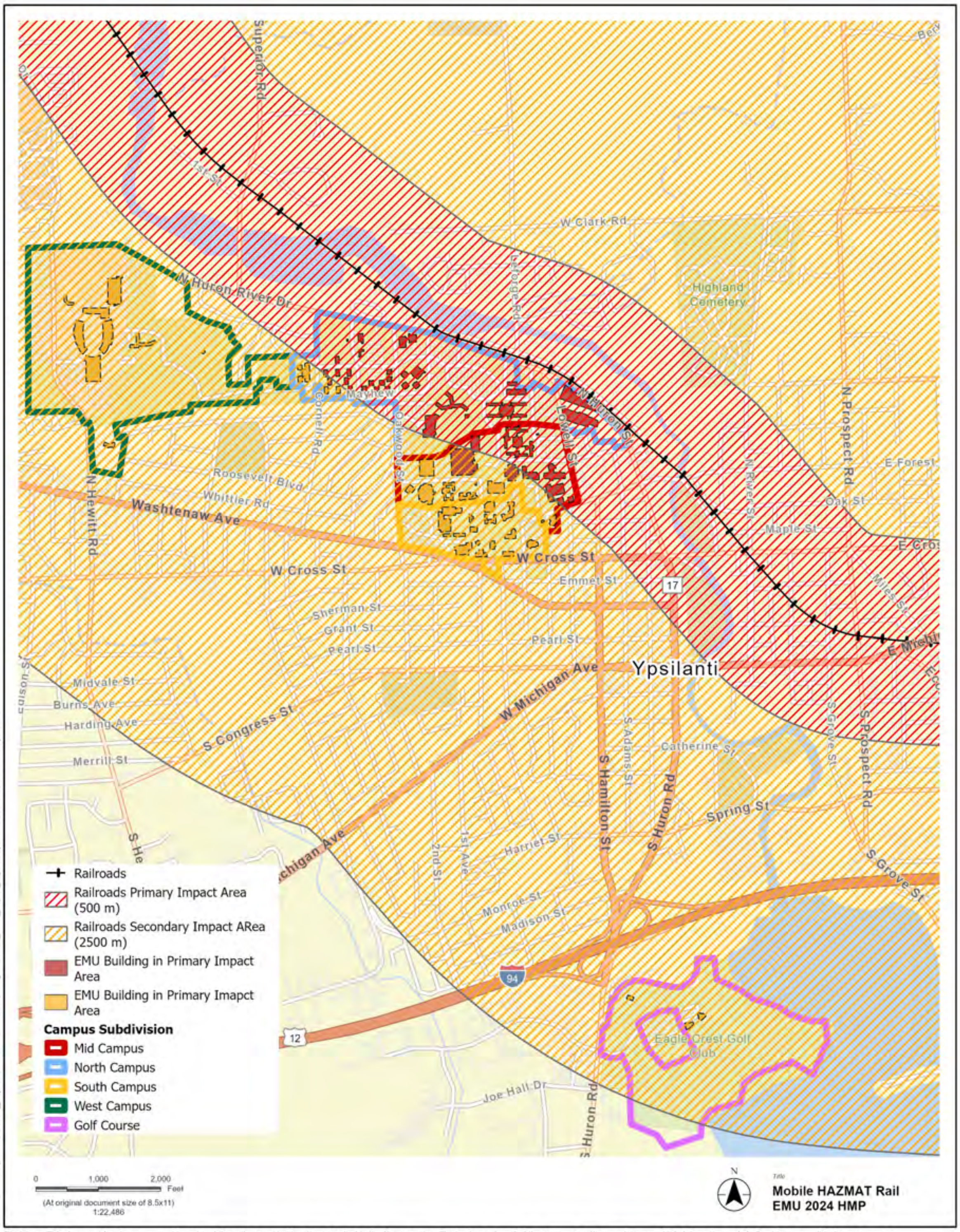

Figure 4-60: Mobile HAZMAT Exposure – Rail

Overall, all EMU buildings fall into the primary or secondary impact buffer from railroads. Forty-seven buildings are in the primary impact buffer. Critical buildings in the primary impact buffer are shown in **Table 4-44.** Additionally, several of the buildings in the primary impact area have a high hazardous material rating by the University due to the presence of hazardous materials in the buildings. These buildings are presented in **Table 4-45**.

Table 4-44: EMU Critical Facilities in Primary HAZMAT buffer – Railroads

Building Name	Subdivision	Category	HazMat	Historical Marker	Critical IT	Statement of Value
Best Residence Hall	Mid Campus	Residence/Apartments	Low	Not Specified	No	$11,911,051
Buell Residence Hall	Mid Campus	Residence/Apartments	Low	Not Specified	No	$11,957,807
Coatings Research Institute	Mid Campus	Non-Residential	Medium	Not Specified	No	$15,462,664
Cornell Courts Apartments C	North Campus	Residence/Apartments	Low	Not Specified	No	$2,599,155
Cornell Courts Apartments D	North Campus	Residence/Apartments	Low	Not Specified	No	$2,599,155
Cornell Courts Apartments E	North Campus	Residence/Apartments	Low	Not Specified	No	$2,599,155
Cornell Courts Apartments F	North Campus	Residence/Apartments	Low	Not Specified	No	$2,599,155
Cornell Courts Apartments G	North Campus	Residence/Apartments	Low	Not Specified	No	$2,807,921
Cornell Courts Apartments H	North Campus	Residence/Apartments	Low	Not Specified	No	$2,807,921
Cornell Courts Apartments K	North Campus	Residence/Apartments	Low	Not Specified	No	$2,807,921
Crossroads Marketplace/DPS	North Campus	Non-Residential	Medium	Not Specified	Yes	$11,956,582
Downing Residence Hall	Mid Campus	Residence/Apartments	Low	Not Specified	No	$20,198,474
Eastern Eateries	North Campus	Residence/Apartments	Medium	Not Specified	Yes	$12,433,141
Hill Residence Hall	North Campus	Residence/Apartments	Low	Not Specified	No	$15,824,970
Hoyt Tower	North Campus	Residence/Apartments	Low	Not Specified	No	$15,824,970
Lakeview Residence Hall	North Campus	-	Low	Not Specified	No	-
Phelps Residence Hall	North Campus	Residence/Apartments	Low	Not Specified	No	$12,433,141
Physical Plant	North Campus	Non-Residential	High	Not Specified	No	$4,094,243
Physical Plant Garage Building	North Campus	Non-Residential	High	Not Specified	No	$2,228,269
Pittman Residence Hall	North Campus	Residence/Apartments	Low	Not Specified	No	$15,824,970

Building Name	Subdivision	Category	HazMat	Historical Marker	Critical IT	Statement of Value
Pray-Harrold Classroom Building	Mid Campus	Classrooms	Medium	Not Specified	Yes	$54,768,841
Putnam Residence Hall	North Campus	Residence/Apartments	Low	Not Specified	No	$12,433,141
Sellers Residence Hall	North Campus	Residence/Apartments	Low	Not Specified	No	$12,433,141
Sill Hall	Mid Campus	Classrooms	Medium	Not Specified	No	$58,183,062
Student Center	North Campus	Meetings/Special Events	Low	Not Specified	No	$49,296,888
The Commons	Mid Campus	Non-Residential	Low	Not Specified	Yes	$8,781,556
Village Residence Hall A	North Campus	Residence/Apartments	Low	Not Specified	No	$4,576,539
Village Residence Hall B	North Campus	Residence/Apartments	Low	Not Specified	No	$4,576,539
Village Residence Hall C	North Campus	Residence/Apartments	Low	Not Specified	No	$4,576,539
Village Residence Hall Commons	North Campus	Residence/Apartments	Low	Not Specified	No	$4,576,539
Village Residence Hall D	North Campus	Residence/Apartments	Low	Not Specified	No	$4,576,539
Village Residence Hall E	North Campus	Residence/Apartments	Low	Not Specified	No	$4,576,539
Village Residence Hall F	North Campus	Residence/Apartments	Low	Not Specified	No	$4,576,539
Walton Residence Hall	North Campus	Residence/Apartments	Low	Not Specified	No	$12,433,141
Wellness Center	North Campus	-	Low	Not Specified	No	$9,406,653
Wise Residence Hall	Mid Campus	Residence/Apartments	Low	Not Specified	No	$18,367,751

Table 4-45: High HAZMAT Presence Buildings in Primary HAZMAT Buffer - Railroad

Building Name	Subdivision	Category	HazMat	Historical Marker	Critical Facility	Critical IT	Statement of Value
Physical Plant	North Campus	Non-Residential	High	Not Specified	Yes	No	$4,094,243
Physical Plant Garage Building	North Campus	Non-Residential	High	Not Specified	Yes	No	$2,228,269
Warner Gym, Bowen Fieldhouse, Rec-IM, and Jones Pool Complex	Mid Campus	-	High	Not Specified	No	No	$88,797,785

Thirty-nine buildings are in the secondary impact buffer. Critical buildings in the secondary impact buffer are shown in **Table 4-46.** Additionally, several of the buildings in the secondary impact area have a high hazardous material rating by the University due to the presence of hazardous materials in the buildings. These buildings are presented in **Table 4-47.**

Table 4-46: EMU Critical Facilities in Secondary HAZMAT buffer – Railroads

Building Name	Subdivison	Category	Hazardous Materials	Historical Marker	Critical IT	Statement of Value
Pierce Hall	South Campus	Non-Residential	Low	Historic	Yes	$10,829,106
Tri Sig House	Mid Campus	Residence/Apartments	Low	Historical Register	No	$258,163
Mark Jefferson Science Building	South Campus	Classrooms	High	Not Specified	No	$104,589,835
Marshall Building	South Campus	Classrooms	Medium	Not Specified	Yes	$17,274,121
Energy Center	Mid Campus	Non-Residential	High	Not Specified	No	$54,830,030
Munson-Brown Hall	Mid Campus	Residence/Apartments	Low	Not Specified	No	$27,730,869
Cornell Courts Apartments A	North Campus	Residence/Apartments	Low	Not Specified	No	$2,599,155
Cornell Courts Apartments B	North Campus	Residence/Apartments	Low	Not Specified	No	$2,599,155
George Gervin GameAbove Center	West Campus	Meetings/Special Events	Medium	Not Specified	No	$43,865,403
Rynearson Football Stadium	West Campus	Sports/Fitness	Low	Not Specified	No	$9,950,061
Westview Residence Hall	West Campus	-	Low	Not Specified	No	-

Table 4-47: High HAZMAT Presence Buildings in Secondary HAZMAT Buffer - Railroad

Building Name	Subdivision	Category	Historical Marker	Critical Facility	Critical IT	Statement of Value
Energy Center	Mid Campus	Non-Residential	Not Specified	Yes	No	$54,830,030
Mark Jefferson Science Building	South Campus	Classrooms	Not Specified	Yes	No	$104,589,835

Although not presented by potential loss values, infrastructure such as roads, bridges, railroad lines, and utilities have the potential to be impacted by hazardous materials incidents, particularly in an incident involving a corrosive material. Often, this infrastructure is being used to transport hazardous materials, making them especially at-risk.

HAZMAT incidents can result in injuries or fatalities when employees, responders, and civilians come in contact with hazardous materials. In certain events, persons may not realize they have been exposed until symptoms are presented. HAZMAT incidents may result in the need for evacuations or sheltering in place.

In the event of a hazardous materials spill that occurs in the county requiring protective action, the Washtenaw County's outdoor warning system will activate.[116] The warning system consists of 22 sirens providing coverage for the entire campus as demonstrated in **Figure 4-39** under this profile's equivalent in the *Severe Winds* profile.

HAZMAT incidents are considered a campus-wide hazard due to the presence of TRI sites, the presence of hazardous materials within campus buildings, and the close proximity of highways and railways that transport hazardous materials.

Climate change is not expected to have direct impacts on hazardous materials incidents. However, HAZMAT incidents can be triggered by certain natural hazards, such as transportation accidents involving hazardous materials preempted by blinding downpours or severe winds. It is common for hazardous materials incidents (i.e., contamination) to occur as a secondary impact of flooding.

Therefore, the projected increase in extreme precipitation events in Ypsilanti may indicate a subsequent increase in HAZMAT incidents. Generally, if the frequency and intensity of natural hazards increases due to climate change, the frequency of HAZMAT incidents may increase as a result.

Nuclear Power Plant Incidents

Description

According to the Nuclear Regulatory Commission (NRC), accidents at nuclear power plants are considered a possibility, and appropriate on-site and off-site emergency planning is conducted. An accident could result in the release of potentially dangerous levels of radioactive materials into the environment and could affect the health and safety of the public living near the nuclear power plant. A nuclear power plant accident might involve both a release of airborne radioactive materials and radioactive contamination of the environment around the plant. The degree and area of environmental contamination could vary greatly, depending on the type and amount of release, and the weather conditions that are present. Response to a nuclear power plant accident requires specialized personnel who have been trained to handle radioactive materials safely, who have specialized equipment to detect and monitor radiation, and who are trained in personal radiation exposure control.

There have been several destructive nuclear power plant accidents in the past. Perhaps the most notable of these are the Three Mile Island accident, the Chernobyl accident, and the Fukushima accident. The Three Mile Island accident occurred in 1979 when a reactor at a plant near Middletown, PA, melted down and radiation was released. The incident resulted in the need to evacuate vulnerable populations within a five-mile radius of the site, as well as thousands of subsequent tests of the area's air, water, soil, vegetation, and other resources.[117] The 1986 accident at the Chernobyl plant in Ukraine was more severe and is

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[116] Sheriff's Office Washtenaw County. (n.d). *Washtenaw County Outdoor Warning System.* Retrieved on September 25, 2023 from [Washtenaw County Outdoor Warning Siren System | Washtenaw County, MI](#).

[117] Backgrounder on the Three Mile Island Accident. (2022). United States Nuclear Regulatory Commission. Retrieved September 7, 2023 from https://www.nrc.gov/reading-rm/doc-collections/fact-sheets/3mile-isle.html#effects.

the only commercial nuclear power-related incident in which radiation-related fatalities occurred. Twenty-eight people, mainly plant operators and firemen, died within a few weeks of the accident from acute radiation syndrome, and over 230 people were diagnosed with the illness. Additionally, over 330,000 people had to be relocated out of the contaminated area.[118] More recently, the 2011 Fukushima accident in Japan occurred after a tsunami disabled the power supply and cooling of three reactors, resulting in the release of radiation. Evacuations were performed within 20 kilometers (about 12.5 miles) of the site.[119]

After a period of decline following the Three Mile Island and Chernobyl accidents, there is a recent renewed interest in nuclear energy because it could partially address problems of dwindling oil reserves and global warming, with far fewer emissions of greenhouse gases than the use of fossil fuels. However, the use of nuclear power is controversial because of the problems of storing radioactive waste for indefinite periods, the potential for radioactive contamination by accident or sabotage, and the possibility that its use could in some countries lead to the proliferation of nuclear weapons.

The City of Ypsilanti is in the secondary (50-mile) Emergency Planning Zone (EPZ) for the Enrico Fermi II Nuclear Power Plant out of Monroe, MI **(Figure 4-61).** The Secondary EPZ (also called the ingestion exposure pathway) indicates the area where contamination has the potential to infiltrate the food chain.

- **Primary EPZ (Plume Exposure Pathway):** The plume exposure pathway EPZ has a radius of about 10 miles from the reactor site. Predetermined protective action plans are in place for this EPZ and are designed to avoid or reduce dose from potential exposure of radioactive materials. These actions include sheltering, evacuation, and the use of potassium iodide where appropriate.
- **Secondary EPZ (Ingestion Exposure Pathway):** The ingestion exposure pathway EPZ has a radius of about 50 miles from the reactor site. Predetermined protective action plans are in place for this EPZ and are designed to avoid or reduce dose from potential ingestion of radioactive materials. These actions include a ban of contaminated food and water.

[118] Chernobyl Accident 1986. (2022). World Nuclear Association. Retrieved September 7, 2023 from http://www.world-nuclear.org/information-library/safety-and-security/safety-of-plants/chernobyl-accident.aspx.
[119] Fukushima Accident. (2023). World Nuclear Association. Retrieved September 7, 2023 from http://www.world-nuclear.org/information-library/safety-and-security/safety-of-plants/fukushima-accident.aspx.

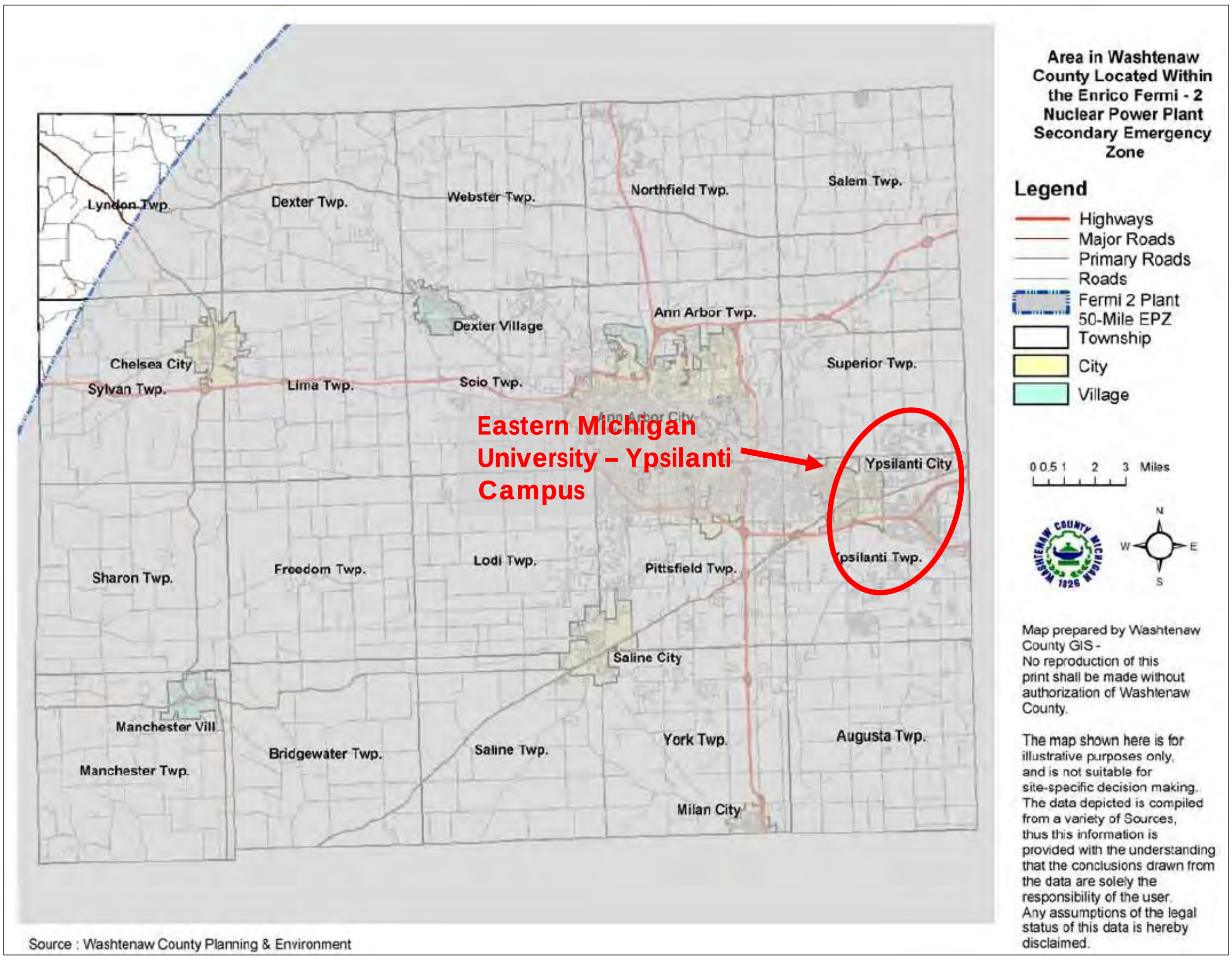

Figure 4-61: Enrico Fermi II Nuclear Power Plant Emergency Planning Zones

Source: 2022 Ann Arbor Hazard Mitigation Plan

Location

The closest nuclear power plant to the Eastern Michigan's Ypsilanti campus is the Enrico Fermi II plant near Monroe, MI. The plant is approximately 27 (linear) miles away from EMU's Ypsilanti campus. Due to its proximity to the plant, the entire campus is considered at-risk to a nuclear power plant incident. **Figure 4-61** shows the Enrico Fermi II plant 50-mile EPZ relative to the University's Ypsilanti campus.

Previous Occurrences

Eastern Michigan University does not have a known history of nuclear power plant incidents. The State of Michigan Hazard Mitigation Plan cites one historic incident that involved the Enrico Fermi II plant's predecessor, the Enrico Fermi I:

October 5, 1966 – Enrico Fermi-1, Monroe County, Michigan

Although Michigan has never experienced a significant nuclear power plant accident that involved an off-site release of radioactive material, on October 5, 1966, a serious incident did occur at Detroit Edison's then-new Enrico Fermi Atomic Power Plant near Monroe (commonly called Fermi-1). Fermi-1 was an experimental breeder reactor designed to *demonstrate the feasibility of liquid fast-metal breeder reactor technology. On October 5, a metal flow guide inside the reactor broke off and blocked the flow of sodium coolant in the space below the reactor core. As a result, approximately 1-percent of the fuel melted. The fuel damage caused the release of some radiation into the reactor containment building; however, no off-site release occurred. The plant was eventually repaired, and it operated for a short period until it was permanently shut down in 1972. The fuel and related materials were removed and sent to a federal government facility in the mid-1970s. The Enrico Fermi-2 nuclear power plant opened next door in 1988.*

Extent

The extent of a nuclear power plant incident could be measured in terms of property damage, injuries, or loss of life. Given the lack of historic incidents resulting in off-site releases, the extent of a nuclear power plant incident at EMU's Ypsilanti campus is difficult to determine. Considering that the campus is in the plant's secondary EPZ, it is likely that the extent of an event would be contamination of the food chain and other natural resources. This could result in the need to ship in food and/or water from outside sources.

Probability

Given the lack of historic nuclear power plant incidents impacting the University, the probability assigned to the nuclear power plant hazard is unlikely (less than 10 percent annual chance).

Vulnerability Assessment

All current and future buildings (including critical facilities), infrastructure, and populations are considered at risk to nuclear power plant incidents. Specific potential impacts to buildings, infrastructure, life safety, public heath, and the economy from the nuclear power plant hazard are described below.

Because of the University's location in the secondary EPZ rather than the primary EPZ, it is unlikely that a nuclear power plant incident has the potential to damage buildings, infrastructure, and critical facilities. However, if the water supply used to power the steam power plant is contaminated, an energy shortage may occur. See the *Power Outages* profile for impacts resulting damages to the University's power plant.

Infrastructure damage due to a nuclear power plant incident is unlikely, though infrastructure closer to Monroe located in the EPZ1 may be compromised. This could impact transportation and services in and around the City of Ypsilanti on which EMU depends.

EMU is in the Enrico Fermi II nuclear power plant's secondary EPZ, an area in which the food chain could be impacted by a severe off-site release incident. If an incident were to occur, public health has the potential to be impacted via radioactive contamination to local food and water supplies. Contamination of the local food and water supply would likely have severe impacts for the University's ability to sustain the staff, faculty, and student populations. The University's health center and nearby hospitals would be significantly impacted in its ability to see and treat patients. A severe nuclear power plant incident could result in the need for evacuation if the city's food, water, or air supply were to become contaminated.

Certain populations may be more severely impacted by a nuclear power plant incident. A nuclear power plant incident could result in the need for evacuation. Evacuation notices must be released in multiple languages to ensure populations where English is not the primary language receive adequate warning and the message is received. Income constrained households may face challenges with evacuation and relocation and may be more likely to lose income sources in the wake of such an event (e.g., individuals in service sector unable to work remotely if forced to evacuation or if businesses must close). These households may also face difficulty obtaining imported food in water in the event the local supply becomes contaminated.

Economic impacts stemming from a nuclear power plant incident could include disruption to University operations, especially for operations dependent on locally sourced food. After an event, a significant number of students may choose online education or to go to another university, which would have severe economic impacts for EMU.

Direct impacts to the nuclear power plant hazard from climate change are not anticipated. However, it should be noted that, as temperatures rise and the number of extreme heat events increases, the demand for energy in the region could increase, resulting in an increase in the number of nuclear power plants built to meet demand. If additional power plants are built near Ypsilanti, the threat from this hazard could increase.

Petroleum and Natural Gas Pipeline Accidents

Description

Petroleum and natural gas pipelines pose a real threat in many communities. Pipelines are used to transport petroleum and natural gas products and are often used as an alternative to road and rail transportation. Products typically transported in pipelines include crude oil, fuel oil, propane, or butane (often referred to as liquified petroleum gas, or LPG), and gasoline. Pipelines are used to transport products from wells and production facilities to storage facilities and local distribution systems. The network of pipelines spans the entire country.

Petroleum and natural gas pipeline accidents occur when pipelines leak, rupture, or fracture, potentially causing fires, explosions, spills, or the release of poisonous gases resulting in property damages, injuries, and loss of life. For example, the danger of hydrogen sulfide (H2S) release can occur where the gas or oil has a high sulfur content. Hydrogen sulfide is not only an extremely poisonous gas but is also explosive when mixed with air at temperatures of 500 degrees Fahrenheit or above. Many structures are located right next to pipelines and thus may be at risk. Petroleum and natural gas pipeline accidents are on the rise, due to the aging of the underground infrastructure (much of which was laid over 50 years ago) and an increase in construction excavation. According to the US DOT Pipeline and Hazardous Materials Safety Administration (PHSMA), 12,783 pipeline accidents occurred in the US between 2003 and 2022, resulting in 269 deaths, 1,116 injuries, and over $10 trillion in costs.[120] Pipelines can also cross through rivers, streams, and wetlands, thus posing the possibility of extensive environmental damage in the event of a major failure.

Increased pipeline safety regulations again came to the forefront in 2000, after deadly pipeline explosions occurred in Bellingham, Washington in June 1999 (three deaths) and Carlsbad, New Mexico in August 2000 (11 deaths). In 2004, the Pipeline and Hazardous Materials Safety Administration (PHMSA) was signed into law. The purpose of the Act was to provide a more focused research organization and establish a separate operating administration for pipeline safety and hazardous materials transportation safety operations.

[120] All reported incidents. (2023). US DOT Pipeline and Hazardous Materials Safety Administration. Retrieved September 22, 2023 from https://www.phmsa.dot.gov/data-and-statistics/pipeline/pipeline-incident-20-year-trends

The Pipeline Safety Improvement Act of 2002 mandated significant changes and new requirements in the way that the natural gas industry ensures the safety and integrity of its pipelines. The law applies to natural gas transmission pipeline companies. The law places requirements on each pipeline operator to prepare and implement an “integrity management program” that, among other things, requires operators to identify so-called “high consequence areas” (HCA) on their systems, conduct a risk analysis of these areas, perform baseline integrity assessments of each pipeline segment, and inspect the entire pipeline system. Companies were required to identify all HCAs and submit specific integrity management programs to the Office of Pipeline Safety (OPS), the Research and Special Projects Administration, and the U.S. Department of Transportation. All pipeline segments within HCAs were to be inspected and remediation plans completed by December 17, 2008, while non- HCA segments must be inspected by 2012. All segments must be re-inspected on a 7-year cycle, with certain exceptions.[121]

Michigan is both a major consumer and producer of natural gas and petroleum products. According to the federal Energy Information Administration, Michigan’s consumption of petroleum products, particularly LPG, is high; Michigan is the largest residential LPG market in the nation, due mostly to high residential and commercial propane consumption. The state has a single petroleum refinery but a large network of product pipelines. More than 78 percent of the overall home heating market uses natural gas as its primary fuel. With over one-tenth of U.S. capacity, Michigan has the greatest underground natural gas storage capacity in the nation and supplies natural gas to neighboring states during high-demand winter months. Driven largely by the residential sector, Michigan’s natural gas consumption is high. More than three-fourths of Michigan households use natural gas as their primary energy source for home heating.[122]

Large quantities of petroleum and natural gas are extracted from, transported through, and stored in Michigan, making many areas vulnerable to petroleum and natural gas emergencies. The state's major natural gas storage facilities are in the central part of the Lower Peninsula. Natural gas is piped into those storage facilities from Michigan wells, and from large transmission pipelines that originate in Canada, the southwestern United States, and the Gulf of Mexico area. Petroleum pipelines have their heaviest concentrations in central Lower Michigan and between Detroit and Toledo. Many of the refineries, terminals, and storage areas are in urban areas where the potential for extensive damage, and threat to lives and property, is greatest. The largest concentration of these facilities is found in the Detroit metropolitan area. In Michigan, most pipeline accidents that occur are caused by third party damage to the pipeline, often due to construction or some other activity that involves trenching or digging operations.

Location

Areas at or near pipelines are most vulnerable to petroleum and natural gas pipeline accidents. As shown in **Figure 4-62,** no hazardous liquid pipelines run through the University’s Ypsilanti campus. However, as shown in blue on the map, a gas transmission pipeline does exist along a segment Geddes Road and North Prospect Road, adjacent to campus.

[121] Parker, C.M. (2003). The Pipeline Industry Meets Grief Unimaginable: Congress Reacts with the Pipeline Safety Improvement Act of 2002.
[122] U.S. Energy Information Administration (2023). Michigan State Energy Profile. EIA. Retrieved from https://www.eia.gov/state/print.php?sid=mi#46 on September 27, 2023.

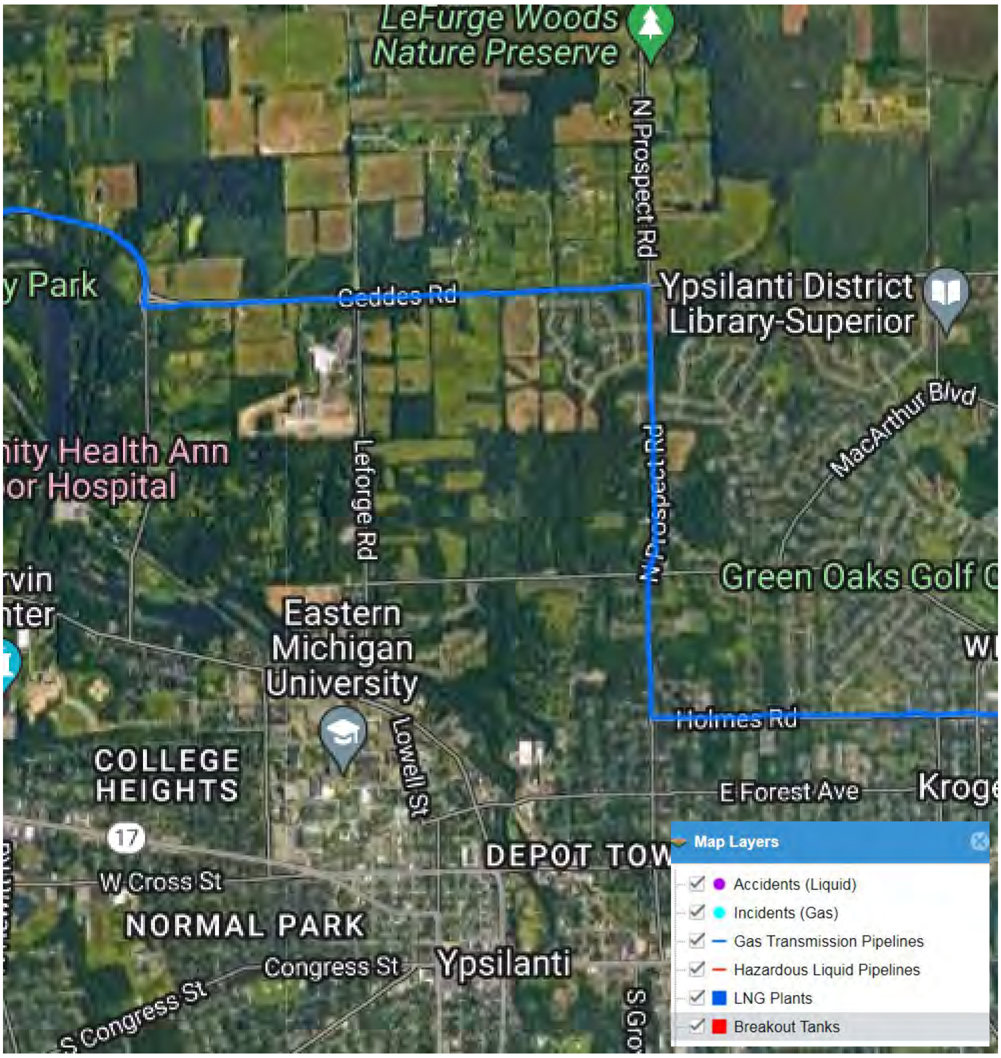

Figure 4-62: Pipeline Locations and Incidents Near EMU

Source: US DOT Pipeline and Hazardous Materials Safety Administration

Previous Occurrences

According to PHMSA, Ypsilanti does not have a history of petroleum or natural gas pipeline incidents. The two closest reported pipeline accidents to EMU's Ypsilanti campus occurred north and east of campus. The first incident was in 2004 which involved excavation damage with DTE Energy, an energy company. The second incident also involved excavation damage in 2016 by another energy company.[123]

To gain an understanding of potential impacts, major pipeline accidents in Michigan were reviewed. According to the State of Michigan Hazard Mitigation Plan, the largest pipeline accident in Michigan was the Enbridge Pipeline Disaster, which occurred in 2010. During this incident, oil from a pipeline near the City of Marshall, MI, leaked into the Talmadge Creek

[123] PHMSA. (2023). National Pipeline Mapping System Public Viewer. Retrieved September 22, 2023 from https://pvnpms.phmsa.dot.gov/PublicViewer/

and then into the Kalamazoo River. By the time the leak was stopped, over 800,000 gallons of crude oil had spilled from the pipeline. Calhoun County declared a State of Emergency, and several local and state departments and agencies were activated for response. Rescue efforts were undertaken to save aquatic life, and several residents were evacuated.

Although there is no history of pipeline accidents on the University's Ypsilanti campus, future events are possible given the existence of pipelines near the campus. In addition, it should be noted that an incident impacting the Huron River upstream of the University could impact the campus.

Extent

The extent of petroleum and natural gas pipeline accidents can be measured in terms of product released. Pipeline accidents can also be measured in terms of deaths, injuries, or property damage. The extent of petroleum and natural gas pipeline accidents on the EMU campus is difficult to determine given the lack of historic accidents. The largest pipeline disaster in the state released over 800,000 gallons of crude oil. It should be noted that a future event is possible and could potentially result in property damage, environmental damage, injuries, and loss of life.

Probability

Given the lack of historic petroleum and natural gas pipeline accidents on the University's Ypsilanti campus, the probability of future pipeline accidents is unlikely (less than 10 percent annual probability).

Vulnerability Assessment

Petroleum and natural gas pipeline accidents have the potential to impact buildings (including critical facilities), infrastructure, life safety, public health, and the economy. All current and future buildings (including critical facilities), infrastructure, and populations are considered at risk to petroleum and natural gas pipeline accidents.

Petroleum and natural gas pipeline accidents can result in direct damage to buildings and critical facilities through fire and explosions caused by released materials. Distribution lines are located near structures that utilize natural gas heating. Accidents can be caused by construction, digging, and excavation occurring at or near distribution lines.

Like building damage, infrastructure damage can occur because of pipeline fires or explosions. The pipelines themselves can be damaged during incidents, or other utilities and their distribution lines, such as water and sewer pipes or electricity transmission lines, can become damaged. Roads and sidewalks may also need to be dug up to fix a damaged pipeline located underground.

Petroleum and natural gas pipeline accidents can result in indirect losses such as injuries or fatalities due to fires, explosions, or releases of poisonous gases. Accidents may result in the need to quickly evacuate buildings, homes, and public spaces near the area of accident occurrence.

Similarly, pipeline leaks have the potential to pollute ground and surface water, which could contaminate drinking water sources. Leaks or ruptures in natural gas pipelines may result in the need to shut of the natural gas supply until the pipeline can be repaired. In the winter months, this could pose a threat to those in off-campus housing without a safe alternative heat source.

While there is low likelihood of pipeline incidents in Ypsilanti, an event has the potential to impact certain populations more than others. Individuals living in older buildings, substandard housing, or housing not built to code may be more likely to experience a natural gas leak due to aging or damaged infrastructure.

Petroleum and natural gas pipeline accidents can result in operational disruptions due to evacuations or damaged buildings. Severe events may also result in shortages of, or higher prices for, petroleum or other fuels. Higher prices could impact populations with low or fixed incomes disproportionately.

There are no known direct impacts of climate change on the frequency and severity of petroleum and natural gas pipeline accidents.

Power Outages

Description

A reliable and adequate electricity supply is critical to economic and social well-being, and systems within the U.S. have become accustomed to uninterrupted and relatively inexpensive power. Short-term power outages caused by weather damage (e.g., downed power lines) or temporary shortages (e.g., brownouts) can have community-wide impacts especially as society's dependence on technology grows.

There are several types of power outages that have the potential to impact the EMU Campus including:

- Physical failures of electrical production or distribution facilities due to aged or faulty equipment, poor maintenance, or employee accidents.
- Physical failures due to exogenous factors, such as severe storms, cyber-attacks, or other sabotage. Ypsilanti experiences storm related disruptions, mostly due to severe winds or severe winter weather.
- Blackouts or brownouts stemming from demand for electricity outpacing supply (generation). These types of outages are typically brief in nature, controlled, and can often be curbed through demand management techniques.
- Other planned outages (i.e., maintenance)

A distinction should be made between routine power outages and more severe outages. During a routine outage, the loss of power is isolated to a small area and power is restored within minutes or hours. Most routine power outages are caused by physical damage to production or distribution facilities, as described above. Most times, routine power outages have a minimal impact, and are carried out by providing advanced notices to those who will be impacted. However, substantial impacts can occur when critical facilities or equipment are impacted by routine outages and do not have a suitable back-up power source. More severe outages may last for days or even weeks and are more likely to happen during or because of another hazard, such as a severe storm or heat wave.

Location

EMU maintains its own energy system, which includes a 55-ton cogeneration system that supplies nearly 98% of the heat, and 93% of the electricity required on the 800-acre campus, making the university almost entirely energy self-sufficient.[124] Cogeneration is a combined heat and power system that uses one fuel source, in this case natural gas, to simultaneously produce electricity and steam heat. This electricity is supplied to campus buildings through underground cables. Areas of campus that are not serviced by the cogeneration system are serviced by DTE Energy. Additionally, DTE serves as a standby source of power in the event of a plant-failure at the University. [125]

It is assumed that all of EMU's Ypsilanti campus is uniformly exposed power outages.

Previous Occurrences

There is limited information about past power outages that have occurred on the EMU campus. No significant events were reported by the University. However, southeast Michigan and the City of Ypsilanti experience several routine power outages annually, in which power to parts of the city are temporarily out (e.g., minutes or hours). In addition to these outages, the city has experienced several severe outages in which power was out for a prolonged period. Significant power outage events from the region were sourced from previous occurrences of natural hazards that caused power outages and from local news sources. It is likely that additional significant power outages have occurred within the city but have gone unreported. Unless explicitly stated, it is not known if the events described below impacted the University's power system.

NCEI data

Table 4-48: Power outages caused by other hazards reported by NCEI

Date	Weather Event	Event Details
5/3/1981	Lightning	Severe lightning caused power lines to be downed in Ypsilanti
3/13/1997	Ice Storm – Severe Winter	A powerful ice storm resulted in power outages to over 425,000 homes in Washtenaw County
7/21/1998	Severe Wind	Intense thunderstorms in the Ann Arbor – Ypsilanti area caused nearly 600,000 homes and businesses to lose power
8/6/2001	Extreme Heat	Extreme heat caused several power outages in Southeast Michigan as demand for power surpassed the supply.
4/20/2003	Severe Wind	An estimated 10,000 homes and businesses lost power due to a severe thunderstorm event in Ypsilanti
7/4/2003	Severe Wind	A thunderstorm effecting several parts of southeast Michigan left 170,000 customers without power in the region.
7/21/2014	Severe Wind	Severe winds caused 400,000 businesses and homes to lose power in southeast Michigan
4/14/2018	Severe Winter	Heavy rain and snow caused power outages to nearly 500,000 customers in Washtenaw County.

124 EMU. (n.d.) Sustainable Campus Infrastructure, Retrieved on September 13, 2023 from, Sustainable Campus Infrastructure - Sustainability (emich.edu)
125 Michigan Radio. (2018). EMU Nearly energy self-sufficient with new cogen plant, Retrieved on September 13, 2023 from EMU nearly energy self-sufficient with new cogen plant (michiganradio.org)

Additional Occurrences from local news sources

August 24, 2023: A cluster of thunderstorms and tornadoes in southeast Michigan left over 500,000 homes and businesses without power in the region. The NCEI report for this event was under development during the preparation of this hazard mitigation plan.

February 25, 2023: A winter storm bringing snow, high winds and freezing rain caused power outages to over 300,000 customers in Michigan, several of whom did not receive power for over 5 days. Ypsilanti was among the regions affected by the outages. [126]

June 12, 2017: The Eastern Michigan University campus experienced a power outage due to a problem by DTE, that affected parts of Ypsilanti. Night classes for the evening had to be cancelled due to the outage. [127]

February 21, 2010: Around 600 customers in Ann Arbor and Ypsilanti were briefly left without power due to unspecified equipment malfunctioning in DTE. [128]

In addition to these reports, several respondents from the public survey reported facing impacts from power outages on campus buildings and residence halls. Another respondent reported losing research materials due to a power outage.

Extent

Without detailed records of major previous outages on campus, the severity of power outages on campus are difficult to determine. The June 12, 2017, power outage caused EMU to cancel night classes for the evening. Most previous occurrences are limited to isolated, short-term power outages caused by severe weather or equipment malfunctions. However, major, prolonged disruptions are possible. In the case that the University's cogeneration energy plant fails, DTE is contracted to provide backup power supply on a standby basis. On the contrary, if the City of Ypsilanti does not have power, campus facilities powered by the EMU plant will serve as a safe haven for citizens stranded without power.

Probability

Routine power outages caused by severe weather or maintenance issues occur multiple times a year in the region, as they do in most places. A prolonged, devasting power outage that surpasses the ability of back-up power supplies to keep critical facilities running are less frequent. However, several factors may increase the likelihood of power outage events in the future. Increased storm activity may cause more frequent outages. Further, increased demand for electricity may strain the grid, resulting in more frequent blackouts or brownouts. For example, in May 2022, the electric grid operator MISO (Midcontinent Independent System Operator), which includes Michigan, warned that controlled outages may be required over the summer as demand was projected to exceed capacity.[129]

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[126] World Socialist Web Site. (2023). More than 300,000 in Michigan with no power five days after ice storm, Retrieved on September 13, 2023 from More than 300,000 in Michigan with no power five days after ice storm - World Socialist Web Site (wsws.org)
[127] EMU Today. (2017) Campus power outage, Retrieved on September 13, 2023 from Campus power outage - EMU Today (emich.edu)
[128] The Ann Arbor News. (2010). Power outages, flickering lights across Ann Arbor and Ypsilanti, Retrieved on September 13, 2023 from Power outages, flickering lights across Ann Arbor and Ypsilanti
[129] Michigan Radio. (2022). There might not be enough electricity to go around this summer in Michigan. That could require planned outages, Retrieved on September 13, 2023 from There might not be enough electricity to go around this summer in Michigan. That could require planned outages (michiganradio.org)

With just one power outage reported on campus in recent years, and considering projected future impacts, the probability assigned to this hazard (a multi-day power outage) is unlikely (under 10 percent annual probability).

Vulnerability Assessment

All current and future university buildings (including critical facilities), infrastructure, and populations are potentially at risk to power outages.

Eastern Michigan University's power plant is a cogeneration power plant has the capacity to provide 7.8 MW of power and 90MMBtu of steam.[130] The plant was renovated to increase generation capacity in 2018 which enhanced the efficiency and resiliency of the system. [131]

Electricity is distributed throughout campus through underground tunnel systems. Therefore, the campus buildings are not particularly vulnerable to power disruptions caused by downing of lines by severe weather. The cogeneration plant is powered by natural gas supplied by ENGIE. Any disruptions in the supply of natural gas have the potential to cause a power outage on campus.

Power outages are most likely to occur in summer or winter months, when demand is highest, and electricity is most critical. Loss of power to student housing during winter months could result in the need to evacuate students if temperatures are too cold for students to stay in housing and loss of power is prolonged. Certain civil disturbances or criminal activities may be more likely to occur during lengthy power outages (increased restlessness, frustration, security system failure due to outages).

The University has dual electrical services, to ensure that power outages are kept to a minimum. In addition, the Physical Plant manages two portable generators. On campus facilities and populations are therefore less vulnerable to power outages. For students and staff living in off-campus residences, power outages can have several impacts.

Typically, power outages cause minimal damages to buildings, especially if equipped with a backup generator. Most buildings on campus are connected to receive backup power supply from DTE, which allows for continued use of the facility during most power outage situations. In extreme cases, surges associated with power outages can cause fires and/or damage electrical systems, includes computers, TVs, and appliances. In addition, prolonged outages during periods of high heat and humidity can cause loss of cooling, during which buildings may retain moisture (e.g., swelling of drywall, wood flooring or trim, etc.) resulting in minor damages. Prolonged outages during periods of extreme cold can cause buildings to lose heat. Buildings without heat are more susceptible to freezing pipes.

Typically, power outages cause minimal damages to infrastructure. Infrastructure that is reliant on electricity, such as water or wastewater treatment and pumping, traffic signals, communications networks, and monitoring system may be temporarily inoperable, which could have wider impacts for the campus, as described in the sections below. In extreme cases, surges associated with power outages can cause fires and/or damage electrical systems. Further, as infrastructure continues to incorporate "smart" technology in the future, the impacts of a power outage may have wider consequences, such as data loss and loss of

[130] ENGIE, EMU. (2018). Cogeneration at EMU, Retrieved on September 13, 2023 from cogeneration-at-emu.pdf (emich.edu)
[131] EMU Today. (2018). Eastern Michigan University, ENGIE Services U.S. launch new cogeneration system that will provide more than 90 percent of the University's electricity and heat, Retrieved on September 13, 2023 from https://today.emich.edu/story/story/10567

automated functionality. Campus critical IT infrastructure may be offline or inaccessible during power outages. Buildings with critical IT infrastructure are shown in **Table 4-49**.

Table 4-49: EMU Buildings with Critical IT Infrastructure

Building Name	Campus Subdivision
Pierce Hall	South Campus
Marshall Building	South Campus
Pray-Harrold Classroom Building	Mid Campus
The Commons	Mid Campus
Eastern Eateries	North Campus
Crossroads Marketplace/DPS	North Campus

Prolonged power outages may have substantial impacts on life safety, warning, and evacuation procedures. Power outages that coincide with extreme heat events may result in heat-related illnesses (see *Extreme Heat* hazard profile) when cooling capabilities are lost. In addition, outages that cause traffic signals to lose functionality may increase the likelihood of vehicle crashes and complicate evacuation processes. Emergency alert sirens that do not have backup power may not be functional during a power outage. Public health impacts from power outages are not common but can occur in extreme cases. For instance, during prolonged outages in which fuel cannot be supplied for backup power to water treatment and/or pumping, a boil water advisory may be required. Similarly, loss of pumping capacity within wastewater systems may result in sewage overflows.

Medical, fire, and EMS facilities impacted by power outages may lose or experience limited functionality, which in turn may impact life safety within the campus, such as access to medical services and emergency response times.

Certain populations are more likely to experience disproportionate impacts from power outages. The elderly and very young are more susceptible to heat-related illnesses, and therefore may be more vulnerable to power outages that occur during extreme heat events. Individuals reliant on medical equipment, such as oxygen pumps, motorized stairlifts, or C-PAP machines, may experience a medical emergency during a power outage, especially if backup power is not available to them. Students and staff living in off-campus housing are more likely to be affected by power outages. Income-constrained households may experience loss of refrigeration and food spoilage more acutely than non-constrained households. In addition, households without an English-speaker may face challenges with reporting outages or receiving information regarding outage notifications and services.

Power outages, especially those lasting several days or more, may have substantial impacts on University operations. The University may have to cancel class for several days. Additionally, University businesses and services may have to close for several days or more such as dining halls, restaurants, and campus stores. Major events, such as concerts, festivals, or sporting events may have to be cancelled, resulting in loss of revenue.

Climate change is expected to have indirect impacts on power outages. Changing climatic conditions are expected to increase severe storm activity and tornadic activity, which could increase the frequency of power outages on campus. As power outages often occur during summer months when thunderstorms are more common, the increase in extreme heat days may also increase the impact of power outage events (e.g., increase the likelihood of heat-related illness during an outage). Further, warmer temperatures are expected to increase future demand for cooling, which may contribute to controlled outages or blackouts.

Structural and Industrial Fires

Description

Structural fires are defined as the uncontrolled burning of any building—residential, agricultural, recreational, institutional, commercial, or industrial (MSP/EMHSD). Structural fires can originate from a number of sources, including faulty electric systems, natural gas leaks, arson, and improperly discarded cigarettes, candles, and incense. Structural fires are an occasional occurrence on the University's Ypsilanti campus, but a catastrophic structural fire has not occurred on campus in recent years.[132]

Within an urbanized area, it can sometimes be difficult to prevent the spread of a major fire to surrounding buildings. Buildings that hold a large number of people, like residence halls, auditoriums, campus gymnasiums, and dining facilities, tend to be regularly inspected, built with masonry, and have emergency evacuation procedures, reducing the potential for injury and death. Of greater concern are densely populated areas, such as student housing sections in urban areas, where people live in over-crowded wood-built homes in close proximity to other over-crowded and wood-built homes. Preventing the spread of a fire in this situation could be extremely challenging.

In the U.S., over 486,500 structure fires were reported in 2021, resulting in 3,010 deaths, 12,600 injuries, and over $12,751 million in property losses. [133] Between 2015 and 2019, Michigan reported higher rates of fatalities and injuries from structure fire when compared to the national average.[134] While potential reasons for state-to-state variations are many, a September 2019 Analysis conducted by the National Fire Protection Association (NFPA) found that higher state fire death rates are positively correlated with a larger percentage of people within a state who:

- Have a disability
- Have incomes below the poverty line
- Are current smokers
- Live in rural areas
- Are either African American/Black or are Native American or Alaskan Native[135]

Location

It is assumed that all of EMU's Ypsilanti campus is uniformly exposed to structural fires. Areas with clusters of wood-built structures or densely developed areas may be at higher risk.

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[132] Eastern Michigan University. (2022). Annual Security and Fire Safety Report

[133] National Fire Protection Agency. (2022). Fire Loss in the United States During 2021, Retrieved on September 8, 2023 from, NFPA report - Fire loss in the United States

[134] National Fire Protection Agency. (2021). U.S Fire Death Rates by State, Supporting Tables, Retrieved on September 8, 2023 from NFPA report - Fire death rates by state report "| NFPA[

[135] National Fire Protection Agency. (2021). US Fire Death Rates by State, Retrieved on September 8, 2023 from NFPA report - Fire death rates by state report "| NFPA[

Previous Occurrences

Data regarding structure fire previous occurrences came from including the University's *Annual Security & Annual Fire Safety Report* and local news sources.

Annual Security & Annual Fire Safety Report[136]

Fire occurrences on campus are reported in EMU's *Annual Security & Annual Fire Safety Report* (2022), which includes structural fires reported on the Ypsilanti campus in 2019, 2020 and 2021. Overall, there were 8 fires reported during this three-year period resulting in damages amounting to at least $12,000. Details for these incidents are provided in **Table 4-50.** None of the reported incidents resulted in reported deaths or injuries.

Table 4-50: Damaging Structural Fires on the EMU's Ypsilanti Campus

Building	Cause and Category of Fire	Damages
Hoyt Hall	Intentional	$0-$99
Sellers Hall	Intentional – Dorm Room	$0-$99
Walton Hall	Intentional	$100-$999
Village Apartments – Building D	Unintentional – Electrical fire in bathroom fan	$10,000-$24,999
Village Apartments – Building F	Unintentional – Electrical fire in bathroom fan	$1,000-$9,999
Westview Apartments – Building Q	Manual Fire in Oven - Unintentional	$100-$999
Phelps Hall, Putman Hall, Sellers Hall, Walton Hall	Deep fryer fire in kitchen of dining commons	$0-$999
Pittman Hall	Intentional – Dorm Lounge	$1,000-$9,999

Local News Reports

In addition to the fires reported in the Annual Fire Safety Report, local news sources were searched for structure fire incidents occurring on or near campus. The following events have the potential to have impacted the University:

- **December 7, 2022**: A fire broke out in an apartment building in Ypsilanti near EMU's campus. Two of 8 apartment units in the building were damaged and 2 residents were rescued from the second floor of the building.[137]
- **November 30, 2021**: Suspected arson caused a fire to break out in the EMU Science Complex. The fire was contained to a computer room and activated the building's sprinkler systems. The fire caused no reported injuries.[138]

[136] Eastern Michigan University. (2022). Annual Security and Annual Fire Safety Report
[137] Clickondetroit. (2022). 2 rescued from apartment fire near Eastern Michigan University, retrieved on September 1, 2022 from 2 rescued from apartment fire near Eastern Michigan University (clickondetroit.com)
[138] The Eastern Echo. (2021). Ypsilanti Fire Department responds to fire at EMU Science Complex, Retrieved on September 1, 2023 from Ypsilanti Fire Department responds to fire at EMU Science Complex | The Eastern Echo

- **February 28, 2017**: A fire that is believed to have started at 1:20 am in the lounge area of Phelps Hall, a student residence hall, caused an emergency evacuation in the dorm. One student was treated for smoke inhalation following the event.[139]
- **September 26, 2016**: A mattress fire was set off in the Putnam Hall residence hall. The fire was contained to the room and caused no injuries.[140]
- **April 3, 2010**: A fire in a rental home in Ann Arbor injured 3 and killed 1 student from EMU. The cause of the fire is unknown and suspected to be arson. The fire was one of four to occur overnight near the University of Michigan's central campus.[141]
- **March 18, 1987**: An early morning fire suspected to have been caused by arson caused nearly $15,000 in damages (adjusted to 2023 dollars) and injured five students from EMU in the Hoyt Center. One of the students was admitted to St. Joseph Mercy Hospital with a broken leg or ankle.[142]

Extent

The extent of structural fires was assessed in terms of casualties and damage. The April 2010 fire at an off-campus residential home caused 1 fatality and 3 injuries. The March 1987 fire at the Hoyt Center on campus injured 5 EMU students. The highest cost incident reported on campus in the last 3 years was an electrical fire in West Village Apartments, which resulted in up to $25,000 in damages. However, more severe events, such as a major residence hall fire, are possible.

Probability

The probability of structure fires is difficult to determine without a complete dataset. Structural fires are a normal occurrence in most communities. Further, based on available information and reports, the University has experienced more than one structural fire per year. Therefore, the probability assigned to this hazard is highly likely (greater than 90 percent annual chance). However, events resulting in multiple fatalities or catastrophic damages are less likely.

Vulnerability Assessment

All current and future buildings, infrastructure, and populations are considered at risk to structural fires.

Structural fires can cause significant damage to buildings, including critical facilities, ranging from smoke and water damage to the total loss of one or multiple structures. Wooden buildings or densely developed areas may be at a higher risk, as fire may spread more quickly. On campus, this may include buildings such as residence halls, where large numbers of students are living, cooking, and using electrical devices among other activities

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[139] Detroit Free Press. (2017). Student injured in dorm fire at Eastern Michigan University, retrieved on September 1, 2023 from [Student injured in dorm fire at Eastern Michigan University (freep.com)]

[140] MLive. (2016). Hot curling iron causes mattress fire at Eastern Michigan dorm, Retrieved on September 1, 2023 from [Hot curling iron causes mattress fire at Eastern Michigan dorm - mlive.com]

[141] The Ann Arbor News. (2010). Fire that killed 22-year old EMU student one of four considered 'suspicious' near U-M campus, Retrieved on September 1, 2023 from [Fire that killed 22-year-old EMU student one of four considered 'suspicious' near U-M campus (annarbor.com)]

[142] UPI. (1987). Five Eastern Michigan University Students were injured in a suspected Arson Fire, Retrieved on September 1, 2023 from [Five Eastern Michigan University students were injured Wednesday in... - UPI Archives]

that may result in fire. Compliance with building and fire codes greatly reduce buildings' vulnerability to structure fires. Older structures, those not meeting current building code, or those without fire suppression systems have a higher vulnerability to structure fires. The University has a project underway to install fire suppression systems within several of it's facilities, and with its insurer has identified several additional facilities that would benefit from fire suppression systems, as identified in the *Mitigation Strategy* Chapter of this plan. Structural fires that spread outward from their originating structure can damage infrastructure, such as utilities and bridges. Fires burning adjacent to infrastructure may damage structural integrity.

People trapped in structures on fire may sustain injuries due to smoke inhalation or burns. Fatalities can occur during structure fire events. Buildings should meet building codes and requirements for smoke detectors to result in early detection and evacuation of structures on fire. Large population centers on campus, like residence halls, apartment buildings, auditoriums, and other buildings that house large numbers of people, tend to be regularly inspected, built with masonry, and have emergency evacuation procedures, reducing the potential for injury and death. Practicing fire drills can reduce impacts to life safety by speeding up the evacuation process in the event of a structure fire. The University also provides guidance on protocols to be followed in the event of a fire in its Emergency Response Procedures guidebook.[143]

Subsequently, displacement of individuals impacted by a structure fire is a concern, especially if the structure housed a large population, such as a student residence hall. Having established emergency shelters and a plan for providing basic necessities to displaced individuals can mitigate issues arising from a structure fire.

Socially vulnerable populations are more likely to be negatively impacted by structure fires. The U.S. Fire Administration (USFA) acknowledges that socioeconomic factors are a good predictor of fire rates at a neighborhood level.[144] Although more recent research is limited, available research indicates that housing characteristics play a key role in the likelihood of a structure fire. This includes the age of a residence, the density of vacant buildings in a neighborhood, and the installation and upkeep of smoke detectors in a residence. Other factors include a parental presence in the home and household income.

The easiest and most effective method for reducing the risk of structure fires is ensuring that smoke detectors are installed and maintained. The State of Michigan Hazard Mitigation Plan indicated that 50 percent of fire related deaths occur in homes without working smoke detectors. Renters may have less control over the testing the replacing of smoke detectors, and those with negligent landlords may be more likely to live in housing without functioning smoke detectors. Students of the University may live off campus in rentals or group housing accommodations. If poorly maintained, such students are at higher risks to structure fires at home.

No direct impacts to structural and industrial fires are anticipated from climate change.

[143] Eastern Michigan University. (2023). Emergency Response Procedures, A guide for Faculty, Staff, Students and Visitors

[144] US Fire Administration. (1997). Socioeconomic Factors and the Incidence of Fire, Retrieved on September 8, 2023 from socio.pdf (fema.gov)

Water Contamination

Description

An adequate supply of clean drinking water is vital to a functioning community. Basic needs, such as hydration, cooking, and sanitation, require an adequate water supply. Water is also often essential for firefighting, medical services, electricity generation, industrial processes, and operations for many businesses. Water contamination occurs when water delivered to customers becomes unsafe for consumption or other uses, and therefore has the potential to result in life-threating illness, as well as limiting water availability.

There are several sources of water contamination with the potential to impact EMU, such as:

- **Water main breaks or loss of pressure**: Water mains that deliver treated, or finished, water to customers are typically pressurized, which keeps outside water and substances from seeping into pipes. However, loss of pressure within the water distribution system, due to main breaks or loss of pumping capacity, has the potential to introduce bacteria or other contaminants into the finished water supply. In addition, contaminants may also enter a drinking water system at the site of a water main break. Water main breaks or leaks that undermine supporting materials under roadways may also result in subsidence events (e.g., sinkholes).
- **Aging pipes:** Aging water pipes have the potential to leach contaminants from the pipes themselves into finished water when appropriate measures, such as the use of anti-corrosives or pipe upgrades, are not employed. Many parts of the U.S., including Michigan, have aging water distribution systems with pipes that are prone to leaks, breaks, and corrosion. For example, in Flint, MI, lead from aging pipes leached lead into the water supply in 2014 after the supply was switched, exposing 100,000 residents to elevated levels of lead exposure. This incident resulted in a federally declared state of emergency, and the long-term health implications of the event, especially on exposed children, is still unknown.
- **Groundwater and surface water pollution:** Groundwater and surface water supplies have the potential to become contaminated through the release of hazardous materials. Releases may have been lawful and/or planned at the time of release or have been released unintentionally through negligence or an accident (e.g., during a flood). Other releases may be a result of an intentional, illegal discharge. Discharge into waterways is typically regulated by the EPA through permitting. Certain chemicals may not dilute or break down over time, and therefore chemicals that were released into water systems decades prior can have a lasting impact. Michigan has a history of industrial uses and manufacturing, which increased the potential for water contamination across the state. More recently, the detection of PFAS chemicals within water systems across the country has received national attention.
- **Sewage overflows:** Sewage overflows have the potential to contaminate water when untreated sewage is released from the sewer conveyance system and flows into surface water supplies. Sewage overflows typically occur during heavy rainfall events; unlike drinking water systems, sewer systems are not pressurized, which allows storm water to seep into the sewer system, especially when sewer and stormwater systems are combined. During heavy rainfall events, the sewer system may become overwhelmed, resulting in the flow of sewage out of the system and onto nearby lands or into waterways. In addition to heavy rainfall events, sewage overflows may occur when loss of pumping capacity is experienced (e.g., during a power outage) and backed-up sewage is released.

- **Sabotage/intentional contamination:** Sabotage, or the intentional contamination of water supplies, occurs when water supplies are compromised by an actor using biological, chemical, nuclear, or radiological contaminants. Such contamination may occur as part of a terrorist act or similar criminal activity.

Location

The entire campus has the potential to be impacted by water contamination.

Previous Occurrences

There is limited information about past water contamination that may occurred on the EMU campus. EMU staff were not aware of any major incidents effecting campus. However, it is likely that previous incidents in the City of Ypsilanti would have affected the EMU campus, its staff, or students in some capacity. Previous instances of water contamination incidents and/or close calls in Ypsilanti were gleaned from local news reports and are included below. It is likely that minor contamination incidents, such as additional boil water advisories, have not been reported.

August 25, 2023, Sewage Overflow. A 500-year storm event led to the overflow of three Ypsilanti-area sewer pumps spilling untreated sewage into water bodies including the Huron River. While officials reported that no drinking water sources were contaminated, water samples were collected from all affected waterbodies for testing the extent of contamination.[145]

June 8, 2023, Pipe Break at Wastewater Treatment Plant. A pipe break at Ypsilanti's wastewater treatment plant caused an unknown amount of wastewater to overflow out of the plant. While the incident was contained within 6 minutes, there is limited knowledge of how much of the contaminated water left the plant's stormwater system. There were no reports of the event causing any contamination concerns in the region.[146]

May 2, 2019, Sewage Overflow. Heavy rainfall caused two sewage overflows in Ypsilanti township. Washtenaw County advised residents along the north branch of Big Swan Creek to avoid contact with the water due to the discharges. Warnings to avoid contact with water bodies are commonly issued after unprecedented rain events and stay in place for 48 hours after the storm. The sewage overflow caused no reported contamination of drinking water sources. [147]

Gelman Dioxane Plume. In addition to the incidents listed above, Ypsilanti's neighboring city, Ann Arbor, has a slow-moving threat that continues to impact the city despite the original source being inactive. Decades ago, a plant manufacturing medical filters released an industrial solvent, dioxane, into the groundwater. Dioxane is a carcinogen. The result has been a slowly moving plume of dioxane in the aquifer under the west side of Ann Arbor. Clean-up is ongoing, but the city can no longer use the aquifer as a drinking water source. There are concerns that the plume will eventually pollute the Ann Arbor's main drinking

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[145] Mlive. (2023). Untreated sewage overflows in multiple Ypsilanti-area locations during heavy rains, Retrieved on September 16, 2023 from Untreated sewage overflows in multiple Ypsilanti-area locations during heavy rains - mlive.com

[146] Mlive. (2023). Pipe break at Ypsilanti treatment plant causes wastewater overflow, Retrieved on September 16, 2023 from Pipe break at Ypsilanti treatment plant causes wastewater overflow - mlive.com

[147] Mlive. (2019). Washtenaw County warns residents to avoid creek due to sewage discharges. Retrieved on September 16, 2023 from Washtenaw County warns residents to avoid creek due to sewage discharges - mlive.com

water source, the Huron River, which is regularly tested for dioxane.[148] In the most recent test of water sources conducted by the city of Ann Arbor and Scio township, 43 drinking water wells were found to be contaminated by low levels of dioxane. All samples detecting the chemical were below 3 parts per billion, while the State's standard is 7.2 parts. **Figure 4-63** shows the location of the dioxane plume in Ann Arbor. [149]

Ypsilanti does not draw its drinking water from the Huron River. The Ypsilanti Community Utilities Authority (YCUA) purchases treated water from the Great Lakes Water Authority (GLWA), which gets it from the Detroit River, and supplies it to the City of Ypsilanti, including EMU.[150] However, it is likely that the dioxane plume can affect groundwater wells in the city in the future.

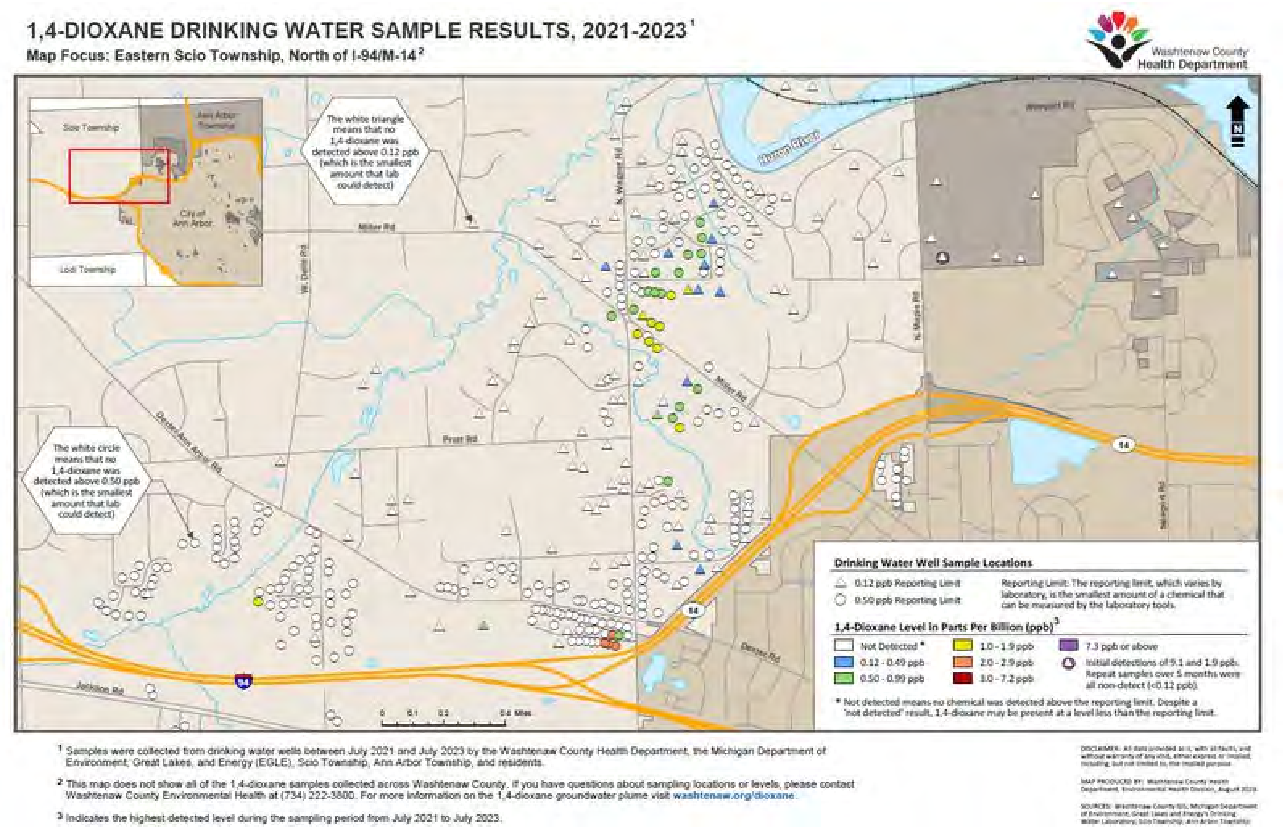

Figure 4-63: Dioxane Drinking Water Sample Results

PFAS (per- and polyfluoroalkyl substances). PFAS is a long-standing chemical contaminant that began to gain statewide attention when it was detected at significant levels in drinking water in 2010. It is a broad term for a variety of related chemicals with unique properties useful in non-stick applications, as stain removers, water repellants, and in firefighting foams. Generally available beginning in the 1940s, ongoing studies of this environmentally persistent chemical have shown harmful health effects in chronically

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148 Health Department Washtenaw County Michigan. (n.d.) 1,4 Dioxane, Retrieved on September 16, 2023 from [1,4-Dioxane | Washtenaw County, MI]

149 Mlive. (2023). Ann Arbor-area dioxane plume affecting dozens of drinking wells north of M-14, new map shows, Retrieved on September 16, 2023 from [Ann Arbor-area dioxane plume affecting dozens of drinking wells north of M-14, new map shows - mlive.com]

150 YCUA. (2021) Drinking Water Quality Report, retrieved on September 16, 2023 from [waterreport.pdf (ycua.org)]

exposed individuals. This is especially true with drinking water contamination or in persons showing high levels that have increased over time (many people in Michigan exhibit at least some level of accumulation). PFAS has been found to significantly alter immune and inflammatory responses. The GLWA, which supplies water to the University's utility servicer, began testing for PFAS in 2017, and as of 2019, had not detected PFAS in water supplies.[151] More recent PFAS testing data was not found.

YCUA's most recent water quality report, from 2022, indicted detection rates of total coliform and *E. Coli* at "greater than 1 sample per month." The testing goal is 0 samples. The cause of this contamination is presumed to be natural presence in the environment and human/animal fecal waste within the water supply.[152]

Extent

The extent of water contamination is difficult to determine without detailed historical records. Contamination could be measured in terms of amount of contaminant or geographic extent of contaminated water. In Ypsilanti, a "worst case" scenario for water contamination would be one in which the city's primary water supply becomes contaminated beyond what is remediable by treatment and must be abandoned as a water source.

Probability

The GLWA along with the U.S. Geological Survey and the Michigan Public Health Institute performed a source water assessment in 2004 to determine the susceptibility of GLWA's Detroit River water source for potential contamination. The rating is determined based on geological sensitivity, water chemistry, and potential contaminant sources. The report described GLWA's Detroit River intakes as highly susceptible to contamination.[153] While the treatment plants for the GLWA have historically provided satisfactory results, more severe contamination can occur.

The probability of water contamination is difficult to determine without complete data. Some contamination issues, such as PFAS and the dioxane plume, are chronic issues. Considering Michigan's industrial history, it is likely that other water contamination events have occurred in the past.

Given annual detected of contaminants within the water system, the probability assigned to this hazard is likely (10 to 50 percent annual chance). However, devasting water contamination events, such as those resulting in acute fatalities/injuries, or a prolonged loss of the water supply are far less likely.

Vulnerability Assessment

All current and future populations and critical facilities within the EMU campus are considered at risk from water contamination. The City of Ypsilanti's water utility performs regular water quality checks to ensure contaminants are within levels permitted through EPA.

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[151] YCUA (2019). PFAS Facts. Retrieved on February 2, 2024 from [PFAS.pdf (ycua.org)](PFAS.pdf).
[152] YCUA (2002). 2022 Drinking Water Quality Report. Retrieved February 2, 2024 from [CCR2022.pdf (ycua.org)](CCR2022.pdf).
[153] YCUA. (2021) Drinking Water Quality Report, retrieved on September 16, 2023 from [waterreport.pdf (ycua.org)](waterreport.pdf)

Damage to buildings due to water contamination is not typical, although buildings may lose potable water service. While infrastructure is unlikely to be damaged by water contamination, water treatment infrastructure or processes may have to be modified to treat potential contamination. Drinking water conveyance systems may have to be flushed following a contamination event, which can be costly (e.g., may result in rate increases) and result in a temporary loss of service. In extreme cases, source water infrastructure, such as wells or reservoirs, may have to be abandoned.

Water contamination is unlikely to impact warning and evacuation procedures, however water contamination may necessitate activation of warning and notification systems such as boil water advisories.

Water contamination has the potential to severely impact public health. Undetected water contamination may result is illness, lifelong impairments, or even fatalities, depending on the contaminant and levels of exposure. Public health impacts from water contamination may be acute, such as contamination introduces during water main breaks, or chronic, such as those from long-term exposure to chemicals.

Water contamination may impact populations through microorganisms, causing waterborne illness. This may include exposure to bacteria, such as *E. Coli*, Listeria, and Legionella, or parasites such as Giardia. Ingestion of these types of contaminants may cause individuals to fall ill (often gastrointestinal) or die. It is also possible to contract certain viruses through contaminated water, such as Hepatitis A or norovirus (see *Public Health Emergencies* profile).

Aside from microorganisms, water contamination from inorganic compounds may also severely impact public health. Compounds such as arsenic, hexavalent chromium, and lead can have dangerous health side effects. For instance, hexavalent chromium is a carcinogen (cancer-causing), and unsafe lead exposure can cause neurological damage.

Certain populations may be disproportionately impacted by water contamination. The very young, elderly, or immunocompromised may be less able to rebound from exposure to contaminants. For instance, children and babies are more likely to experience developmental issues associated with lead exposure. Income constrained households may struggle to purchase bottled water in the event the drinking water supply is contaminated and may also be less able to pay for at-home testing of their water supply. Historically, communities of color have been more likely to be exposed to unsafe drinking water. A study by the National Resources Defense Council found that water systems with chronic noncompliance were 40 percent more likely to be in counties with the highest racial, ethnic, and language diversity than those with the lowest.[154]

Water contamination could have catastrophic operational impacts. Waterborne illnesses may result in closure of campus and cancellation of sporting or festival events. Long-term contamination may cause populations to choose not to move to the city and deter incoming admissions. To combat contamination, large sections of the water distribution system may have to be replaced (as occurred in Flint, MI), or specialized treatment facilities may be required.

[154] Fedinic, K. P. et. al. (2019). Watered Down Justice, National Resources Defense Council

Additionally, climate change can exacerbate the problems of water contamination. Increased water temperatures associated with climate change may result in certain bacteria or viral contaminants being able to thrive.[155]

Human-Caused Hazards

Civil Disturbances

Description

Civil disturbances are any public disturbance involving acts of violence or unlawful protest by a group of persons causing or threatening to cause danger, damage, or injury to the University or its students, staff, faculty, or visitors. Generally, civil disturbance events involve a gathering of many people collectively engaging in unlawful behavior, such as rioting, looting, vandalism, or arson. Civil disturbances can escalate from a public event, like a sporting event, or lawful political rallies, protests, and demonstrations. Civil disturbances can be both planned or unplanned, organized, or unorganized. Riots inspired by demonstrations or football and basketball games have the potential to involve active participants as well as people and property in the surrounding area. Civil disturbances can be centered around a particular facility, such as an office, research facility, stadium, or public meeting place.

Universities and college campuses are often selected by demonstrators for organized marches and protests. Political or social demonstrations and sporting events have the potential to ignite a riot or result in counter-protesting that can turn violent. For example, during an August 2017 protest in Charlottesville, VA (home to the University of Virginia) protesters and counter-protestors clashed violently, and a vehicle-borne attack struck a crowd of counter-protesters, resulting in the death of a woman. Like the University of Virginia, the Eastern Michigan University's Ypsilanti campus has many aspects that make it a prospective location for a civil disturbance to occur. The University hosts a wide range of sporting events, speakers, meetings, and summits that may include high-profile activists or politicians.

Aside from violence, civil disturbances can block traffic and roadway access, disrupt classes, and impede the functionality of the University's educational and research systems.

Location

The entire campus is considered at-risk for civil disturbances. However, areas where large crowds can gather, particularly those including public meeting spaces or event venues are considered at a higher risk. Specifically, Welch Hall and the Rynearson Stadium are vulnerable to civil disturbances.

Previous Occurrences

EMU's campus has seen several protests and demonstrations on campus, from a wide variety of social and political groups and causes. There are no instances on these demonstrations escalating to civil disruption events in recent years. Examples of these events include:

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[155] Time. (2023). Deadly Waterborne Bacteria are Surging Because of Climate Change, Retrieved on September 16, 2023 from [Deadly Waterborne Bacteria Are Surging Due to Climate Change | Time]

September 2022 Faculty Union Strike: Roughly 50 faculty members on the EMU campus went on strike for 3 days to negotiate a better deal for their healthcare plans. The University sought an injunction to end the strike during this time to prevent the disruption of regular class schedules. The protests did not lead to any eruptions of violence or disruption of regular activities. [156]

March 2021 EMU Sexual Assault protest Several hundred EMU students marched around campus to protest the university's alleged mishandling of sexual assault cases, including a lawsuit that accused EMU officials of covering up a series of sexual assaults. The protesters were peaceful, and no violent eruptions occurred.[157]

One significant civil disturbance event occurred in the EMU campus in 1969. Details about that event are below:

February 1969 Pierce Hall Protest: On February 20, 1969, 50 students marched across campus and locked themselves in Pierce Hall in support of the demands for more racial, social and gender equality that students made to the administration at EMU. The police were called to remove the students from the building and 14 students were arrested. The arrests resulted in hundreds of students participating in wide-spread protests and class boycotts. [158] Further, disturbances that do not occur on campus, but in the vicinity of campus have the potential to disrupt campus activities. Examples of such events are below.

May 2020 Protest against police brutality in Washtenaw County: A video showing a Black woman from Ypsilanti Township being repeatedly punched in the head by a Washtenaw County sheriff's deputy sparked outrage among the residents of the region. Over 300 protestors gathered for 3 consecutive days to protest outside the Washtenaw County sheriff's office. The sheriff's office warned residents to avoid the Washtenaw Avenue and Carpenter Road intersection, as well as the nearby U.S. 23 exits due to the protests, all crucial roads connecting to Ypsilanti. [159]

July 1967 Detroit Riots: On an early Sunday morning, Detroit police raided an unlicensed liquor establishment arresting about 80 people attending a party to celebrate the return of two Detroit GIs from Vietnam. A crowd gathered in the streets to oppose the arrests sparking a series of fires, looting, and violence including pelting people with rocks and bottles. The violence continued for over five days resulting in the state police calling the Michigan National Guard and two U.S. Army Divisions to finally put an end to it. Rippling events occurred in several cities across Michigan. Forty-three people died, 342 were injured, and 1,400 buildings were burned down. Property damage was estimated at over $507 million (adjusted to 2023 dollars). The protests effected several EMU students who witnessed the violence firsthand. [160]

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[156] EMU Today. (2022). Eastern Michigan University seeks injunction to end illegal strike by faculty union, while negotiations continue, Retrieved on 7 September, 2023 from, Eastern Michigan University seeks injunction to end illegal strike by faculty union, while negotiations continue - EMU Today (emich.edu)

[157] The Detroit News. (2021). Hundreds protest at EMU amid sex assault allegations, Retrieved on September 7, 2023 from Hundreds protest at EMU amid sex assault allegations (detroitnews.com)

[158] Eastern Magazine. (2019). Taking Great Risk, retrieved on 7 September 2023 from Taking Great Risk - Eastern Magazine (emich.edu)

[159] Mlive. (2020). "free Sha'Teina:' Continued incarceration of Ypsilanti woman leads 300 protestors to block streets again, Retrieved on September 8, 2023 from 'Free Sha'Teina:' Continued incarceration of Ypsilanti woman leads 300 protesters to block streets again - mlive.com

[160] Eastern Magazine. (2019). Taking Great Risk, retrieved on 7 September 2023 from Taking Great Risk - Eastern Magazine (emich.edu)

Civil Disturbance of 1969: As noted in the Ann Arbor Hazard Mitigation Plan, the night of June 17, 1969, ranks as one of the most contentious moments in Ann Arbor's history, from the violence of the South University Avenue riot. Police from five agencies used tear gas and night sticks to twice clear the street of more than 1,000 people making 47 arrests in the process. The conflict began the night before partly out of an interest in creating a pedestrian mall or People's Park on the street, which some called "the liberation" of South University Avenue. The unruly crowd blocked cars, threw rocks, and yelled obscenities at police who braced for a confrontation as the University of Michigan President Robben Fleming pleaded for restraint on both sides.

At the time of this plan, the ongoing Israeli-Palestinian conflict centered in Gaza, sparked in October 2023, has caused concerns over a potential civil disturbance on or near campus. Pro-Israeli and pro-Palestinian demonstrations have occurred across the country, including at EMU. While EMU has not experienced violence with these demonstrations to-date, clashes between demonstrators have occurred in other parts of the country.

Extent

The severity of civil disturbances can be measured in terms of crowd-size, arrests, injuries, or property damage. The most severe event of civil disturbance in the University's history is the Pierce Hall Protest of 1969, which resulted in hundreds of people in attendance and 14 arrests. However, more devastating events are possible, including ones that could result in vandalism, university closures, loss of life, and economic loss.

Probability

In considering future probability of civil disturbances, it is necessary to consider the number of past events, along with the current climate regarding demonstrating and protesting on campus. Further, real-time media coverage and use of social media may allow civil disturbances to form and grow faster than in the past. Given the limited history of civil disturbances on campus, combined with the characteristics that make it prone to such events and the recent increase in demonstrations, the probability assigned to the civil disturbance hazard is "possible" (between 10 and 50 percent annual probability).

Vulnerability Assessment

All current and future buildings (including critical facilities), infrastructure, and populations on the University's Ypsilanti campus are considered at risk to civil disturbances.

Civil disturbances can include vandalism and arson, which may result in damages to public and private property, including critical facilities. Damages to buildings and infrastructure may include, but are not limited to, fire and smoke damage, broken windows and doors, and spray painting. Additionally, access to roads and buildings, including critical facilities, can be blocked by civil disturbances. The occupation of spaces in protest can result in significant disruption to operations.

Physical violence to participants, bystanders, and responders is possible. Dangers resulting from explosions, fire, smoke inhalation, and tear gas is also possible. Civil disturbances may result in the need to evacuate a building, structure, or public space, or alternatively, prevent students or staff from leaving buildings. During severe and/or long-lasting events, residents living or working near the disturbance may not have safe access to essential goods and services, especially for employees stuck in offices or facilities that are not equipped for overnight or extended stays. For example, during a civil unrest event in Baltimore, Maryland in April 2015, senior residents reported rationing medications due to inadequate safe access to pharmacies. Residents also reported a shortage of food and basic supplies and required assistance from the Baltimore Health Department.[161]

Civil disturbance events can result in disruption to the University. Some disturbances may be planned and organized with the intent to disrupt normal business operations or traffic flows, while others may indirectly impact the University by creating unsafe conditions for employees and customers to access nearby businesses. In extreme cases, some businesses or institutions may need to close down to repair or rebuild following damages from a civil disturbance.

Aside from the impacts listed above, the reputational impact on the University from a high-profile civil disturbance would be immense and may lead to difficulty recruiting students, faculty, and research partners. This would have a detrimental impact to the University, its mission, and its operations.

Certain socially vulnerable populations may be disproportionately impacted by civil disturbance events. Those living in dense urban areas, where disturbance events are more likely to occur, may be at a higher risk to having homes or property damaged or roads blocked during events. In addition, racial inequities may occur during arrests at protests and civil disturbances. For example, one analysis found that Black people were nearly twice as likely to be arrested as white people at Portland, OR protests.[162] Populations with limited access to information, such as those without telephone service or access to the internet may experience delays in receiving and acting upon hazard information related civil disturbances in their community. Additionally, those who do not speak English well may not comprehend event information to the extent that enables them to make timely decisions and take appropriate actions. A civil disturbance event may cause disruptions to public transportation. Populations with limited vehicle access or transportation routes are more likely to experience mobility challenges and have difficulty accessing needed supplies or commuting to work.

It is possible that warmer days may lead to greater numbers of civil disturbance, as studies show a positive correlation between warmer temperatures and crime.[163] Further, given the political nature of climate change policy, it is possible that civil disturbances may occur because of policy changes, new information, or general activism.

Cyber-Attacks

Description

According to the State of Michigan Hazard Mitigation Plan, cyber-attacks involve the use of computers, electronic devices, and/or the Internet to attack computer systems. There are several types of cyber-attacks, including:

[161] Wen, L. S. et. al. (2015). Public Health in the Unrest: Baltimore’s Preparedness and Response after Freddie Gary’s Death, American Journal of Public Health

[162] OPB. (2020). *Analysis shows Black People more likely than whites to be arrested at Portland protests*. OPB. Retrieved on September 8, 2023 from https://www.opb.org/article/2020/08/26/analysis-shows-black-people-more-likely-than-whites-to-be-arrested-at-portland-protests/

[163] CBS News. (2012). *Hot and bothered: Experts say violent crime rises with the heat,* Retrieved on September 8, 2023, from https://www.cbsnews.com/news/hot-and-bothered-experts-say-violent-crime-rises-with-the-heat/

- Computer viruses, which can damage infected computers;
- Denial-of-service attacks, which can shut down a targeted website; and
- Hacking, in which sensitive information can be compromised.

There are many different motives for cyber-attacks, including undermining public confidence in cyber security, vandalism, and obtaining or altering information to commit fraud, identity theft, extortion, or sabotage. For instance, confidential personal information, such as birth dates and Social Security numbers, can be sold by hackers in order to be used in identity theft activities. Additionally, ransomware restricts a user's access to their data and requires a user to pay the attacker prior to regaining access.

A more recent cyber-attack capability is the ability to impair or destroy machinery by taking over the software that controls the machines. Cyber-attacks such as these could be used to damage critical infrastructure such as electrical grids, water treatment systems, and fuel pipelines.

Cyber-attacks can be ad-hoc or planned. Similarly, perpetrators of cyber-attacks can range from individual, amateur hackers to organized, highly skilled groups of "professional" criminals. Further, cyber-attacks can be committed by parties operating globally through the internet, making prevention, enforcement, and response even more challenging.

The State of Michigan Hazard Mitigation Plan contains the following definitions associated with cyber-attacks:

- **Adware:** A form of software that displays advertising content in a manner that is potentially unexpected and unwanted by users, and which may also include various user-tracking functions (like spyware).
- **Botnet:** The word BOTNET is short for the combination of the word robot and network. The term often applies to groups of computer systems that have had malicious software installed by worms, Trojan horses or other malicious software that allows the "botnet herder" or botnet's originator to control the group remotely.
- **Cookie:** A small text file that is placed on a computer's hard drive by a web site, in order to allow that site to retain and use information about the user (and the user's activities) at a later time.
- **Keystroke logger:** Any method that allows the recording or interpretation of which keys have been pressed by a user on the person's computer keyboard, typically without the person's awareness or consent. The methods may include software or hardware that records all typed information, possibly including the analysis of video and acoustic information about the user's behavior, but often accomplished by means that make use of the computer itself to relay information to a remote person or machine, for later use.
- **Malware:** Software that can destroy your data, affect your computer's performance, cause a crash, or even allow spammers to send email through your account.
- **Pharming:** Arranging for a web site's traffic to be redirected to a different, fraudulent site, either through a vulnerability in an agency's server software or using malware on a user's computer system.
- **Phishing:** the attempt to trick someone into providing confidential information or doing something that normally wouldn't or shouldn't be done. For example, phishing could involve sending an e-mail that falsely claims to be from an established legitimate enterprise, to scam the user into surrendering private information that will be used for identity theft.

- **Social engineering:** In the context of cyber-security, this refers to an effort to psychologically manipulate a person, especially through misrepresentation or deception (as in a con game), to gain access to information. The manipulation often relies on the trusting nature of most individuals or makes use of many persons' natural reluctance to offend others or to appear too mistrustful. The ruse may involve creating impressions that make things appear more benevolent, trustworthy, and reliable than they are. Some schemes are very complex and involve several stages of manipulation over a substantial period of time.
- **Spear phishing:** A form of phishing that targets a specific individual, company, or agency, usually relying on an accumulation of information to make subsequent ruses more effective when further probing the target, until a successful security breach finally becomes possible.
- **Spoofing:** (1) Attempting to gain access to a system by posing as an authorized user. Synonymous with impersonating, masquerading or mimicking. (2) Attempting to fool a network user into believing that a particular site was reached, when the user has been led to access a false site that has been designed to appear authentic, usually for the purpose of gaining valuable information, tricking the user into downloading harmful software, or providing funds to the fraudsters.
- **Spyware:** Software that allows others to gain private information about a user, without that person's knowledge or consent, such as passwords, credit card numbers, social security numbers, or account information.
- **Trojan (or Trojan Horse):** A program that, although neither replicating nor copying itself, performs some illicit activity when it is run. It stays in the computer doing its damage or allows somebody from a remote site to take control of the computer.
- **Virus:** A program or code that attaches itself to a legitimate, executable program, and then reproduces itself when that program is run.
- **Worm:** A self-contained program (or set of programs) that is able to spread copies of itself to other computer systems—usually through network connections or e-mail attachments.

There are additional common threats affecting universities across the nation. If not regarded, they leave students, faculty, and staff and their information vulnerable to cyberattacks. Common examples include:[164]

- **Ransomware:** Hackers attack the university's computer system with a type of malicious software that locates valuable data. The software holds the data and/or computer system access hostage unless the university pays the ransom sum.
- **SQL Injections:** Hackers enter a piece of malicious code into a query box on a website such as a login page or contact form. The code allows the hacker to access and/or alter protected data.
- **Data Breaches:** Hackers use several types of malware (software that can destroy data, affect computer performance, or allow internal access) to access valuable university data.
- **Outdated Technology:** Many universities use outdated technology which puts them at a higher risk of more modern cybersecurity threats. Additionally, many students use their personal computers to access university systems and to perform research.

[164] Lukehard, A. (2022). Top 5 Cybersecurity Threats Facing Higher education, *Fierce Education*. Retrieved on September 14, 2023 from https://www.fierceeducation.com/technology/top-5-cybersecurity-threats-facing-higher-education

In context of EMU, a cyber-attack is any willful criminal attack on the University's information system. Cyber-attacks have the potential to impact public safety, harm the University's critical functions and services, impair the integrity, confidentiality, and availability of information, and diminish public confidence in the University's ability to store and handle sensitive data. Cyber-attacks can have serious impacts on a university's reputation. Universities also contain expensive, cutting-edge equipment for research which may be targets to use for larger attacks.

Universities have increasingly become targets of cyber-attacks. In 2022, 44 colleges/universities were impacted by ransomware.[165] The targeting of universities for cyber-attacks is likely due to the use of open networks and the large amount of data kept by higher education institutions, including personal information on students, alumni, faculty and employees, vendors, and research partners. Further, universities could be targeted for research data containing intellectual property regarding valuable or innovative products and services. While hundreds of university cyber-attacks have occurred in recent years, some notable attacks include:

- **Michigan State University**. In 2023, a cyberattack to third-party service used by the university resulted in potential exposure of community member data.[166] A larger scale threat occurred in 2016 when, a database containing records of approximately 400,000 individuals, including, names, social security numbers, and university identification numbers, was breached. The University offered free credit monitoring services to those potentially impacted.[167]
- **Lincoln College**. In 2022, Lincoln College had to shut down following financial challenges due to the COVID-19 pandemic and a ransomware attack.[168] A December 2021 ransomware attack kept the college from being able to access its data including systems needed for enrollment, recruitment, and fundraising. The college faced significant enrollment shortfalls and was forced to close in May 2022.
- **University of California, San Francisco (UCSF).** In 2020, hackers attacked the University's medical school servers with ransomware.[169] To regain access to the servers, the University paid the hackers approximately $1.14 million.
- **Stanford University Hospital and Clinic**. In 2014, the health information of 20,000 hospital patients was posted on a website.[170] Following a class-action lawsuit, the case was settled at $4 million.

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[165] Ward, M. (2023). No improvements: Schools were hit steadily with ransomware attacks in 2022, *University Business*. Retrieved on September 14, 2023 from https://universitybusiness.com/no-improvements-schools-were-hit-steadily-with-ransomware-attacks-in-2022/#:~:text=There%20were%2045%20school%20districts,rose%20to%2058%25%20in%202022.

[166] Michigan State University (2023). MSU Third-Party Vendors Victim of Data Breach. Michigan State University. Retieved on September 14, 2023 from Technology at MSU - MSU third-party vendors victim of data breach | Michigan State University

[167] Michigan State University (2016). *MSU data breach exposed records*. MSU Today. Retrieved on September 14, 2023 from https://msutoday.msu.edu/news/2016/msu-data-breach-exposed-records/.

[168] Lorhrmann, D. (2022). *College Closing Another Sad Milestone for Ransomware Impact*, Government Technology, Retrieved from https://www.govtech.com/blogs/lohrmann-on-cybersecurity/college-closing-another-sad-milestone-for-ransomware-impact

[169] Landi, H. (2020). UCSF pays hackers $1.1M to regain access to medical school servers. Fierce Healthcare, Retrieved from https://www.fiercehealthcare.com/tech/ucsf-pays-hackers-1-14m-to-regain-access-to-medical-school-servers

[170] Ouellette, P. (2014). Stanford Hospital, BAs agree to $4 million breach settlement. Health IT Security. Retrieved from https://healthitsecurity.com/news/stanford-hospital-agrees-to-4-million-breach-settlement

Location

The entire campus and its systems are assumed to be at risk to cyber-attacks. University IT nodes, servers, and databases that store personal or sensitive information, may be more likely to be targeted for a cyber-attack.

Previous Occurrences

As noted by the University's Division of Information Technology (IT), the University's cyber systems are commonly threated by cyberattacks including phishing, pharming, spyware, scareware, and identity theft. University personnel have worked to strengthen both security systems and community awareness to decrease the level of threats and vulnerabilities. The University routinely manages phishing and other types of cyber intrusions.[171] In the public survey, respondents reported receiving phishing attempts via email. Significant cyber threats to impact EMU are noted below.

- The University notes that between November 2012 and July 2013, roughly more than 400 accounts were compromised at EMU.
- In 2018 and 2019, IT listed a financial aid scam and employment scam as known cyber threat cases to the community.
- In 2023, the National Student Clearinghouse had a data breach which impacted hundreds of colleges that utilize their services, including EMU. Some EMU specific data was exposed.

Extent

The severity of cyber-attacks can be measured in terms of records breached or data compromised. The 2012 to 2013 EMU data breach, impacting 400 accounts, was the most severe. It should be noted that cyber-attacks affecting more individuals are possible.

Probability

Due to reports from University officials, upwards trends in cyber-attacks, and the potential for attacks that have not been discovered or reported, the probability assigned to a successful cyber-attack is likely (50 to 90 percent annual chance). It should be noted that the University experiences both attacks and threats routinely, however a majority of these are blocked prior to impacts occurring.

Vulnerability Assessment

All current and future university buildings (including critical facilities), infrastructure, and populations are potentially at risk, directly and indirectly, to cyber-attacks. Universities are especially vulnerable to cyber-attacks due to the large number of users on personal devices and use of open networks. Cyber-attacks can occur on an individual (i.e., viruses and malware) or large-scale basis (i.e., hacking of university databases, taking control of critical facilities).

Eastern Michigan University provides a dedicated faculty balance teaching and research to prepare students with relevant skills and real world awareness. Potential cyber-attacks may

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[171] Eastern Michigan University. (2023). *Cyber Security Awareness.* Division of Information Technology. Retrieved September 15, 2023 from https://www.emich.edu/it/security/cyber-security-awareness/index.php

be aimed at stealing information or intellectual property for personal, political, or financial gain, such as the releasing or selling of intellectual property or ground-breaking research, holding intellectual property for ransom, or destroying valuable research to further or promote a political agenda.

Further, cyber-attacks could be targeted at critical facilities and infrastructure, which the aim of harming life and property. Any software used for building or facility access control, or automated messaging, may also be at risk to cyber-attacks. **Table 4-51** shows buildings on campus that have critical IT infrastructure.

Table 4-51: EMU Buildings with Critical IT Infrastructure

Table Redacted

Additionally, databases containing sensitive personal information, such as those associated with the admissions and alumni offices, as well as servers storing or backing-up valuable or confidential personal data are vulnerable to cyber-attacks.

Overall, potential impacts of cyber-attacks on the university may include:

- Permanent or temporary loss of access to data (e.g., research, course websites, patient files, administrative information);
- Loss of important research;
- Monetary damages (e.g., lawsuits and other costs associated with breached personal information);
- Funds spend on investigations into attacks, providing notice and support to those affected, mitigation to parties affected (e.g., LifeLock); and
- Physical damage to property (and population impacts) stemming from losing control of software associated with the university's critical infrastructure.

Aside from the impacts listed above, the reputational impact on the University from a large-scale breach would be immense and may lead to people being fearful to conduct confidential research with the University. A large-scale breach could also result in difficulty recruiting students, faculty, and research partners. This would have a detrimental impact to the university, its mission, and its functionality.

Public Health Emergencies

Description

Public health risks, such as those presented by infectious diseases, vector-borne illnesses, water-borne illnesses, and chronic diseases, are present within every community. They include commonly occurring illnesses like the common cold and influenza, as well as less common inflictions such as bacteria-caused Escherichia coli ("*E. coli*") and mosquito-transmitted Zika virus.

The degree to which communities are susceptible to or actively experiencing public health issues can impact a community's vulnerability to natural hazards, as well as its ability to respond to disasters. For instance, an infectious disease outbreak may complicate evacuations or/and mass sheltering required due to a natural hazard. Similarly, high incidents of chronic diseases may decrease mobility within a community, and natural disasters may reduce access to vital healthcare services needed by the ill.

An infectious illness outbreak is the occurrence of a disease in excess of what would normally be expected in a certain geographic area, in this case the Eastern Michigan University's Ypsilanti campus. An outbreak may last only a few days or weeks but could also last several years. Further, a single case of a communicable disease not previously recognized in the defined area may also be recognized as an outbreak and require investigation[172]. An infectious illness outbreak is often referred to as an epidemic. An epidemic or outbreak can occur when there are sufficient numbers of a disease agent and susceptible hosts, and the agent is effectively conveyed from the source to hosts. The following mechanisms may result in an epidemic[173]:

- An increase in the amount and/or the potency of a disease agent
- The introduction of a disease agent into a new location
- An enhanced mode of transmission, increased exposure
- A change in the susceptibility of the host to the agent
- An increase in host exposure through new portals of entry
- An outbreak may occur in several different patterns, including:
- A common-source outbreak: a group of individuals are all exposed to an infectious agent or toxin from the same source (e.g., a group of patrons who all ate lettuce from a specific restaurant contract Hepatitis A)
- A propagated outbreak: a disease is transmitted by person-to-person contact, by a vehicle (e.g., needles), or by a vector (e.g., mosquito)
- A mixed outbreak: a common-source outbreak occurs and is then spread from person-to-person

Other outbreaks: a disease is not spread by either a common source nor propagated from person-to-person. This can be the result of sufficient interaction between humans and vectors (e.g., the epidemic of Lyme disease in the northeastern U.S. in the 1980s, in which the disease spread from deer to ticks to humans)

In addition to localized or regional epidemics, infectious illness outbreaks can also be pandemic in nature, meaning the outbreak occurs at the national or global level.

University campuses are recognized as being highly susceptible to infectious illnesses and outbreaks, due to living conditions (e.g., residence halls) and behaviors in which college students are in close proximity to one another (e.g., classrooms, sports teams, social gatherings). In recent years, a few notable infectious illness outbreaks on university campuses include:

- **2013-2014:** Nine students at Princeton University in New Jersey contracted serogroup B meningococcal meningitis (an infection of the brain and spinal cord that can cause brain damage and death)[174]

[172] World Health Organization, (n.d.). Disease Outbreaks, Retrieved on August 27, 2023, from https://www.emro.who.int/health-topics/disease-outbreaks/index.html
[173] National Geographic. (2022). Epidemic, Retrieved on August 27, 2023 from https://education.nationalgeographic.org/resource/epidemic/

[174] Centers for Disease Control and Prevention. (2014). Meningococcal Disease Update, Retrieved on August 27, 2023, from Meningococcal Disease Update | CDC Online Newsroom | CDC

- **2015-2016**: Hundreds of university students from Iowa and Illinois contracted mumps.[175]
- **2018**: About 100 students presented symptoms of a norovirus at Davenport University in Grand Rapids, Michigan. Officials decided to close the main campus for several days, which hosts 3,000 students.[176]
- **2020 - ongoing**: On March 27, 2020, a major disaster declaration was declared for the COVID-19 Pandemic response. Between 2020 and May 2021, over 700,000 COVID-19 cases were linked to American colleges and universities.[177]

Emerging infectious diseases are outbreaks of previously unknown diseases, known diseases that are rapidly increasing in incidence or geographic range over the last two decades, or the persistence of infectious diseases that cannot be controlled[178]. Since the 1970s, approximately 40 infectious diseases have been discovered including COVID-19[179]. In 2007, the World Health Organization (WHO) reported that infectious diseases are emerging at a rate that has never been seen before. With the trends of increased travel, population density, and closer contact with wild animals, the potential for emerging infectious disease-causing global epidemics is a major concern.

In addition to diseases, natural and human-caused hazards can also cause public health emergencies. For example, wildfires can travel and carry toxic smoke, triggering air quality alerts in regions far from the fire. A decline in air quality can cause short term and long-term damages to the respiratory system of populations.

Other events, such as severe water contamination (like the Flint Water Crisis) or hazardous materials spills, can also have serious public health consequences. These events are covered under the Technological and Industrial Hazards section of this chapter.

Location

The entire Ypsilanti campus is presumed to be equally at-risk to public health emergencies. Students living in residence halls, fraternity or sorority houses, or off-campus housing may be at a higher risk for contracting diseases. In addition, staff/students working at the campus health center may also by at a higher risk.

Previous Occurrences

The University deals with a range of public health emergencies whether they are isolated to campus, regional, or pandemics. Some, such as the **flu**, occur every year at levels that require planning and response from the University.

On March 27, 2020, a major disaster declaration was declared for the **COVID-19** Pandemic response. The University moved the spring semester online following the outbreak of the

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[175] Centers for Disease Control and Prevention. (2023) Mumps Cases and Outbreaks, Retrieved on August 27, 2023 from [Mumps | Cases and Outbreaks | CDC]
[176] Mlive (2018). Norovirus Outbreak closes Davenport University Campus, Retrieved on August 27, 2023, from [Norovirus outbreak closes Davenport University campus through Sunday - mlive.com]
[177] New York Times. (2021). Tracking Coronavirus Cases at U.S. Colleges and Universities, retrieved on August 27, 2023, from https://www.nytimes.com/interactive/2021/us/college-covid-tracker.html
[178] Johns Hopkins Medicine. (n.d.). Emerging Infectious Diseases, Retrieved on August 27, 2023, from https://www.hopkinsmedicine.org/health/conditions-and-diseases/emerging-infectious-diseases
[179] Baylor College of Medicine, (n.d.). Emerging Infectious Diseases, Retrieved on August 27, 2023, from https://www.bcm.edu/departments/molecular-virology-and-microbiology/emerging-infections-and-biodefense/emerging-infectious-diseases

pandemic. The University reinvented operations to resume classes on campuses including revising scheduling systems, designing new layouts for buildings, classrooms, and housing, and preparing comprehensive COVID health screening and compliance systems.[180] As the COVID-19 pandemic transitions to an endemic, the University has scaled back its response following CDC Guidance.

Diseases that have a high average annual incidence rate in Washtenaw County as reported by the county's Public Health Department are reported in **Table 4-52.**[181]

Table 4-52: Diseases with a high average annual incidence in Washtenaw County

Disease Name	Average Annual Cases between 2012-2022	Disease Classification
Campylobacter	61	Communicable – Food/ Waterborne
Salmonellosis	34	Communicable – Food/ Waterborne
Aseptic Meningitis (Viral)	30	Communicable – Meningitis/ Meningococcal
Lyme Disease	22	Communicable – Vector Borne
Chlamydia	1,566	Sexually Transmitted Disease
Gonorrhea	436	Sexually Transmitted Disease

There are other diseases that do not have recorded occurrences on campus but have the potential to impact the University. Other examples of diseases include the Measles, which is an ongoing significant concern that has impacted several institutions of higher education. Ebola was of concern in 2014 due to global attention to outbreaks. The Zika virus was also a concern in 2016 for higher education institutions, especially with the large number of students and faculty traveling to impacted areas, as well as visitors on campus from impacted countries. Additionally, the University specifically mentions Norovirus, Salmonella, and Influenza outbreaks as potential risks in its Emergency Response Procedures guide. [182]

Besides infectious diseases, there has been an uptick in wildfire smoke triggering air quality alerts across the United States. The EMU campus was affected by two events recently.

July 28, 2023: Wildfires in Canada travelled through Southeast Michigan causing air quality alerts throughout the region. As of noon on July 28, Detroit was ranked at No. 6 in the world for worst air quality. The haze from wildfire smoke lasted for several days. [183]

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[180] EMU Today. (2021). 'Dramatic Consequences' Eastern Michigan University President outlines how the pandemic has affected finances at Michigan's public universities, Retrieved on August 27, 2023, from 'Dramatic consequences.' Eastern Michigan University President James Smith outlines how the pandemic has affected finances at Michigan's public universities - EMU Today

[181] Health Department of Washtenaw County. (n.d.). Communicable Disease Data, Retrieved on August 31, 2023 from Communicable Disease Data | Washtenaw County, MI

[182] Eastern Michigan University. (2023). Emergency Response Procedures, A Guide for Faculty, Staff, Students and Visitors

[183] CBS News. (2023). Wildfire smoke from Canada triggers air quality alert in Michigan, Retrieved on September 13, 2023 from https://www.cbsnews.com/detroit/news/wildfire-smoke-canada-triggers-air-quality-alert-in-michigan/

June 29, 2023: Wildfires in Canada caused poor air quality for several days in almost all regions of Michigan. In the Detroit region, double-pollutant air quality alerts were issued for smoke and ozone for the first time in history. [184]

Extent

The severity of infectious illnesses is difficult to determine without detailed records. In addition, it is likely that many disease cases, such as the flu, go unreported.

COVID-19 had the largest overall impact on the University in recent history when considering number of cases, deaths, educational disruptions, and societal impacts. The University has incurred enormous expenses related to cleaning, testing and technology, with testing alone costing more than $1 million.[185] As a result of the COVID-19 pandemic, many universities, including EMU, became eligible for federal grant money due to expenses and forgone revenue related to the disruption of campus activities from the pandemic[186]. EMU was awarded $6.8 million under the Coronavirus Aid, Relief and Economic Security (CARES) Acts for institutional costs and student emergency relief. The University received an additional $673,000 in federal relief funds for institutional relief for disruption of activities caused by the pandemic. These numbers represent a piece of the financial impact COVID-19 had on the University. COVID-19 also impacted the number of enrollments in the University. In fall 2020, the University saw a drop of total new graduate and undergraduate students entering the school by 8.3 percent. [187] However, more severe events are possible.

Probability

The probability of public health emergencies impacting the University is variable, with a mix of chronic public health risks and acute outbreaks. Many public health risks occur seasonally and are ongoing, such as the common cold and influenza. Major outbreaks, such as the COVID-19 pandemic, are less common. Based on the information available regarding historic or current events, this hazard was assigned a probability of likely (50 to 90 percent annual chance).

Vulnerability Assessment

All current and future populations on the Ypsilanti campus are considered at risk to public health emergencies.

Buildings and infrastructure are not typically impacted by public health emergencies but may need to be sterilized or decontaminated in some cases. Infectious illness outbreaks can include an above average occurrence of a common disease, such as the flu, or a single case of a disease not formerly diagnosed on campus. As a University, the Ypsilanti campus has

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[184] Mlive. (2023). Unorecedented month of poor air quality in Michigan from wildfire smoke, Retrieved on September 16, 2023 from, Unprecedented month of poor air quality in Michigan from wildfire smoke - mlive.com

[185] EMU Today. (2021). 'Dramatic Consequences' Eastern Michigan University President outlines how the pandemic has affected finances at Michigan's public universities, Retrieved on August 27, 2023, from 'Dramatic consequences.' Eastern Michigan University President James Smith outlines how the pandemic has affected finances at Michigan's public universities - EMU Today

[186] Eastern Michigan University. (n.d.). Federal Student Emergency Relief Funds under the CARES Act, Retrieved on August 27, 2023 from Federal Student Emergency Relief Funds under the CARES Act (emich.edu)

[187] Eastern Michigan University. (2020). Fall 2020 Data Book, Retrieved on August 27, 2023, from EMU_Databook_2020_v2.pdf (emich.edu)

characteristics that make it vulnerable to infectious illnesses, include the close living quarters associated with residence halls and university housing, communal dining halls and bathrooms, and classrooms and libraries where large numbers of students work in close proximity to one another. These factors allow for diseases to spread quicker than they would in other settings. Further, the University receives visitors from all over the world, and has many faculty and students that travel abroad, increasing the risk of bringing a disease from another country or region back to campus.

Socially vulnerable populations may experience the impacts of public health risks at higher levels compared to less vulnerable populations. The elderly and immunocompromised may be more susceptible to contracted diseases, and may experience disproportionate impacts in terms of illness, missed work or school, required isolation, and/or medical costs. Economically stressed households, such as those living below the poverty line, may have troubling paying for preventative measures and medical care or taking needed time off to recover from an illness. Those who are mobility impaired or living in isolated areas without access to transportation may have issues accessing medical supplies, equipment, or care. Further, those living in crowded households (such as residence halls and apartments) may have difficulty quarantining when a member of the household is ill, leading to an increased likelihood or spreading disease. Single-parent households may face increased challenges with childcare during a public health emergency, for instance if daycares or schools are closed.

An infectious illness outbreak could have severe impacts for the University. Students, faculty, and staff who contract infectious diseases could become sick or die as a result of the illness. In extreme cases, classes may have to be canceled or the University may have to implement quarantines or campus reductions in operations in order to minimize the spread of disease. During the COVID-19 pandemic, the University had to move classes online, implement quarantines, run testing facilities, and severely alter operations. After actions taken during the COVID-19 pandemic, University officials noted feeling better equipped and prepared to handle a similar situation in the future.

When possible, the University takes precautions against infectious illnesses. Prior to and during flu season, the University encourages students to get flu shots, and promotes public awareness campaigns to self-quarantine if a student displays flu symptoms.

Aside from the public health impacts described above, the reputational impact on the University from a high-profile infectious illness outbreak would be immense and may lead to people being fearful come to campus or interact with students, staff, and facility.

Increases in temperature, precipitation, and humidity associated with climate change may all have impacts on public health. Warmer and wetter conditions create a more favorable environment for the growth and spread of some vector-borne infectious diseases, such as mosquito-borne viruses[188]. Insects also have a limited range of temperatures where they can live, which may bring new insects to the area or lead to the decline of others. Conversely, warmer, and more humid weather generally weakens the spread of certain respiratory illnesses, such as influenza.

Changing climate conditions may also lead to virus mutations and adaptation leading to a rise in emerging diseases. It will also shift habitats for wildlife and livestock, bringing different animals, and their diseases, closer to humans.

[188] Kingsland, J. (2020) How might climate change affect the spread of viruses?, Medical News Today, (2020), Retrieved on August 27, 2023, from https://www.medicalnewstoday.com/articles/how-might-global-warming-influence-the-spread-of-viruses

In addition to disease outbreaks, a decline in air quality due to wildfire smoke can affect populations. Wildfires can cause smoke to spread over much broader areas than the area that is actively burning, negatively impacting air quality. The smoke can carry large quantities of carbon dioxide, carbon monoxide, and particulate matter into the atmosphere. Because smoke from wildfires is a mixture of gases and fine particles from burning trees and other plant materials, it can irritate eyes and cause damage to respiratory systems causing shortness of breath, chest pain, headaches, asthma exacerbations, coughing, and death. For those with heart disease, rapid heartbeat and fatigue may be experienced more readily under smoky conditions. The World Health Organization identifies infants, children, women who are pregnant, and older adults as being more susceptible to health impacts from ash and smoke.

When air quality alerts are issued, populations must limit their time outdoors. The University campus may have several people, such as students, outdoors throughout the day, especially during class changes, that can be exposed to poor air quality. People engaged in outdoor activities during an air quality alert should reduce vulnerability by taking appropriate precautions such as wearing protective face masks and limiting exposure.

Terrorism and Similar Criminal Activities

Description[189]

Terrorism and Similar Criminal Activities are categorized as non-natural and non-technological human-caused hazards.

Terrorism is the use of violence to achieve political goals by creating fear. Terrorism can be distinguished from other violent crimes because it is politically motivated. Terrorism is carried out for a cause and is not used for the sole purpose of financial gain, personal revenge, or a desire for fame. While terrorist acts can be carried out by individuals, terrorists generally work in groups or networks. Terrorism is practiced by many different groups worldwide. The United States is threated by international terrorist groups, such as the Islamic State (ISIS), and by domestic or “home-grown” terrorist groups, such as groups using violence to advance racist, ecological, anti-abortion, and anti-government causes. Terrorists often seek great amount of media exposure, as the goal of terrorists is to frighten as many people as possible rather than to inflict the greatest amount of damage possible, and media exposure allows terrorists to reach more people than those who are directly involved in an attack.

Non-Terrorist Criminal Activities may resemble terrorist attacks but lack a political motive. These do not include routine crimes committed daily, but rather crimes that impact a large number of people. Such attacks may require resources beyond those available at the local level. Non-Terrorist Criminal Activities may be motivated by financial gain, a desire for fame or revenge, mental illness, or a combination of the above. Non-terrorist criminal activities can be committed by groups but are often carried out by a single criminal. The range of motives and lack of a formal network that characterizes many non-terrorist criminal activities makes them difficult to predict.

Universities and colleges may be more likely to be targeted by terrorists and criminals than other types of institutions. There could be several reasons for this: universities are historic symbols of education and independent thought, which could make them a target for terrorists

[189] Several of the terms, definitions, and examples in this section were adapted from the 2019 State of Michigan Hazard Mitigation Plan, along with other documented sources.

with counter-ideals; universities are home to infrastructure, research laboratories, medical facilities, and art/cultural collections that may be counter to a terrorist group's ideals; and, universities have high concentrations of students and faculty inside buildings and in outside spaces that are easily accessible.[190]

Below is a non-comprehensive list of crimes that may be perpetrated by terrorists or criminals carrying out similar activities, especially on a university campus:

- **Arson/use of incendiaries**: arson is the act of deliberately setting fire to property. Incendiaries are used to start fires. This tactic is typically used to harm property rather than to directly injure people and is therefore popular with animal rights terrorists or ecological terrorists looking to minimize casualties.

  One notable example of arson used by terrorists on a university campus is the Michigan State University Agriculture Building Arson (1999), in which terrorists affiliated with the Earth Liberation Front (ELF) set fire to the Agriculture Biotechnology Support Project classroom. The university was targeted because of its work on genetically modified crops. The fire was set when there were few people in the building. Damages to the building and research equipment totaled approximately $1 million. This attack, a similar attack against Michigan State in 1992, and an attempted attack against the Michigan Technological University Forestry Center in 2001 demonstrate the vulnerability of universities and research centers to terrorist attack.

  Previous instances of suspected arson and the risk assessment for fire related incidents are covered in the *Structural and Industrial Fires* profile.
- **Bomb threat:** a bomb threat is a threat, communicated by telephone, electronically, verbally, or in writing, to detonate an explosive device to cause property damage or casualties whether or not such a device exists. Bomb threats can occur annually at schools and universities and require the evacuation of the threatened building or area.
- **Chemical/biological weapons**: chemical weapons involve the use of poisonous materials, usually toxic gases. The impacts of a chemical attack are similar to those from a hazardous materials incident. Chemical attacks are rare in practice. Biological weapons involve the intentional release of disease organisms to cause illness and death. Biological agents can be released into air, food, or potable water sources. Biological weapons can also be used to contaminate crops or livestock, resulting in economic damages. It may be difficult to distinguish a biological weapons attack from a naturally occurring disease outbreak, as impacts may be similar. Therefore, biological weapons are not popular amongst terrorists looking to advance political motives. Further, deadly biological agents such as smallpox or anthrax are difficult to obtain, transport, and control. Therefore, use of biological weapons is considered rare.

  Although rare, there are several instances of biological weapons being used. One such example is the Amerithrax Anthrax Attack of 2001, in which letters contaminated with anthrax were mailed to locations in Washington, D.C., Florida, and New York, targeted at politicians and media figures. Twenty-two victims were confirmed, and five died as a result of anthrax infection. In 2008, it was discovered that the source of the attacks was an anthrax researcher who was likely hoping to spur funding for a project. [191]

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[190] Campus Safety Magazine. (2017). Why do Terrorists Target Colleges and Universities?, Retrieved on September 20, 2023 from Why Do Terrorists Target Colleges and Universities? - Campus Safety (campussafetymagazine.com)

[191] Federal Bureau of Investigation. (2011). Amerithrax or Anthrax Investigation, Retrieved on September 20, 2023 from Amerithrax or Anthrax Investigation — FBI

- **Cyber-attack** (covered separately, see profile)
- **Explosions:** explosives are the most common tool used by terrorists to carry out attacks. Commercial explosives, such as those used by mines, farms, and businesses can be easily obtained; alternatively, explosive devices can be built at home with commonly purchased materials. Explosive devices can be delivered to a site in a wide variety of ways, including car bombs, suicide vests, and packages left in an area or sent by mail. One especially detrimental tactic used by terrorists is a secondary device, in which a second explosive is detonated after emergency personnel and bystanders have gathered at the site of an initial explosion.

  One notable incident involving an explosive device is the Northwest Airlines Flight 253 Bombing Attempt (2009) on Christmas Day 2009. A terrorist with ties to al-Qaeda attempted to destroy Northwest Airlines Flight 253 as it approached Detroit Metropolitan Airport. The terrorist had concealed an explosive device in his underwear that failed to properly detonate.[192] This attack demonstrates the potential effectiveness of even small bombs when used against vulnerable targets such as an aircraft. It also demonstrates that international terrorism may be directed at targets in Michigan.
- **Infant/child abduction**: while infant or child abduction is not typically considered a non-terrorist criminal activity, in the university context, abduction from university-sponsored child-care facilities should be considered, especially when perpetrated by an individual known to the victim or when multiple children are abducted.
- **Infrastructure sabotage**: deliberate harm to or destruction of infrastructure can have wide-spanning consequences. Basic functionality of everyday systems and processes are dependent upon critical infrastructure such as highways, rail systems, airports, dams, bridges, power plants, and network communications systems. Further, these systems are often interconnected, meaning the failure of one can impact the ability of another to serve its purpose. Infrastructure sabotage is the deliberate act of targeting critical infrastructure. Infrastructure sabotage can result in significant economic damages (both physical and those stemming from disruption) and well as deaths and injuries.
- **Large-scale theft of collections, arts, and antiquities**: universities are often home to rare, highly valuable, and/or culturally significant collections of historic documents, artifacts, works of art, and other antiquities. Further, universities often have highly valuable equipment used in laboratories and research facilities. These items could make universities targeted for large-scale theft, especially considering the general open access of many university buildings.

  A high-profile example of such theft is the 1985 theft of a painting - Willem de Kooning's *Woman – Ochre* – from the University of Arizona Museum of Art. At the time, the painting was valued at $137 million.[193]
- **Mass shooting/active attacker**: Shooting attacks are popular among both terrorists and criminals, and usually involve the use of firearms to target a crowded area and/or a specific individual or group of individuals. Firearms such as rifles, pistols, and shotguns, including semi-automatic weapons with high magazine capacities, are easily available in the United States. Schools, universities, and workplaces are common places for mass shootings to occur, as are crowded venues with limited options for evacuation, such as theaters, auditoriums, and concert venues. These venues are also vulnerable to attackers' wielding knives or other dangerous weapons.

[192] The New York Times. (2009). Terror Attempt Seen as Man Tries to Ignite Device on Jet, Retrieved on September 20, 2023 from https://www.nytimes.com/2009/12/26/us/26plane.html
[193] NPR. (2015). Where's this painting? 30 years after its theft, nobody knows, Retrieved on September 20, 2023 from Where's This Painting? 30 Years After Its Theft, Nobody Knows : NPR

Although there is no universal definition for a mass shooting, the Congressional Research Service defines a mass shooting as one in which the gunman:

- Kills four or more people
- Selects victims randomly (rules out gang-related shooting and domestic violence)
- Attack occurs in a public place[194]

Mass shooting incidents have risen exponentially in the United States in recent decades. From 1916 to 1966, 25 mass shootings were recorded, compared with over 150 mass shootings in the next 51 years (including some of the deadliest shootings recorded).[195] A report from the FBI, released in 2014, found that even since 2000, mass shootings in the U.S. had risen exponentially, from 6.4 shootings annually between 2000 and 2006 to 16.4 shootings annually from 2007 to 2013.[196] **Figure 4-64** shows the magnitude and frequency of mass shooting occurrences in the U.S. since 1966.

Source: The Washington Post

Figure 4-64: Prevalence of Mass Shootings in the U.S. Since 1966

Similarly, deaths from mass shootings are on the rise. In the 1970s, mass shootings claimed an average of 5.7 lives per year; this figure rose to 14 in the 1980s, 21 in the 1990s, and 23.5 in the 2000s. From 2010 to 2019, the average has been 51 deaths per year.[197]

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194 Congressional Research Service. (2015). Mass Murder with Firearms: Incidents and Victims, 1999-2013

195 The Washington Post. (2021). The terrible numbers that grow with each mass shooting, Retrieved on September 20, 2023 from [Mass shooting statistics in the United States - Washington Post]

196 The New York Time. (2014). F.B.I. Confirms a sharp rise in Mass Shootings since 2000, Retrieved on September 20, 2023 from [F.B.I. Confirms a Sharp Rise in Mass Shootings Since 2000 - The New York Times (nytimes.com)]

197 The New York Times. (2019). Attacks aren't just increasing, they're getting deadlier, Retrieved on September 20. 2023 from [Opinion: We analyzed 53 years of mass shooting data. Attacks aren't just increasing, they're getting deadlier - Los Angeles Times (latimes.com)]

There have been several high-profile mass shootings at universities. Perhaps known as the first incident to be coined as a “mass shooting” in the era of mass media, the University of Texas or “Texas Tower” shooting of 1966 occurred after a student and prior marine killed 13 students and injured 30 more by shooting from the university’s clock tower.[198]

In November 2021, a 15-year-old fatally shot four students and injured seven others at his high school in Oakland County, near Detroit, Michigan. [199]

More recently, a shooting occurred at Michigan State University in February 2023 that killed three students and critically wounded five others. The shooting was committed by a lone shooter, who had no prior connections to the University, and took place in two separate buildings on campus.[200]

- **Radiological weapons:** Radiological weapons, sometimes referenced to as radiological dispersal devices or “dirty bombs,” are weapons designed to spread hazardous radiological materials. These devices do not create a nuclear explosion, but rather expose victims to radiation. Hospitals, food-processing centers, and research facilities possess radiological materials and may be targeted by terrorists looking to create a radiological weapon. There are no records of a radiological weapon being used in an attack but plans for radiological devices have been found in the possession of foreign and domestic terrorists.

  While not an example of a radiological weapon, a small amount of weapons-grade radioactive plutonium was discovered missing from a research facility at Idaho State University in 2018. The amount stolen was reported as being enough to develop a “dirty bomb.” This event highlights the need for such facilities to carefully track, monitor, and secure radiological materials.[201]

- **Special event disruption**: special event disruptions can include one or more of the other criminal activities described here, such as a vehicle ramming or detonation of an explosive device but require special consideration and planning as they involve a large number of people coming together for a specific reason (e.g., a sporting event, concert, parade, graduation ceremony). Special events draw above average crowds of people, often concentrated into a small area, making them especially vulnerable to a terrorist attack or similar criminal activity. Further, during such an attack there is potential for injuries or deaths due to trampling while people rush to evacuate the venue.

  One such example of a special event disruption is the 2016 Bastille Day attack in Nice, France. During the attack, a driver drove a lorry into a crowd watching a fireworks display, killing 86 people, and injuring 303.[202]

- **Vehicle-borne attack/ vehicle ramming**: like the event described above, a vehicle-borne attack is characterized by a terrorist or criminal using a vehicle as a weapon, typically by driving it into a crowd of people. Another example of a vehicle-borne attack was an attack at Ohio State University in 2016 where a student intentionally

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[198] The Texas Tribune. (2022). Essay: America’s first modern mass shooting never really ended, Retrieved on September 20, 2023 from Essay: America’s first modern mass shooting never really ended | The Texas Tribune

[199] CNN. (2022). Teen pleads guilty to terrorism and murder charges after Michigan school shooting that killed 4 students, Retrieved on September 26, 2023 from Ethan Crumbley: Teen pleads guilty to terrorism and murder charges after Michigan school shooting that killed 4 students | CNN

[200] The Guardian. (2023). Shooter at Michigan State who killed three had no ties to school, officials say, Retrieved on September 20, 2023 from Shooter at Michigan State who killed three had no ties to school, officials say | Michigan | The Guardian

[201] Daily News. (2018). Idaho State University says it lost a piece of weapons-grade plutonium, Retrieved on September 20, 2023 from, Idaho State University says it lost a piece of weapons-grade plutonium – New York Daily News (nydailynews.com)

[202] BBC News. (2016). Nice Attack: What we know about the Bastille Day Killings, Retrieved on September 20, 2023 from Nice attack: What we know about the Bastille Day killings - BBC News

rammed a car into a busy sidewalk and began slashing passers-by with a butcher knife. 11 students were injured in the attack. The attack suspect was shot and killed by a university police officer within a minute of the attack. [203]

Location

The entire campus is considered at risk to terrorism and similar criminal activities. Large gathering spaces, such as quads, sporting arenas, and auditoriums may be at a higher risk, along with potentially controversial research facilities. Additionally, mass shooting instances in the United States have increased by 75% in the 10-year period from 2011-2021. [204] In the schoolyear 2021-22, the United States reported 193 incidences of school shootings as compared to 69 the previous year, indicating a 211% year on year increase. [205]

Previous Occurrences

The University has not experienced a large-scale act or terrorism or similar criminal activity to date. The University has received reports of weapons, including guns, or campus, as well as threatening or erratic behavior. Bomb threats have also been reported in the past. In 2012, a high-school student in Ypsilanti called in a fake bomb threat at a graduation ceremony taking place in the EMU convocation center. The threat was dismissed after the local police department traced the calls to the student's number. [206]

According to the Annual Fire Safety and Security Report, the campus has also experienced intentionally started fires, although none of these incidents resulted in deaths, injuries, or damages. Details of these incidents are covered in the *Structural and Industrial Fires* section of this report.

Additionally, several instances of terrorism crime were reported close to campus or have had impact on the University. These details were gleaned from local news reports and are described below.

May 2023, EMU graduate killed in Texas shooting: An EMU graduate was killed in a mass-shooting that took place in a Texas mall. The University mourned her death with a remembrance ceremony. The event also brought up repeated fear in the EMU community following the shootings at Michigan State University (MSU) in February the same year. [207]

February 2023, MSU Shootings: The mass shooting at another university in the state raised alarm bells in the EMU campus where additional police staffing was deployed on the

[203] New York Times. (2016). Suspect is Killed in Attack at Ohio State University that Injured 11. Retrieved on September 20, 2023 from [Suspect Is Killed in Attack at Ohio State University That Injured 11 - The New York Times (nytimes.com)]

[204] Katsiyannis. A. et. al. (2023). An Examination of US Mass Shootings, 2017-2022: Findings and Implications, National Library of Medicine

[205] Everytown Research and Policy. (2023). How to Stop Shootings and Gun Violence in Schools, Retrieved on September 26, 2023 from [How To Stop Shootings and Gun Violence in Schools: A Plan to Keep Students Safe | Everytown Research & Policy]

[206] The Ann Arbor News. (2012). Ypsilanti student accused of making bomb threat at graduation ceremony, Retrieved on September 20, 2023 from [Ypsilanti student accused of making bomb threat at graduation ceremony (annarbor.com)]

[207] Detroit Free Press. (2023). Eastern Michigan University graduate among 8 dead in Texas mall shooting, Retrieved on September 20, 2023 from [Eastern Michigan grad Aishwarya Thatikonda killed in Texas shooting (freep.com)]

day for increased surveillance. The incident also caused fear and panic amongst the students and staff at EMU. [208]

February 2022, Shots fired on the EMU Campus: Two individuals fired shots at each other near the residential building on the EMU campus at 3am. The individuals were unidentified. No injuries or deaths were reported. [209]

September 2021, Suspect Homicide near EMU campus: A 21-year-old man was killed in a shooting near the EMU campus. The suspected shooter was reported to have stopped outside the University's Physical Plant's main entrance before driving away from the scene. The University reminded its community of public safety measures following the incident. [210]

In addition to these reports, several respondents in EMU's public input survey reported witnessing or being impacted by crime and violence on or near campus. The reports included one instance of an armed robbery, and several instances of theft and sexual assault. Additionally, several respondents reported instances when active shooter threats were suspected on campus.

Extent

With limited previous incidents on campus, the severity of terrorism and similar criminal activities on campus is difficult to determine. However, a catastrophic event resulting in deaths, injuries, and/or destruction of property is possible on the EMU campus.

Probability

Although the campus does not have a history of terrorism or similar criminal activities, schools and universities have seen an uptick in large scale criminal activities in recent years, particularly in active shooter incidents. Due to the University's size and reputation, a probability of possible (between 10 percent and 50 percent annual chance) was assigned to this hazard.

Vulnerability Assessment

All current and future buildings (including critical facilities), infrastructure, and populations on the EMU campus are considered at risk to terrorism and similar criminal activities. As a university, the campus is vulnerable to terrorist and criminal acts due to its concentrated populations of students, staff, and faculty, its accessibility, and the presence of valuable and potentially high-profile operations and facilities.

During normal hours, most buildings on campus are accessible to anyone. Public outdoor spaces on campus are crowded, especially during class changes, and are also accessible to anyone. The University has a system in place to alert students, faculty, and staff of terrorist and/or similar criminal activities, such as an active attacker. The system is operated from the EMU Public Safety Communications Center and is activated in the event of an emergency or potentially dangerous situation. The University also provides shelter in place and emergency

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[208] Today Emich. (2023). MSU Shooting Incident: EMU Administration message to campus community, Retrieved on September 20, 2023 from [MSU shooting incident: EMU Administration message to campus community - EMU Today (emich.edu)]

[209] The Eastern Echo. (2022). Police investigate shots fired on Eastern Michigan University Campus, Retrieved on September 20, 2023 from [Police investigate shots fired on Eastern Michigan University campus | The Eastern Echo]

[210] The Eastern Echo. (2021). Man killed in shooting near Eastern Michigan University's campus, police say, Retrieved on September 20, 2023 from [Man killed in shooting near Eastern Michigan University's campus, police say | The Eastern Echo]

response guidelines for active attacker situations in its Emergency Response Guide. Additionally, EMU has adopted the ALICE (Alert, Lockdown, Inform, Counter and Evacuate) program to teach the proactive measures that people can take when faced with an assailant entering a building or classroom. The ALICE program conducts routine training sessions for campus members.[211]

Aside from the above, the University's Ypsilanti campus has unique features that make it vulnerable to terrorism and criminal activities. Universities tend to be very transient communities and therefore can be attractive environments. Additionally, the University's research institutions could make it more vulnerable to terrorists and criminal acts. Further, the presence of chemicals and other materials on campus make the facilities housing them potentially vulnerable. There is also the potential for theft of university research materials, such a radiological materials or biological agents, to develop weapons.

The University hosts specials events at some of its facilities, during which vulnerability to terrorism and similar criminal activities is heightened. Sports centers on campus that house large crowds are vulnerable to attacks on game days. With high concentrations of people in such a small area, the stadium, and the area around it are vulnerable to active shooter attacks, vehicle ramming, bombings, and other violent acts. Unmanned Aerial Vehicles (UAV/ drones) also pose a threat on game days.

The University hosts speakers and concerts that could be vulnerable to attacks. Venues such as the Pease Auditorium, which seats 1,700 people, may be vulnerable in these instances.

Gun violence is also shown to have disproportionate impacts on students of color. Per a recent report, black children despite constituting of only 15% of total K-12 school population in America, constitute of 25% of the K-12 student victims who were killed or shot and wounded on school grounds. [212]

Finally, it is possible that climate change may lead to more instances of violent crime, as studies show a positive correlation between warmer temperatures and crime.[213]

Aside from the impacts listed above, the reputational impact on the University from a high-profile terrorist or criminal activity, especially a violent one, would be significant and may lead to difficulty recruiting students, faculty, and research partners. This would have a detrimental impact to the university, its mission, and its operations.

Summary of Overall Risk

This section summarizes overall vulnerability by looking at several measures including the priority risk index results, ranking of hazards, and key points on vulnerability.

Priority Risk Index Results

The PRI results are presented in the following table by the order they are presented in the plan (**Table 4-53**). This information was used to inform the ranking of hazards.

[211] EMU. (N.d.) Active Shooter Response Training, Risk and Emergency Management, Retrieved on September 20, 2023 from Active Shooter Response Training - Eastern Michigan University (emich.edu)
[212] Everytown research & Policy. (2021). The Impact of Gun Violence on Children and Teens, Retrieved on September 26, 2023 from The Impact of Gun Violence on Children and Teens | Everytown Research & Policy
[213] CBS News. (2012). Hot and bothered: Experts say violent crime rises with the heat, Retrieved on September 8, 2023, from Hot and bothered: Experts say violent crime rises with the heat - CBS News

Table 4-53: PRI Results

Hazard	Probability	Impact	Spatial Extent	Warning Time	Duration	PRI Score
Dam Failure	Unlikely	Minor	Negligible	Less than 6 hours	More than one week	**1.6**
Drought	Highly Likely	Minor	Moderate	More than 24 hours	More than one week	**2.6**
Flood and Extreme Precipitation	Likely	Critical	Large	Less than 6 hours	More than one week	**3.4**
Extreme Cold/Wind Chill	Likely	Critical	Large	More than 24 hours	Less than one week	**3.0**
Extreme Heat	Likely	Critical	Large	More than 24 hours	Less than one week	**3.0**
Hail	Highly Likely	Minor	Small	Less than 6 hours	Less than 6 hours	**2.4**
Lightning	Highly Likely	Minor	Negligible	Less than 6 hours	Less than 6 hours	**2.2**
Severe Winter Weather	Highly Likely	Critical	Large	More than 24 hours	Less than one week	**3.3**
Severe Wind	Highly Likely	Critical	Large	12 to 24 hours	Less than 24 hours	**3.3**
Tornado	Possible	Catastrophic	Large	Less than 6 hours	Less than 6 hours	**3.1**
Earthquake	Possible	Minor	Large	Less than 6 hours	Less than 6 hours	**2.2**
Hazardous Materials Incident	Likely	Limited	Small	Less than 6 hours	Less than 24 hours	**2.5**
Nuclear Power Plant Incidents	Unlikely	Minor	Large	More than 24 hours	More than one week	**1.9**
Petroleum and Natural Gas Pipeline Accidents	Unlikely	Minor	Large	Less than 6 hours	Less than one week	**2.1**
Power Outages	Unlikely	Critical	Large	Less than 6 hours	Less than 6 hours	**2.5**
Structural and Industrial Fires	Highly Likely	Limited	Negligible	Less than 6 hours	Less than 6 hours	**2.5**
Water Contamination	Likely	Limited	Small	Less than 6 hours	More than one week	**2.7**
Civil Disturbances	Possible	Critical	Moderate	6 to 12 hours	Less than one week	**2.7**
Cyber-attacks	Likely	Limited	Moderate	Less than 6 hours	Less than one week	**2.8**
Public Health Emergencies	Likely	Critical	Small	More than 24 hours	More than one week	**2.7**
Terrorism and Similar Criminal Activities	Possible	Catastrophic	Moderate	Less than 6 hours	Less than 6 hours	**2.9**

Hazard Ranking

Hazards were ranked based on PRI results, public survey results, and risk assessment findings. The rankings were reviewed and confirmed by the Mitigation Planning Committee and vetted during a public meeting. Rankings within each category (high, moderate, or low) are presented along with PRI score in **Table 4-54.**

Table 4-54: EMU Hazard Rankings

2023 EMU Hazards		PRI Score
High	Flood and Extreme Precipitation	3.40
	Severe Wind	3.30
	Severe Winter Weather	3.30
	Tornado	3.10
	Extreme Cold/Wind Chill	3.00
	Extreme Heat	3.00
	Terrorism and Similar Criminal Activities	2.90
Moderate	Cyber-attacks	2.80
	Water Contamination	2.70
	Civil Disturbances	2.70
	Public Health Emergencies	2.70
	Drought	2.60
	Hazardous Materials Incident	2.50
	Power Outages	2.50
	Structural and Industrial Fires	2.50
Low	Hail	2.40
	Earthquake	2.20
	Lightning	2.20
	Petroleum and Natural Gas Pipeline Accidents	2.10
	Nuclear Power Plant Incidents	1.90
	Dam Failure	1.60

Several key points on vulnerability for specific hazards with the potential to impact EMU include:

- **Flooding and Extreme Precipitation:** The campus is not within a mapped FEMA flood hazard area. However, the University has experienced stormwater flooding, especially due to stormwater entering the campus from off-site. Extreme precipitation events are likely to increase in frequency and severity due to climate change.

- **Extreme Heat:** The University is likely to experience increased extreme heat days and heatwaves as the climate changes. Buildings without air conditioning may need to have HVAC systems installed, and outdoor activities may need to be restricted during the hottest part of the day.

- **Tornado:** While EMU has not been directly impacted by a tornado event, the frequency of tornado occurrences in the state is increasing, and several catastrophic tornado events have been reported in Washtenaw County. During public outreach, many students indicated they did not know where to go or what to do in the event they heard tornado sirens.

- **Hazardous Materials Releases:** The University has several buildings on campus considered high risk due to the presence of hazardous materials. The presence of hazardous materials on campus, at nearby facilities, and proximate to the campus via transportation systems, means EMU is considered at risk to hazardous materials releases.
- **Power Outages:** The University maintains its own power cogeneration facility to serve 98 percent of buildings on campus, and secondary backup power can be provided by DTE if needed. In addition, the campus maintains several portable generators, reducing the risk of prolonged power outages on campus.
- **Cyber-Attacks:** The University remains vulnerable to cyber-attacks given the use of open networks and storage of sensitive material but has taken measures to detect and prevent such incidents on campus. A combination of public education, IT infrastructure hardening, and cyber hygiene helps reduce risk to cyber-attacks on campus.
- **Terrorism and Similar Criminal Activities:** While the University has not experienced an active attacker, concerns remain on campus, especially for active shooter threats. This hazard was selected by far as the hazard considered to pose the greatest threat by public survey respondents.

Section 5 – Capability Assessment

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Introduction

The purpose of conducting the *Capability Assessment* is to determine the ability of Eastern Michigan University (EMU) to implement a comprehensive mitigation strategy and to identify potential opportunities for establishing or enhancing specific mitigation policies, programs, or projects.[1] In any planning process, it is important to establish which goals, objectives, and actions are feasible based on an understanding of the organizational capacity of those departments tasked with their implementation. The capability assessment helps to determine which mitigation actions are practical, and likely to be implemented over time, given the University's planning and regulatory framework, level of administrative and technical support, amount of fiscal resources, and current political climate.

The *Capability Assessment* has two components: 1) an inventory of the University's relevant plans or programs already in place and 2) an analysis of its capacity to carry out current and future programs, plans, and projects. Careful examination of EMU's capabilities will detect existing gaps or shortfalls within university activities that could hinder proposed mitigation activities and possibly exacerbate hazard risks. A capability assessment also highlights the positive mitigation measures already in place or being implemented by the University, which should continue to be supported and enhanced through future mitigation efforts.

The *Capability Assessment* completed for the *2024 Eastern Michigan University Hazard Mitigation Plan* serves as a critical planning step and an integral part of an effective hazard mitigation strategy. Coupled with the *Risk Assessment* (Section 4), the *Capability Assessment* helps identify and target meaningful mitigation actions for incorporation in the *Mitigation Strategy* (Section 6) portion of this plan. Any potential shortcomings in the ability of EMU to implement hazard mitigation is tied to the mitigation strategy in the form of actions selected by the planning team. The capability assessment not only helps establish the goals and objectives for the University to pursue under this plan, but it also ensures that those goals and objectives are realistically achievable under given local conditions. Specific recommendations for actions that will improve EMU's ability to implement the hazard mitigation plan and increase resilience are offered at the conclusion of this section.

Conducting the Capability Assessment

The *Capability Assessment* began with a request of pertinent plans from the hazard mitigation plan leadership team. The request asked for existing local plans, policies, or programs related to hazard mitigation or emergency management. A summary of the requested plans is outlined in **Table 5-1**. Not all plans requested were considered pertinent to EMU. In addition, the consultant team conducted conversations with key university stakeholders (e.g., Athletics, Academic and Student Affairs, Budget Office / Business and Finance, Communications, Public Safety, Environmental Health and Safety, Facilities Maintenance, Facilities Planning and Construction, Information Technology, Network and System Services, Risk and Emergency Management, Public Safety) to determine if there are any policies or programs that contribute to and/or hinder the University's ability to implement hazard mitigation. Understanding general university procedures is an important consideration with respect to hazard mitigation implementation.

Table 5-1: Requested Plans for Capability Assessment

Requested Plan	Available from EMU	Notes
Comprehensive Land Use Plan / University Campus Planning	N/A	EMU is working on the campus planning effort. This will include a Small Area Plan and an Open Space/Landscape Plan. Data from this planning

[1] While the Final Rule for implementing the Disaster Mitigation Act of 2000 does not require a local capability assessment to be completed for local hazard mitigation plans, it is a critical step in developing a mitigation strategy that meets the needs of the region while taking into account their own unique abilities. The Rule does state that a community's mitigation strategy should be "based on existing authorities, policies, programs and resources, and its ability to expand on and improve these existing tools" (44 CFR, Part 201.6(c)(3)).

Requested Plan	Available from EMU	Notes
		process was used to inform the hazard mitigation plan.
EMU Long Range Transportation Plan	N/A	
Evacuation Plan	✓	Evacuation plans for each building and campus are available
Transit, Bike, and/or Pedestrian Plan	N/A	EMU does not maintain its own transit service.
Liquid Damage Prevention and Flood Response Plan	✓	Developed in 2023.
Climate Action Plan / Sustainability Plan	N/A	
EMU Hazard Mitigation Plan	✓	
EMU Water Management Plan / Drought Plan	N/A	Water is provided by the City of Ypsilanti.
Campus Stormwater Management / Green Infrastructure Plan	N/A	EMU maintains a Stormwater Plan. Updating the Stormwater Management Plan has been noted as a Mitigation Action to include in the plan (Section 6).
Watershed Management Plan / River Management Plan	N/A	
Electrification Plan	N/A	Currently reviewing path forward for electrification plan
Continuity of Operations Plans/SOP	✓	EMU has a campus-wide Business Continuity Plan that is in the process of being updated and enhanced; departmental COOPs are in-progress.
Shelter Plan	✓	
Emergency Warning/Crisis Communications Plan	N/A	EMU has a number of emergency warning systems; however, there is no formalized emergency communications plan.
EMU Emergency Management /Operations Plans	✓	
Equity Plans	N/A	
Capital Improvement Plan	✓	EMU provided Capital Outlay Plan FY2024.
Enrollment Projections/Trends	✓	Included in Capital Outlay Plan FY2024.
Sporting Events Plan	✓	EMU provided an example of University Operations Plan for a football game. Unique plans are created for each large events held on campus.
Economic Development Plan	N/A	
EMU Pandemic Response Plan	✓	

At a minimum, results provide an extensive inventory of existing campus plans, programs, and resources that are in place or under development in addition to their overall effect on hazard loss reduction. However, the information can also serve to identify gaps or conflicts that the University can recast as opportunities for specific actions to be proposed as part of the hazard mitigation strategy. The results of this *Capability Assessment* provide critical information for developing an effective and meaningful mitigation strategy.

Emergency Management

Hazard mitigation is widely recognized as one of the four primary phases of emergency management. The three other phases include preparedness, response, and recovery. Each phase is interconnected, as **Figure 5-1** illustrates. Opportunities to reduce potential losses through mitigation practices are often implemented before a disaster event strikes, such as flood-proofing of flood prone structures, installing back-up power sources, or enhancing security measures. Mitigation opportunities will also be presented during immediate preparedness or response activities, such as activating emergency response teams prior to severe storms, and certainly during the long-term recovery and redevelopment process following a hazard event.

Planning for each phase is a critical part of a comprehensive emergency management program and a key to the successful implementation of hazard mitigation actions. As a result, the *Capability Assessment* assesses the University's willingness to plan and their level of technical planning proficiency.

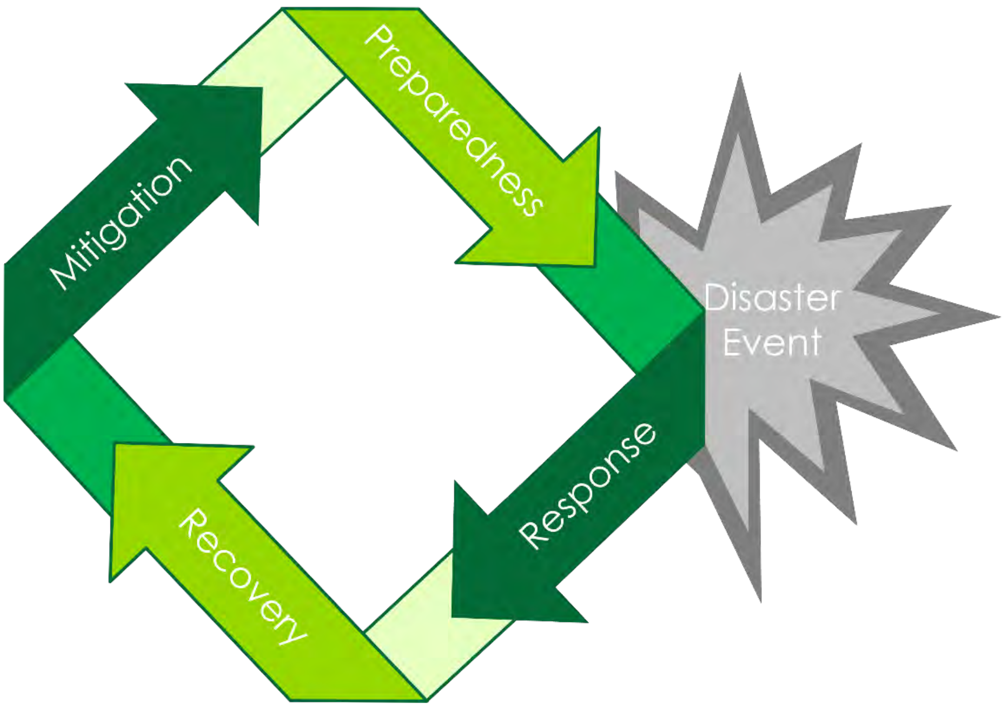

Figure 5-1: The Four Phases of Emergency Management

Hazard Mitigation Plan: A hazard mitigation plan (HMP) represents a community or University's blueprint for how it intends to reduce the impact of natural and human-caused hazards on people and the built environment. The essential elements of a hazard mitigation plan include a Risk Assessment, Capability Assessment, and Mitigation Strategy.

This plan serves as an update to EMU's first stand-alone hazard mitigation plan, the 2013 Multi-Hazard Mitigation Plan. As EMU's 2013 HMP expired in 2018, and Washtenaw County, where the University resides, does not have an active HMP, the University was not covered by a local HMP during plan development and will not be covered until approval and adoption of this plan.

The 2013 plan centered on EMU's main campus in Ypsilanti. It addressed all identified hazards at a high level with each hazard categorized as low, medium, or high risk. For hazards deemed to be high risk, a more in-depth analysis was conducted. The 2013 plan incorporated information from the City of Ypsilanti and Washtenaw County Hazard Mitigation Plans current at the time. These plans have since expired but were still referenced to provide historical context to this plan. At the state level, EMU is covered under the State of

Michigan Hazard Mitigation Plan. Because universities are classified as a local government, they are eligible for all hazard mitigation funding and education programs administered by the State. Specifically to universities, the State plan provides information regarding civil disturbances on campuses and fire protection in university residence halls.

Disaster Recovery Plan: A disaster recovery plan serves to guide the physical, social, environmental, and economic recovery and reconstruction process following a disaster. In many instances, hazard mitigation principles and practices are incorporated into local disaster recovery plans with the intent of capitalizing on opportunities to break the cycle of repetitive disaster losses. Disaster recovery plans can also lead to the preparation of disaster redevelopment programs and projects to be enacted following a hazard event. The IT department has a disaster recovery plan. EMU has a campus-wide Business Continuity Plan that is in the process of being updated and enhanced and departmental COOPs are in-progress.

Comprehensive Emergency Management Plan: A comprehensive emergency management plan (CEMP) outlines responsibilities and the means by which resources are deployed during and following an emergency or disaster. The CEMP is being updated and will be called the Integrated Emergency Management Plan (IEMP). EMU's CEMP includes a Basic Plan and series of Incident Annexes including Active Assailant Incident Awareness and Response, Bomb Threat and Suspicious Package Procedure, Campus Evacuation Procedure, Direction and Control, Liquid Damage Prevention Plan and Flood Response Protective Actions, and Public Information and Crisis Communications.

During the hazard mitigation planning process, the CEMP was being updated to better integrate, reference, and align with other University plans and policies as appropriate, such as this hazard mitigation plan and even specific mitigation actions. The CEMP also functions as the University's Emergency Operations Plan (EOP).

EMU's Emergency Management Office is responsible for reviewing and updating their CEMP. The CEMP defines roles and responsibilities for University staff and students and outlines how the University will coordinate an appropriate response in the event of an emergency or disaster. The CEMP is designed to function in unison with various other University plans, such as the Continuity of Operations (COOP), and focuses on two main components of emergency management: 1) planning and preparation and 2) response and recovery.

The CEMP establishes two broad teams utilized during any University emergency response: The Crisis Management Team (CMT) and the Emergency Response Team (ERT). The CEMP describes the purpose of each team, both of which are comprised of University staff, and outlines specific responsibilities for each team. The CMT is made up of the EMU's executive leadership and, directed by the President, makes strategic decisions and approves applicable policies during an event. The ERT is comprised of university staff with technical and tactical expertise, based on the type of emergency event. The ERT is further broken down into four sections (Operations, Planning, Logistics, and Finance) which each serve a role in the prevention and response to an emergency event.

The plan also establishes 16 emergency support functions (ESFs) which are based on the National Response Framework. These ESFs provide a structure for interdepartmental coordination and outlines responsibilities for common tasks that are frequently needed during an emergency response. The ESFs assign a primary and supporting lead for each function and facilitates smooth transition from preparedness to response, to recovery activities. A list of the ESFs is below:

- ESF-1: Transportation & Roads
- ESF-2: Emergency Communications
- ESF-3: Facilities & Engineering
- ESF-4: Fire Fighting
- ESF-5: Emergency Management
- ESF-6: Mass Care, Housing & Human Services
- ESF-7: Logistics & Resource Management
- ESF-8: Health & Medical Services
- ESF-9: Search & Rescue

- ESF-10: Hazardous Materials Response
- ESF-11: Agriculture & Natural, Cultural, Historic Resources
- ESF-12: Energy
- ESF-13: Public Safety & Security
- ESF-14: Long-Term Recovery
- ESF-15: External Affairs (Public Information)
- ESF-16: Information Technology

Liquid Damage Prevention Plan and Flood Response Incident Annex: The Incident Annex is a component of the CEMP and details actions that should be considered to effectively limit property damage and to respond to a flood event impacting the EMU campus. The Liquid Damage Prevention Plan (LDPP) portion of the annex consists of assessments and inspections that help to identify potential sources of liquid damage, prepare to address and correct issues when found, and build a database of items to check on an annual basis for each building on campus. The Flood Response Plan (FRP) portion of the annex provides guidance to EMU staff in the conduct of emergency operations across the life cycle of stormwater, no-notices, and other flood events.

Business Continuity Plan and Continuity of Operations Plans: A continuity of operations plan (COOP) establishes a chain of command, line of succession, and plans for backup or alternate emergency facilities in case of an extreme emergency or disaster event. EMU published their most recent version of the Campus-Wide Business Continuity Plan (BCP), which serves as the COOP, in April 2023. The EMU Emergency Management Office (EM) prepared the BCP and it is designed to work in conjunction with the University's CEMP and this HMP. The BCP's intent is to provide a framework for continuing essential functions in the event of a local or regional emergency for up to 30 days. The University is also expanding their COOP program by developing departmental COOP plans for all campus departments. Continued development of departmental COOPs has been identified as a mitigation action.

Evacuation Plan: An evacuation plan provides an evacuation strategy for all or part(s) of a jurisdiction in the event that a life safety threat or hazard occurs or is projected to occur. The evacuation plan is meant to facilitate the safe, timely, and efficient evacuation of an area. An evacuation plan provides a general outline of the expected roles, responsibilities, and evacuation-related response activities during an evacuation. EMU EM, in collaboration with the EMU Public Safety and other campus partners, has developed a Campus Evacuation Procedures Plan, which was last updated in July 2018. EMU Public Safety is primarily responsible for executing evacuation procedures, with support from Facilities Management (as the situation allows). The plan establishes initiation procedures, identifies evacuation routes for the entire main campus, including the athletic facilities, and discusses returning to campus following an evacuation.

Building Emergency Plans: Each residential building on EMU's campus has a Building Emergency Plan (BEP). The BEP outlines emergency procedures for a variety of scenarios and is tailored to the layout and location of each building. The BEP touches on training and executing drills with staff and residents (if applicable). Additionally, the BEP describes communication methods and procedures to be used during an incident. This includes phone numbers for various EMU departments, medical facilities, and describes emergency notification systems used by EMU. There are incident response procedures for a number of situations, including: suspicious behavior, a threatening situation, secure or shelter-in-place scenarios, an evacuation, tornado warnings and watches, and medical emergencies.

Sporting and Special Events Plans: The University develops an operations plan for large sporting events and special events held on campus to facilitate operation and outlines potential emergency response actions during the event. These plans are each unique and vary greatly depending on the size and location of the event. The operation plans are designed to prepare EMU Public Safety staff for the event by outlining a schedule, organizing traffic control (if necessary), and describing any potential hazards or threats that may occur during the event and an appropriate response.

Emergency Communication: EMU uses several emergency communication systems to communicate with students and staff in an emergency; these are listed below. EMU Public Safety operates a Communications Center which administers the notifications. In addition to University run notification systems listed below, Washtenaw County Emergency Management operates outdoor warning sirens that are activated for sever weather events or other emergencies.

- Emergency Text Alert System
- Alertus Desktop and VOIP Alert System
- Blue Light Phones and Emergency Assistance Stations
- Fire Alarms and Voice-Over Fire Alarms
- Outdoor Public Address System
- EMU Website
- WEMU 89.1 FM Radio Station

Non-Emergency Communication: While there is not in a formal plan in place, the University has a program in place to send reminders to faculty and staff with precautions to prevent pipes from freezing and bursting, such as closing windows near pipes. These reminders go out several times throughout the winter season, generally in late fall and prior to staff leaving for the holidays. The University also uses university websites, local media outlets, and social media to advise students on severe weather (e.g., dressing appropriately for extreme cold and winter weather) or theft prevention (e.g., locking bikes).

Pandemic Response Plan: Public health emergency preparedness and response is a facet of hazard mitigation planning that has received renewed attention following the COVID-19 pandemic, which resulted in both a federally declared national emergency and a federally declared public health emergency. In response to impacts from the COVID-19 pandemic, the University released their first ever Pandemic Response Plan (PRP) in 2023. A pandemic or epidemic response plan is particularly relevant to a university setting, where faculty, students, and staff live and/or work in close proximity to each other. By having a plan in place ahead of time, the University will be able to react quickly in the event of a public health emergency, minimizing the impact on essential academic and administrative functions. EMU's PRP is aimed at preparing for and responding to communicable disease outbreaks. The PRP establishes a 4 pandemic classification stages which will be designated by the University President in the event of an outbreak. The plan outlines a chain of command and outlines communication methods and actions to be taken by various University departments, depending on the stage of pandemic declared. The plan also outlines roles and responsibilities for students and staff at a general level, as well as outlining specific roles for 11 different University departments including the President's Executive Council, Public Safety, EHS, Financial Aid, Administration, and Housing and Residential Life.

Planning and Regulatory Capability

Planning and regulatory capability is based on the implementation of plans, policies, and programs that demonstrate the University's commitment to guiding and managing growth, while maintaining the general welfare of the community. It includes emergency response and mitigation planning, master planning, capital planning, and enforcement of design and construction standards. Although conflicts can arise, these planning initiatives present significant opportunities to integrate hazard mitigation principles into the University decision making process.

This assessment is designed to provide a general overview of key planning tools and programs at EMU along with their potential effect on hazard mitigation. This information will help identify opportunities to address existing gaps, weaknesses, or conflicts with other initiatives in addition to integrating the implementation of this plan with existing planning mechanisms where appropriate.

The implementation of hazard mitigation activities often involves departments and individuals beyond the emergency management profession. Stakeholders may include department chairs/directors, building managers, and administrators. In many instances, concurrent planning efforts will help to achieve or complement hazard mitigation goals, even though they are not designed as such. Therefore, the *Capability Assessment* also included general planning capabilities and the degree to which hazard mitigation is integrated into other on-going planning efforts.

Campus Planning: Campus planning establishes the overall vision for what a university wants to be and serves as a guide for future campus facilities. Typically, campus planning determines the need for and location of new facilities and open space. Given the broad nature of campus planning and its standing in many universities, the integration of hazard mitigation measures into campus planning can enhance the likelihood of achieving risk reduction goals, objectives, and actions. As of Fall 2023, EMU is in the process of furthering campus planning efforts and the University currently uses the Capital Outlay Plan to fund major renovations and upgrades. Campus planning will act as a framework for to plan renovations, reallocation of space, removal of unused assets, and potential future development.

Capital Outlay Plan: EMU releases a Capital Outlay Plan (COP) on an annual basis. The purpose of this plan is to provide an update on the current state of the University's academics, campus, and finances. The COP provides an overview of short- and long-term goals of the University and outlines how these goals will be accomplished. The latest iteration of the COP was written for fiscal year 2024 and describes the University's progress in expanding their GameAbove College of Engineering and Technology's facilities and capabilities.

In addition to the enrollment and academic updates provided, the COP also includes a Facility Assessment section and an Implementation Plan section. The Physical Plant Department maintains a record of existing facilities' conditions within the Asset Preservation module of their Computerized Maintenance Management System. This record is also used to guide projects outlined in the COP, which focuses on projects of over $1 million in capital that are considered essential for the operations of the University. The Facility Assessment also includes itemized expenses for mandated testing of life safety equipment, chemical treatment equipment, and other building components that are essential for continued operation of EMU's facilities. The Facility Assessment assesses and records the status of several systems and facilities that make up the infrastructure of the University. These include:

- Building and Classroom Utilization Rates
- Architectural Systems
- Mechanical Systems
- Steam Supply and Distribution System
- Electrical Systems (Buildings)
- Elevator Systems
- Fire Protection Systems
- Electric Supply and Distribution Systems
- Site Work and Drainage Systems
- Energy Plan Goals
- Roads, Streets, Parking Lots and Structures

Stormwater Management Plan: A stormwater plan typically outlines a university's stormwater management program and is aimed at protecting the health, safety, and welfare of a university's students and staff, as well as the surrounding community. Historically, EMU has developed stormwater management plans, but the current stormwater management plan is out of date. Updating the stormwater management plan has been identified as a mitigation action which will be addressed in *Mitigation Strategy*. It should be noted that the University actively manages stormwater and in recent years has implemented stormwater controls on campus, such as upsized piping and underground detention facilities.

National Flood Insurance Program (NFIP): The University is not subject to the City of Ypsilanti floodplain regulations and, thus, does not participate in the NFIP. Further, as a state university, they are under state jurisdiction. As such, there are no NFIP repetitively flooded properties on campus. However, the University is insured through Travelers Companies, Inc. and completed a statement of values in 2023.

Building Design and Construction: As a state institution, EMU is not required to follow local ordinances; however, EMU does work with the City of Ypsilanti and other municipalities in an effort to be a responsible community partner. EMU follows the State of Michigan building code for the design and construction of new facilities. Chapter 390 of the Michigan Compiled Law governs the operations of universities and colleges. Section 558 outlines the University's authority to acquire and develop land, buildings, and other facilities, to include health centers, stadiums, athletic fields, parking structures, and other educational facilities. EMU is also subject to the 2002 Construction of School Buildings Act, which was passed by the state legislature to address fire safety after multiple residence hall fires at Michigan universities.

Fiscal Capability

The ability of a university to take action is closely associated with the amount of fiscal resources available to implement policies and projects. This may take the form of outside grant funding awards or university-based revenue and financing. The cost of mitigation policy and project implementation vary widely. In some cases, policies are tied primarily to staff time or administrative costs associated with creation and monitoring of a given program. In other cases, direct expenses are linked to an actual project, such as installing back-up power generators or storm shelters, which can require a substantial commitment from university, state, and federal funding sources. The University has made fiscal commitments to the mitigation of hazards and security of the population to date. This *Hazard Mitigation Plan* provides a foundation to plan for future needs as well.

Political Capability

One of the most difficult capabilities to evaluate involves the political will of a university to enact meaningful policies and projects designed to reduce the impact of future hazard events. The political climate must be considered in designing mitigation strategies as it could be the most difficult hurdle to overcome in accomplishing their adoption and implementation. EMU officials have emphasized the need and desire for a safe, secure campus, and their completion of the hazard mitigation plan is one such commitment to this effort.

Conclusion on Campus Capability

The *Capability Assessment* examines a university's capabilities to detect any existing gaps or weaknesses within ongoing activities that could hinder proposed mitigation activities and possibly exacerbate community hazard vulnerability. Several areas where capability for mitigation could be expanded were identified for EMU through an examination of existing plans and programs and conversations with University staff and administrations. The conclusions of the *Risk Assessment* and *Capability Assessment* serve as the foundation for the development of a meaningful mitigation strategy. During the process of identifying specific mitigation actions to pursue, EMU considered not only level of hazard risk, but also the existing capability to minimize or eliminate that risk. The list below outlines key opportunities for EMU to expand its mitigation capabilities.

- Update the Stormwater Management Plan;
- Continue development of departmental COOPs;
- Establish Electrification Plan that includes back-up power plan;
- Update the building emergency plan for all buildings on campus;
- Establish formalized emergency communications plan;
- Develop severe weather evacuation procedures for residence halls;
- Develop procedures for minimizing liquid damage to structures, such as on on-site checklist for personnel who discover burst pipes;
- Continue to work with insurer to understand mitigation needs and opportunities; and,
- Integration of mitigation actions into University's capital improvements program.

Section 6 – Mitigation Strategy

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Introduction

In the last decade, disasters have affected university and college campuses with disturbing frequency, sometimes causing death and injury, but always imposing monetary losses and disruption of the institution's teaching, research, and public service. The effects from natural, human-caused and technological hazards directly impact the safety and wellbeing of university faculty, staff and students.

Depending on the degree of severity, disasters can result in loss of educational time for students and economic hardship for the university and community. Significant losses can result from damage to campus buildings and infrastructure or interruption to the institutional mission. These losses can be measured by faculty and student departures, decreases in research funding, and increases in insurance premiums. While most hazards cannot be eliminated, the effects and losses can be substantially reduced through comprehensive pre-disaster planning and mitigation actions.

The first step in designing the *Mitigation Strategy* includes the identification of mitigation goals. Mitigation goals represent broad statements that are consistent with the hazards identified within the plan and achieved through the implementation of more specific mitigation actions. These goals set the blueprint for the Mitigation Strategy and allowed the stakeholders to vision what they wanted to achieve over the next five-year period.

The second step involves the identification, consideration, and analysis of available mitigation measures (i.e., activities, policies, etc.) that lead to identifying mitigation actions that will help achieve the identified mitigation goals. This is a long-term, continuous process sustained through the development and maintenance of this plan. Alternative mitigation measures will continue to be considered as future mitigation opportunities are identified, as data and technology improve, as mitigation funding becomes available, and as this plan is maintained over time.

The third and last step in designing the *Mitigation Strategy* is the development of the Mitigation Action Plan. The Mitigation Action Plan represents a comprehensive and functional plan for each action and is the most essential outcome of the mitigation planning process. The Mitigation Action Plan includes a prioritized listing of proposed hazard mitigation actions (policies and projects) for the University to complete. Each action has accompanying information, such as those departments or individuals assigned responsibility for implementation, potential funding sources, and an estimated target date for completion. The Mitigation Action Plan provides those departments or individuals responsible for implementing mitigation actions with a clear roadmap that also serves as an important tool for monitoring success or progress over time. The cohesive collection of actions listed in the Mitigation Action Plan can also serve as an easily understood menu of mitigation policies and projects for those local decision makers who want to quickly review the recommendations and proposed actions of the Plan and potentially integrate with other planning documents.

In preparing the 2024 Mitigation Action Plan, members of the Eastern Michigan University Mitigation Planning Committee considered the overall hazard risk and capability to mitigate the effects of hazards as recorded through the risk and capability assessment process. The adopted mitigation goals were also considered when developing each action item.

Developing the 2024 Mitigation Goals

44 CFR Requirement
44 CFR Part 201.6(c)(3)(i): *The mitigation strategy shall include a description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards.*

The purpose of this section is to provide an outline for Eastern Michigan University to follow to become less vulnerable to hazards. EMU's mitigation goals were derived from descriptions of potential impacts from hazards in the hazard profiles, developed in the 2013 plan and reviewed and revised by the Mitigation Planning Committee during the 2023 - 2024 planning process.

Through the preparation of the mitigation plan, emergency management considered EMU's overall risk, vulnerability, and capacity to mitigate the effects of identified hazards. There was careful consideration of undertaking feasible mitigation projects.

The mitigation goals provide an outline for Eastern Michigan University to follow to become less vulnerable to identified hazards. EMU's mitigation goals are broad statements but are achieved through more specific objectives and implementation steps. They are based upon the results of the risk assessment, capability assessment, and a review of goals and objectives from other state and local plans, specifically, the State of Michigan Multi-Hazard Mitigation Plan.

Going through the process, the University was guided by four principles for mitigation. These four principles provide a foundation for mitigation by establishing the key elements by which mitigation aims to manage risk with the goal of reducing risk and increasing resilience throughout the campus community.

Resilience and Sustainability Preparing the campus community, its property and critical infrastructure resources to absorb the impact of a threatening event and bounce back in a manner that sustains it mission and functions in the aftermath of a disaster, makes it more resilient. Sustainability employs a longer-term approach through plans, policies, and actions that reflect a comprehensive understanding of the economic, social, and environmental systems within the campus community and its host communities.

Leadership and Campus-focused Implementation Mitigation empowers university leaders and members to embrace their ownership of building a resilient and sustainable campus. Effective, ongoing mitigation is led by the campus community, working together to identify, plan for, and reduce vulnerabilities and promote long-term personal and community resilience and sustainability. Everyday discussions and actions can have unexpected implications for risk management and therefore should be viewed through the mitigation lens.

Partnerships and Inclusiveness Mitigation is advanced through the collective actions of many groups. No one entity can accomplish these goals. These partnerships may include: staff, faculty, students, local government, the private sector and area non-profit organizations. Establishing trusted relationships prior to a disaster is essential to campus resilience and sustainability. These relationships enhance and strengthen day-to-day mitigation efforts and are critical for timely and effective response and recovery activities during and after a disaster event.

Risk-conscious Culture The campus community is bolstered and made more resilient by anticipating, communicating, and preparing for threats and hazards—both internal and external—through comprehensive and deliberate risk management. The value of a risk management approach or strategy to decision makers is not in the promotion of a particular course of action, but rather in the ability to distinguish between various risk management choices for accepting, avoiding, reducing, or transferring the risk within the larger context. A risk-conscious culture involves providing clear, meaningful, consistent, accessible (including for those with limited English proficiency and individuals with functional needs) messaging, so that the whole campus community embraces mitigation and reduces its exposure and vulnerability to risk.

EMU's mitigation goals were derived from descriptions of potential impacts from hazards in the hazard profiles, developed in the 2013 plan and reviewed and revised by the Mitigation Planning Committee during the 2023 - 2024 planning process. Also, the wide campus and public had the opportunity to provide input of goals and objectives through two campuswide public meetings. The Mitigation Planning Committee reviewed and ultimately defined six goal statements for the 2024 plan. These goals will be used as a blueprint for campus hazard mitigation planning. The consultant team used information gathered from discussions with key University stakeholders and existing university goals to recommend a set of goals to the Mitigation Planning Committee. These were initially introduced and reviewed at the Mitigation Planning Committee and Campuswide meetings on September 27, 2023. The goals were also reviewed at the Mitigation Strategy Meetings held on November 14, 2023 (Mitigation Planning Committee Meeting) and January 24, 2024 (Mitigation Planning Committee Meeting and Campuswide Public Meeting). Revisions to the goals and objectives are underlined and new goals and objectives are noted below.

Goal 1: Create a safe and secure environment for students, faculty, staff and visitors.

- Objective 1-1: Implement mitigation actions that will assist in protecting lives and property by making buildings, infrastructure, critical facilities and individuals more resistant to hazards.
- Objective 1-2: Better characterize hazard events by conducting additional hazard studies.
- Objective 1-3: Review existing university policies, plans and procedures, safety inspection procedures, and other processes to help ensure that they address the most recent and generally accepted standards for the protection of buildings and environmental resources.
- Objective 1-4: Implement mitigation actions that encourage environmental stewardship and protection of the environment.
- Objective 1-5: Implement mitigation programs that protect critical university facilities and services and promote reliability of lifeline systems to minimize impacts from hazards, maintain operations, and expedite recovery in an emergency.

Goal 2: Enhance emergency communications systems to provide the campus community with appropriate protective action and mitigation information.

- Objective 2-1: Harden communications capabilities to ensure post event functionality.
- Objective 2-2: Enhance alert and notification procedures/system to improve notice to the campus community and off-campus partners.
- Objective 2-3: Maintain good working relationships with off-campus departments and agencies in identifying warning sources and coordinating emergency notifications.

Goal 3 (New): Develop Business Continuity Plan at Department or Unit level.

- Objective 3-1 (New): Develop Business Impact Analysis for Business Continuity Plan

Goal 4: Develop University continuity of operations through integration with emergency response plans and procedures, including the mitigation plan.

- Objective 4-1: Encourage the establishment of policies to help ensure the prioritization and implementation of mitigation actions and/or projects designed to benefit essential facilities, services, and infrastructure.
- Objective 4-2: Where appropriate, coordinate and integrate hazard mitigation actions with existing University and local emergency operations plans.
- Objective 4-3: Implement mitigation actions that enhance the technological capabilities of the University to better profile and assess exposure of hazards.

Goal 5: Be proactive in identifying mitigation opportunities into capital improvement and infrastructure planning projects and other campus functions and programs.

- Objective 5-1: Identify and pursue funding opportunities to develop and implement mitigation activities.
- Objective 5-2: Strengthen communication, coordination, and community partnerships to foster hazard mitigation actions and/or projects.
- Objective 5-3: Identify the need for, and acquire, any special emergency services, training, or equipment to enhance response capabilities for specific hazards.

Goal 6: Enhance emergency preparedness, increase awareness, and promote risk reduction activities through education of and outreach to the campus community.

- Objective 6-1: Develop and implement additional education and outreach programs to increase campus community awareness of the risks associated with hazards and to educate the public on specific, individual preparedness activities.
- Objective 6-2: Provide information on tools, partnership opportunities, funding resources, and current initiatives to assist in implementing mitigation activities.
- Objective 6-3: Provide comprehensive information to the campus community, local emergency service providers, the media and the public during and following disaster and hazard events.

Identification & Analysis of Mitigation Actions

44 CFR Requirement
44 CFR Part 201.6(c)(3)(ii): *The mitigation strategy shall include a section that identifies and analyzes a comprehensive range of specific mitigation actions and projects being considered to reduce the effect of each hazard, with particular emphasis on new and existing buildings and infrastructure.*

Mitigation strategies have been developed and prioritized to address the vulnerabilities identified in the plan. Going through the process, the University was guided by four principles for mitigation. These four principles provide a foundation for mitigation by establishing the key elements by which mitigation aims to manage risk with the goal of reducing risk and increasing resilience throughout the campus community.

A wide range of mitigation actions can be considered in order to help achieve established mitigation goals to create a feasible mitigation strategy and action plan. Mitigation activities can fall into a number of categories, including preventative measures, property protection, public education and awareness, natural resource protection, emergency services, and structural projects. The following is an overview of potential activities by category:

Preventative Measures

Preventative measures protect new development from hazards and ensure that potential loss is not increased. Preventative measures are guided through University programs and policies or external enforcement actions that influence the way campus open space is developed, buildings are constructed, or how people respond. Prevention activities can be particularly effective where development has not yet occurred or where capital improvements have not been significant. Preventative mitigation activities include:

- Planning and Design
- Stormwater Management
- Public Safety
- Facilities Construction
- Capital Improvement Programming

Property Protection

Property protection measures prevent a hazard from damaging a building. Property protection measures are typically implemented by the University, but government can often provide technical and sometimes financial assistance. There are five general activities that can be classified as property protection:

- Building Relocation/Building Elevation
- Retrofitting (security enhancements, wind-proofing, fireproofing, etc.)
- Insurance Coverage
- Demolition
- Barriers (safe rooms, impact resistant glass)

Public Education and Awareness

Public education and awareness is a mitigation strategy that has a broad reaching impact across both the university and community. Activities that provide university faculty, staff, students, visitors and the off-campus community with information on how to protect themselves and others from potential hazards that may have the greatest impact on people to protect their own property and lives. Examples of public education include:

- Outreach Projects
- Speaker Series
- Training & Exercises
- Hazard Map Information

Natural Resource Protection

Resource protection mitigation activities are a way to enable land to function in a natural way. Because many natural areas have been affected by development and will be affected by development in the future, there are a number of ways to protect and restore the environment. This measure is important when considering activities for the Eagle Crest Golf Center, the EMU Parsons Center in Lake Ann, and the EMU Kresge Environmental Center (Fish Lake) in Lapeer.

Resource protection activities can include:

- Wetlands Protection
- Erosion & Sedimentation Control
- Watershed Management
- Best Forest & Vegetation Management Practices
- Habitat Preservation

There are many benefits to naturally functioning watersheds, floodplains, and wetlands and they can include:

- Reduction in runoff from rainwater and snowmelt
- Infiltration and velocity control during overland flow
- Filtering of excess nutrients, pollutants, and sediments
- Floodwater storage
- Water quality improvement
- Groundwater recharge
- Habitat availability
- Recreation and aesthetic qualities

Emergency Services

A thorough emergency services program addresses all hazards and involves all response departments and facilities, including those beyond the university in the community. While not typically considered a “mitigation” technique, emergency service measures do minimize the impact of a hazard event on people and property. There are a number of components to emergency services, and they include:

- Threat Recognition
- Warning
- Response
- Critical Facilities Protection
- Post-Disaster Recovery & Mitigation

Structural Projects

Structural projects are intended to protect people and infrastructure from damage due to natural hazards. The complexity and cost of structural projects can vary greatly and are dependent on individual circumstances. Structural projects are undertaken where non-structural measures would not be effective. Structural projects may include:

- Reservoirs and Detention Areas
- Roadway & Pedestrian Pathway Improvements
- Drainage and Storm water Improvements/Maintenance

Developing the 2024 EMU Hazard Mitigation Actions

An excel file 'Mitigation_Action_Worksheet' was created by the consultant team with the mitigation actions included in the 2013 hazard mitigation plan. During the Mitigation Strategy Meetings, the planning team refined preliminary actions and added additional actions after reviewing results of the *Risk Assessment* and *Capability Assessment.*

To estimate cost, the planning-level cost of each action was categorized based on the following criteria:

- Low Estimated Cost ($0 - $4,999)
- Moderate Estimated Cost ($5000 - $49,999)
- High Estimated Cost ($50,000 - $249,999)
- Very High Estimated Cost ($250,000 - Above)

Actions for which costs were not applicable (e.g., creation of a policy) were estimated at $0 or marked as "staff time."

In addition, the Mitigation Planning Committee prioritized actions as "very high," "high," "moderate," or "low" priority based on the following criteria:

- Effect on reducing overall risk to life and property on campus
- Ease of implementation / technical feasibility
- Political and campus support
- Funding availability
- Alignment with insurer requests and recommendations
- Cost-benefit review (as described above)

The planning team was provided two weeks to review the 'Mitigation_Action_Worksheet' and provide feedback on the identified actions as well as to provide additional actions. During this two-week period, the University's Risk and Emergency Services staff held internal discussions with Mitigation Planning Committee members to discuss actions with specific divisions and departments and obtain missing required information. Multiple members of the planning team provided feedback, resulting in 20 identified hazard mitigation actions.

The last step in revising the Mitigation Strategy was accomplished during the draft plan review period from Date to Date. During this time, the Mitigation Planning Committee members were provided the opportunity to individually review each mitigation action in the Mitigation Action Plan and provide comments. Feedback was accepted through Date. Through this process, the final Mitigation Action Plan was developed as presented at the end of this section. Feedback on the mitigation action plan was also requested from the campus wide community during the public review period from Date to Date.

2024 EMU Mitigation Action Plan

44 CFR Requirement
44 CFR Part 201.6(c)(3)(iii): *The mitigation strategy shall include an action plan describing how the actions identified in paragraph (c)(3)(ii) of this section will be prioritized, implemented, and administered by the local jurisdiction.*

The EMU Hazard Mitigation Action Plan is intended to be comprehensive of all potential mitigation action needs on campus. The following key elements are captured within the Mitigation Action Plan to help the planning team track each action over the next five years.

- Action Number
- Action Description
- Comments
- Hazard(s) Addressed
- Estimated Cost
- Estimated Benefit
- Priority
- Potential Funding Source
- Lead Implementer/Other Partners
- Implementation Schedule

Table 6-1 presents the Mitigation Action Plan.

Table 6-1: Mitigation Action Plan

Mitigation Action #	Action Description	Hazard(s) Addressed	Type	Estimated Cost	Benefits	Priority	Potential Funding Sources	Lead Implementer and other Partners	Timeframe	Status
1	Update campus stormwater management plan.	Flooding	Prevention	Staff Time	Moderate	Low	NA	Physical Plant (Grounds)	Within 2 years	New
2	Identify storm water projects such as rain gardens and detention areas to help reduce and control runoff and to promote protection of the Huron River Watershed.	Flooding and Extreme Precipitation	Prevention	Staff Time	Moderate	Moderate	NA	Physical Plant	Ongoing	Existing
3	Flood proofing of sensitive equipment or buildings with routine issues in addition to retention improvements	Flooding	Property Protection	High	High	Moderate	University funds, Grant Funds	Physical Plant, Risk & Emergency Management, EHS	1 - 2 years	New
4	Expand Mass Notification capabilities to high use/critical facilities. Continue to assess enhancements to the Mass Notification system (new language for 2024).	All	Emergency Services	Moderate	High	High	University funds, Grant Funds	Emergency Management Office, IT	Within 2024	Existing
5	Complete structural fire suppression measures in residence halls.	Structural and Industrial Fires	Prevention	Very High	Very High	High	Capital Project	Physical Plant	Fall 2025	Existing
6	Identify funding opportunities to implement fire suppression systems at identified buildings.	Structural and Industrial Fires	Prevention	Very High	High	High	NA	Physical Plant, Business and Finance Office	Within 5 years	New
7	Expand hazard identification and risk assessment and mitigation planning to Fish Lake and Parsons Center. Replace roof at both locations.	All	Prevention	Very High	High	Low	University funds	Physical Plant, Emergency Management Office	Summer 2024	Existing
8	Review and revise the Multi-Hazard Mitigation Plan to reflect changes in development, progress in mitigation efforts, and changes in priorities annually. Resubmit to state and FEMA every 5 years.	All	Prevention	Low	High	High	University funds	Emergency Management Office	Annual	Existing
9	Establish or expand the tree maintenance program to include maintenance within the DTE easement	Windstorms	Prevention	Low	Low	Moderate	University funds	Physical Plant (Grounds)	Annual	New
10	Coordinate and establish departmental COOPs.	All	Prevention	Staff Time	Moderate	High	University funds	Emergency Management Office	Within 5 years	New
11	Complete or Update Building Emergency Plans for campus buildings and facilities.	All	Prevention	Staff Time	Moderate	Moderate	University funds	Emergency Management Office	Within 5 years	New
12	Replace stadium parking lot, which supports overflow parking and could be used during an emergency.	All	Structural Projects	Very High	Low	Low	Capital/University funds	Physical Plant (Grounds)	Within 5 years	New

Mitigation Action #	Action Description	Hazard(s) Addressed	Type	Estimated Cost	Benefits	Priority	Potential Funding Sources	Lead Implementer and other Partners	Timeframe	Status
13	Upgrade the existing dispatch center.	All	Emergency Services	Very High	Very High	High	Capital project/Grant funds	EMU Public Safety	Within 5 years	New
14	Consider a virtual EOC activation.	All	Emergency Services	Very High	Moderate	Moderate	Capital project/Grant funds	EMU Public Safety	Within 5 years	New
15	Develop procedures and training procedures for employees responding to potential building flooding on campus. Procedures should include which buildings to check first and equipment that should be deployed when water is initially detected.	Flooding and Extreme Precipitation, Extreme Cold	Emergency Services	Low	Low	Moderate	University funds	Physical Plant, Emergency Management Office	Within 2 years	New
16	Establish formalized emergency communications plan.	All	Prevention	Staff Time	Moderate	Moderate	University funds	EMU Public Safety	Within 2024	New
17	Explore options for providing alternative housing, including transportation between housing, for students in residence halls in the event of power outages during inclement weather and extreme freezing temperatures.	Extreme Cold/Wind Chill, Power Outage, Severe Winter Weather	Emergency Services	Staff Time	Moderate	Moderate	University funds	Student Life, Housing; supported by Emergency Management	Within 2024	New
18	Explore options for cell signal boosters for cell dead zones so emergency notifications can be received.	All	Prevention	Staff Time	High	High	NA	IT	Within 5 years	New
19	*Redacted*	All	Prevention	Staff Time	High	High	NA	IT	Within 5 years	New
20	Update campus-wide Business Continuity Plan	All	Emergency Service	Staff Time	High	High	University funds	Emergency Management Office	Within 6 months	New
21	Explore options for a state-of-the-art emergency dispatch center	All	Structural Project	Staff Time	High	Moderate	Capital project/Grant funds	Public Safety & Physical Plant	Within 2 years	New
22	Enhance and leverage the existing Edwards Fire Watch System to include efficient and effective mass notification options, holistic monitoring and oversight, and backward compatibility features.	Structural/Fire	Emergency Services	High	High	High	Capital project/Grant funds	Public Safety & Physical Plant	Within 5 years	New

The following mitigation actions have been completed since the last plan update.

- Provide outreach and awareness campaigns to the campus community to promote mitigation and preparedness efforts.
- Identify critical facilities/infrastructure needing backup power sources and means to provide backup power.
- Identify opportunities for the creation of a dual-use storm shelter for the athletic (West) campus.
- Identify opportunity for installation of an automated lightning detection system for the athletic (west) campus, main campus mall and Eagle Crest.

Recommendation & Prioritization of Mitigation Actions

The *Mitigation Strategy* includes a wide range of mitigation actions that will reduce vulnerabilities to hazard events. Mitigation actions are typically presented in general terms without specific project details. Developing a mitigation project from these mitigation actions may require a great deal of effort. Not all mitigation actions identified in the plan will necessarily become fully developed projects. Some actions may be deleted from the mitigation strategy or deferred for implementation when the plan is updated.

After plan approval and implementation, when mitigation opportunities arise, the University will follow a seven-step process for developing proposed mitigation actions into well-defined mitigation projects.

The **first** step in the process is a review of the actions specified in the mitigation strategy and the information contained in the Risk Assessment section of the hazard mitigation plan to identify opportunities to develop mitigation projects.

The **second** step in the process is to specify the problem and identify alternative projects that will solve the problem.

The **third** step is to conduct a feasibility review to identify obstacles to implementing the project and to determine the best alternative for the community. The feasibility review should include a preliminary evaluation of mitigation funding opportunities to determine whether funding beyond existing community resources might be available. Potentially negative environmental impacts of the proposed project should be identified at this stage of the process.

The **fourth** step is to select a project and to fully develop the project scope of work by establishing the exact specifications and costs of the project.

The **fifth** step is to obtain sufficient funding to implement and maintain the proposed mitigation project. This step may entail completing and submitting an application for funding to FEMA or another agency.

The **sixth** step is to implement, manage, and maintain the mitigation project. Communities receiving FEMA Hazard Mitigation Assistance must also comply with all reporting and administrative requirements.

The **seventh** and final step is to update the University's hazard mitigation plan.

Selected mitigation actions will be evaluated using various criteria as recommended by FEMA. This includes using the "STAPLEE" evaluation criteria (see **Table 6-2**).

Table 6-2 STAPLEE Evaluation Criteria

Criteria	Description
Socially Acceptable	Is the proposed activity socially acceptable to the University community? Is the activity compatible with present and future University values? Are there disparity issues that would leave one part of the University community adversely affected?
Technically Feasible	Will the proposed activity be effective in the long run? Will it create negative secondary impacts? Will it create more problems than it solves? Will it solve the problem or only the symptoms?
Administratively Possible	Does the University have the capability to implement the proposed activity? Is there someone who will coordinate, implement, and maintain the activity?
Politically Acceptable	Is there political support to implement the proposed activity? Is there enough University and/or community support to ensure the success of the activity?
Legal	Does the University have the authority to implement the proposed activity? Is there a clear legal precedent, and are there any potential legal consequences of the activity?
Economically Sound	Are there current sources of funding to implement the proposed activity? Do the benefits outweigh the costs of the activity? Is the activity compatible with other economic goals of the University?
Environmentally Sound	How will the proposed activity affect the environment? Will this activity comply with local, state, and federal environmental laws and regulations? Is the activity consistent with University environmental goals?

Section 7 – Plan Maintenance

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Implementation and Integration

44 CFR Requirement
44 CFR Part201.6(c)(4)(i): *The plan shall include a plan maintenance process that includes a section describing the method and schedule of monitoring, evaluating, and updating the mitigation plan within a five-year cycle.* ***44 CFR Part 201.6(c)(4)(ii):*** *The plan maintenance process shall include a process by which local governments incorporate the requirements of the mitigation plan into other planning mechanisms such as comprehensive or capital improvement plans, when appropriate.*

Implementation

Each agency, department, or other partner participating under the Eastern Michigan University Hazard Mitigation Plan is responsible for implementing specific mitigation actions as prescribed in the Mitigation Action Plan. Every proposed action listed in the Mitigation Action Plan is assigned to a specific "lead" department or division in order to assign responsibility and accountability and increase the likelihood of subsequent implementation.

In addition to the assignment of a University lead department, an implementation time period has been assigned in order to assess whether actions are being implemented in a timely fashion. The University will seek internal and external funding sources to implement mitigation projects in both the pre-disaster and post-disaster environments. When applicable, specific potential funding sources have been identified for proposed actions listed in the Mitigation Action Plan.

To further promote implementation, the Mitigation Planning Committee intends to convene annually as a whole, with smaller subgroups to meeting more frequently throughout the year. A key agenda item at the annual meeting will be to determine which actions are being implemented by members of the Mitigation Planning Committee. The subgroups will be formed to focus on implementation efforts, and Risk & Emergency Management will convene the Mitigation Planning Committee on an annual basis and establish the subgroups.

Integration

The Mitigation Planning Committee will integrate this Hazard Mitigation Plan into relevant University decision-making processes, plans, or mechanisms, where feasible. This includes integrating the requirements of the Hazard Mitigation Plan into other University planning documents, processes, or mechanisms, such as a capital outlay plan, when appropriate.

The members of the Mitigation Planning Committee will remain charged with ensuring that the goals and mitigation actions of new and updated University planning documents for their departments or facilities are consistent, or do not conflict with, the goals and actions of the Hazard Mitigation Plan, and will not contribute to increased hazard vulnerability on campus.

Opportunities to integrate the requirements of this plan into other University planning mechanisms shall be identified through future planning efforts. Some mechanisms for integration under consideration include:

- Integration of the University's mitigation plan is considered on a case-by-case basis.
- Integration of University's mitigation plan as a supporting document for other University plans.

- Integration of the University's mitigation plan into stormwater planning, continuity planning, exercises, and major event programming.
- Integration of the University's mitigation plan into new development on campus, especially in terms of environmental concerns, security, and life safety.

Monitoring, Evaluation, and Enhancement

Periodic revisions and updates of the Hazard Mitigation Plan are required to ensure that the goals of the plan are kept current, taking into account potential changes in hazard vulnerability and mitigation priorities. In addition, revisions may be necessary to ensure that the plan is in full compliance with applicable federal and state regulations. Periodic monitoring and evaluation of the plan will also ensure that specific mitigation actions are being reviewed and carried out according to the Mitigation Action Plan.

The Mitigation Planning Committee shall meet annually to monitor and evaluate the progress attained and to revise, where needed, the activities set forth in the plan. The Director of Risk and Emergency Management will reconvene the Mitigation Planning Committee annually. The annual meetings provide the Mitigation Planning Committee with an opportunity to:

- Evaluate those actions that have been successful;
- Document hazard occurrences and impacts;
- Explore the possibility of documenting potential losses avoided due to the implementation of specific mitigation measures; and
- Identify any new or additional vulnerabilities that may be faced by the University and may need to be addressed through an amendment or in a future update of this plan.

In addition to annual meetings, subgroups of the Mitigation Planning Committee may meet more frequently to monitor and evaluate actions tasked to their specific department, division, or facility.

Five Year Plan Review and Update

The plan will be thoroughly and formally reviewed by the Mitigation Planning Committee every five years in alignment with federal regulations. This update is also used to determine whether there have been any significant changes on campus that may, in turn, necessitate changes in the types of mitigation actions proposed, goals, or priorities. New development in identified hazard areas, an increased exposure to hazards, an increase or decrease in capability to address hazards, and changes to federal or state legislation are examples of factors that may affect the necessary content of the plan. EMU's Director of Risk and Emergency Management will be responsible for reconvening the Mitigation Planning Committee and conducting the five-year review.

Upon completion of the review and update/amendment process, the *2024 Eastern Michigan University Hazard Mitigation Plan* will be submitted to the State Hazard Mitigation Officer at the Michigan State Police, Division of Emergency Management and Homeland Security for a state-level compliance review. Final approval is obtained in from the Federal Emergency Management Agency in coordination with the state. Once an "approved pending adoption" status has been issued by FEMA, the President of Eastern Michigan University can then review and formally adopt the plan via a written resolution. The University review process consists of review by the Mitigation Planning Committee with final approval by the President.

Disaster Declaration

Following a disaster declaration, the *2024 Eastern Michigan University Hazard Mitigation Plan* may be revised as necessary to reflect lessons learned, or to address specific issues and circumstances arising from the event. It will be the responsibility of EMU's Director of Risk and Emergency Management to reconvene the Mitigation Planning Committee and ensure the appropriate stakeholders are invited to participate in the plan revision and update process following declared disaster events.

Plan Amendment Process

Unique circumstances, such as availability of critical data or an omission or a disaster event, may necessitate a plan amendment. Upon the initiation of the amendment process, the University will forward information on the proposed change(s) to all interested parties including, but not limited to, all directly affected University divisions and departments. Information will also be forwarded to Michigan State Police, Division of Emergency Management and Homeland Security, and FEMA Region 5. This information will be disseminated in order to seek input on the proposed amendment(s) for no less than a 45-day review and comment period (unless circumstances necessitate a shorter review).

At the end of the 45-day review and comment period, the proposed amendment(s) and all comments will be forwarded to the EMU Risk and Emergency Management Director for final consideration.

In determining whether to recommend approval or denial of a plan amendment request, the following factors will be considered:

- There are errors, inaccuracies, or omissions made in the identification of issues or needs in the plan.
- New issues or needs have been identified which are not adequately addressed in the plan.
- There has been a change in information, data, or assumptions from those on which the plan is based.

If the Director opts to move forward with the amendment, the revised plan must be reviewed and approved by the state and FEMA. The Board of Regents will also need to approve the revised plan. Prior to approval, the University may make the plan and proposed amendments available to the public by request. The Board of Regents will review the recommendation from the Mitigation Planning Committee (including the factors listed above) and any oral or written comments received by the public. Following that review, the Board of Regents will take one of the following actions:

- Adopt the proposed amendments as presented;
- Adopt the proposed amendments with modifications;
- Refer the amendments request back to the Director and planning team for further revision; or
- Defer the amendment request back to the Mitigation Planning Team for further consideration and/or additional hearings.

Continued Public and Stakeholder Involvement

44 CFR Requirement
44 CFR Part 201.6(c)(4)(iii): *The plan maintenance process shall include a discussion on how the community will continue public participation in the plan maintenance process.*

Public participation is an integral component to the mitigation planning process and will continue to be essential as this plan evolves over time. In order to keep the public (i.e., campus community including staff, faculty and students) engaged over the five years, the University will regularly post information about hazards, risk, and safety on University communication channels (e.g., social media and websites). These efforts are underway now and will continue over the next five years with specific content for hazard mitigation.

Risk and Emergency Management will also work to “piggyback” other public engagement efforts to relay hazard mitigation effort to the campus community.

Other efforts to continually involve the public will be made as opportunities are presented. These efforts include:

- Advertising public meetings on University websites, social media channels, public bulletin boards and/or University listservs;
- Utilizing available University channels to update the public on any maintenance and/or periodic review activities taking place;
- Documentation of distribution of annual review meeting notes;
- Designating willing and voluntary staff, students, faculty, or community members as official members of the Mitigation Planning Committee, as appropriate;
- Making the plan available to the public by request through Risk and Emergency Management.

APPENDIX A: ADOPTION MATERIALS

This appendix includes:

A1: Adoption Resolution

A2: FEMA Letter of Approval

A1: Adoption Resolution

Placeholder for Adoption Resolution

A2: FEMA Letter of Approval

Placeholder for FEMA Letter of Approval

APPENDIX B: PLANNING TOOLS

This appendix includes:

B1: Blank Public Survey

B2: Blank Staff Capability Assessment Form (Plan Request Checklist)

B1: Blank Public Survey

**PUBLIC SURVEY FOR INPUT INTO THE EASTERN MICHIGAN UNIVERSITY
2024 HAZARD MITIGATION PLAN UPDATE**

We need your help!

Eastern Michigan University is currently engaged in a planning process to become less vulnerable to natural, manmade, and technological disasters, and your participation is important to us!

EMU, along with partners, is working to update the University's campuswide hazard mitigation plan, developed in 2013. The purpose of this Plan is to identify and assess EMU's hazard risks and determine how to best minimize or manage those risks. Upon completion, the Plan will provide a comprehensive approach to managing hazards on the EMU campus.

This survey provides an opportunity for you to share your opinions and participate in the hazard mitigation planning process. The information you provide will help us better understand your hazard concerns and help us identify mitigation activities that should help lessen the impact of future hazard events, including natural and human-caused hazards.

Please help us by completing this survey by <u>October 30, 2023</u> and returning it to:

Laura Drabczyk, Director
Risk & Emergency Management
Eastern Michigan University
Email: ldrabczy@emich.edu
Phone: (734) 487–2270
Address: Welch Hall, Room 11G, Ypsilanti, MI 48197

This survey is also available online at: https://questionpro.com/t/AJ8lIZzqn4

All responses will be kept confidential and will only be used to inform Eastern Michigan University's Hazard Mitigation Plan and the associated planning process.

If you have any questions regarding this survey or would like to learn about more ways you can participate in the development of the *Eastern Michigan University's Hazard Mitigation Plan*, please contact Director Laura Drabczyk at ldrabczy@emich.edu.

1. **What is your affiliation with the University (select all that apply)?**

    - ❑ Student
    - ❑ Faculty or Instructor
    - ❑ Staff
    - ❑ Community Member
    - ❑ Other ____

Campus-Related Questions

2. **Please select the <u>one</u> hazard you think is the *highest threat* to campus:**

    - ❑ Civil Disturbances / Civil Unrest
    - ❑ Cyber Attack
    - ❑ Dam Failure
    - ❑ Drought
    - ❑ Earthquake
    - ❑ Extreme Cold / Wind Chill
    - ❑ Extreme Heat
    - ❑ Flood and Extreme Precipitation
    - ❑ Hail
    - ❑ Hazardous Materials Incident
    - ❑ Lightning
    - ❑ Petroleum and Natural Gas Pipeline Accidents
    - ❑ Power Outages
    - ❑ Public Health Emergencies
    - ❑ Severe Wind
    - ❑ Severe Winter Weather
    - ❑ Structural and Industrial Fires
    - ❑ Terrorism and Similar Criminal Activities (including Active Shooter and Special Event Disruptions)
    - ❑ Tornadoes
    - ❑ Water Contamination
    - ❑ Other (please describe)__________

3. **Please select the <u>one</u> hazard you think is the *second highest threat* to campus:**

    - ❑ Civil Disturbances / Civil Unrest
    - ❑ Cyber Attack
    - ❑ Dam Failure
    - ❑ Drought
    - ❑ Earthquake
    - ❑ Extreme Cold / Wind Chill
    - ❑ Extreme Heat
    - ❑ Flood and Extreme Precipitation
    - ❑ Hail
    - ❑ Hazardous Materials Incident
    - ❑ Lightning
    - ❑ Petroleum and Natural Gas Pipeline Accidents
    - ❑ Power Outages
    - ❑ Public Health Emergencies
    - ❑ Severe Wind
    - ❑ Severe Winter Weather
    - ❑ Structural and Industrial Fires
    - ❑ Terrorism and Similar Criminal Activities (including Active Shooter and Special Event Disruptions)
    - ❑ Tornadoes
    - ❑ Water Contamination
    - ❑ Other (please describe)__________

4. **Have you ever experienced or been impacted by a hazard event on campus?**

 - ❑ Yes
 - ❑ No

 If "Yes," please explain:

5. **How concerned are you about the possibility of your campus being impacted by a future hazard event?**

 - ❑ Extremely concerned
 - ❑ Somewhat concerned
 - ❑ Not concerned

6. **A number of campus-wide activities can reduce our risk from hazards. In general, these activities fall into one of the following six broad categories. Please tell us how important you think each one is for our University to pursue.**

Category	Very Important	Somewhat Important	Not Important
1. Prevention Administrative or regulatory actions that influence the way land is developed and buildings are built. Examples include planning and zoning, building codes, open space preservation, and floodplain regulations. This may also include security enhancements.	❑	❑	❑
2. Property Protection Actions that involve the modification of existing buildings to protect them from a hazard or removal from the hazard area. Examples include acquisition, relocation, elevation, structural retrofits, and storm shutters.	❑	❑	❑
3. Natural Resource Protection Actions that, in addition to minimizing hazard losses, also preserve or restore the functions of natural systems. Examples include: floodplain protection, habitat preservation, slope stabilization, and forest management.	❑	❑	❑

Category	Very Important	Somewhat Important	Not Important
4. Structural Projects Actions intended to lessen the impact of a hazard by modifying the natural progression of the hazard. Examples include dams, levees, detention/retention basins, channel modification, retaining walls and storm sewers.	❑	❑	❑
5. Emergency Services Actions that protect people and property during and immediately after a hazard event. Examples include warning systems, evacuation planning, emergency response training, and protection of critical emergency facilities or systems.	❑	❑	❑
6. Public Education and Awareness Actions to inform citizens about hazards and the techniques they can use to protect themselves and their property. Examples include outreach projects, school education programs, library materials and demonstration events.	❑	❑	❑

7. In your opinion, what are some of the things the University is doing currently that should be continued to reduce or eliminate the risk of future hazards impacts on campus?

8. In your opinion, what are some additional steps the University could take to reduce or eliminate the risk of future hazard impacts on campus?

Respondent-Specific Questions

9. Are some areas of the campus particularly vulnerable to hazards?

- ❑ Yes
- ❑ No
- ❑ I don't know

10. If "Yes," what areas are most vulnerable, and what are their uses?

11. Are some buildings on campus particularly vulnerable to hazards?

- ❑ Yes
- ❑ No
- ❑ I don't know

12. If "Yes," what are the uses of the vulnerable buildings, and who occupies them?

13. What is the most effective way for you to receive information about how to make the University more resistant to hazards (select all that apply)?

- ❑ Newspaper
- ❑ Digital Signage
- ❑ Radio
- ❑ Social Media
- ❑ Email
- ❑ Mail
- ❑ Phone
- ❑ Public workshops/meetings
- ❑ School meetings
- ❑ Other (please explain): ____

14. Are there any other issues regarding the reduction of risk and loss associated with hazards or disasters on campus that you think are important?

15. Is there any additional information you would like to share?

THANK YOU FOR YOUR PARTICIPATION!

This survey may be submitted anonymously*; however, if you provide us with your name and contact information below, we will have the ability to follow up with you to learn more about your ideas or concerns (optional):*

Name: ______________________________

Phone: __________ **E-Mail:** ______________

B2: Blank Staff Capability Review Form (Plan Request Checklist)

2024 EMU Hazard Mitigation Plan – Capability Assessment

The Capability Assessment is intended to help the planning team understand EMU's capabilities related to addressing the impacts of future hazard events and climate change. Please review the planning tools below and indicate whether they are currently being implemented. If so, please provide.

DATA DESCRIPTION	AVAILABLE?	RECEIVED?	SOURCE(S)	POC
Land Use and Transportation Plans				
Comprehensive Land Use Plan / University Master Plan				
Facilities Master Plan (if different from Campus Master Plan)				
Small Area Plans / Corridor Studies				
Open Space/Forestry/Landscape Plans				
EMU Long Range Transportation Plan				
Evacuation Plan				
Transit Plan				
Bike / Ped Plans				
Resilience / Emergency Management Plans				
Liquid Damage Prevention and Flood Response Plan				
Climate Action Plan / Sustainability Plan				
EMU Hazard Mitigation Plan				
EMU Water Management Plan / Drought Plan				
Campus Stormwater Management / Green Infrastructure Plan				
Watershed Management Plan / River Management Plan				
Electrification Plan				
Continuity of Operations Plans/SOP				
Shelter Plan				
Emergency Warning/Crisis Communications Plan				
Emergency Operations Plan/SOP				
EMU Emergency Management /Operations Plans				
Other Plans				
Equity Plans				
Capital Improvement Plan				
Relevant Codes and Ordinances				
Enrollment Projections/Trends				
Sporting Events Plan				
Economic Development Plan				
EMU Pandemic Response Plan				

APPENDIX C: ENGAGEMENT DOCUMENTATION

This appendix includes:

C1: MPC Kickoff Meeting Documentation
a) Invite and Attendee List
b) Meeting Presentation

C2: MPC Meeting #2 Documentation
a) Invite and Attendee List
b) Meeting Presentation

C3: MPC Meeting #3: Risk Assessment and Capability Assessment Results Documentation
a) Invite and Attendee List
b) Meeting Presentation

C4: MPC Mitigation Strategy Meeting #1 Documentation
a) Invite and Attendee List
b) Meeting Presentation

C5: MPC Mitigation Strategy Meeting #2 (in-person) Documentation
a) Invite and Attendee List
b) Physical Sign-In Sheet
c) Meeting Presentation

C6: Public Kickoff Meeting Documentation
a) Invite and Announcement
b) Attendance Documentation and Meeting Notes
c) Meeting Presentation

C7: Public Meeting #2 (in-Person) Documentation
a) Invite and Announcement
b) Physical Sign-In Sheet
c) Meeting Presentation

C8: Student Center Table Documentation
a) Poster Results
b) Sign-In Sheet

C9: Public Survey Documentation
a) Public Survey Announcement / Posting
b) Public Survey Summary Results

C10: Plan Landing Webpage Documentation

C11: Public Plan Review
a) Plan Review Announcements

C1: MPC Kickoff Meeting Documentation

This appendix includes:

a) Invite and Attendee List
b) Meeting Presentation

Project Mgt Team Haz. Mitigation Plan Mtg

Save | More actions

May 8, 2023 1:00pm to 2:00pm May 8, 2023 (GMT-04:00) Eastern Time - New York Time zone

All day Monthly on the second Monday

RSVP: Yes Add note / guests

Event details | Find a time

Add location

Notification 30 minutes

Add notification

ldrabczy@emich.edu

Busy Default visibility

Laura Drabczyk is inviting you to a scheduled Zoom meeting.

Topic: Laura Drabczyk's Personal Meeting Room

Join Zoom Meeting
https://emich.zoom.us/j/3118769447?pwd=bW1rL2FyZ3ppaG9wQ0wxVEcrYTNjQT09

Meeting ID: 311 876 9447
Passcode: 509270
One tap mobile
+16468769923,,3118769447# US (New York)
+16469313860,,3118769447# US

Dial by your location
+1 646 876 9923 US (New York)
+1 646 931 3860 US
+1 301 715 8592 US (Washington DC)
+1 309 205 3325 US
+1 312 626 6799 US (Chicago)
+1 408 638 0968 US (San Jose)
+1 564 217 2000 US
+1 669 444 9171 US
+1 669 900 6833 US (San Jose)
+1 719 359 4580 US
+1 253 215 8782 US (Tacoma)

Guests

Add guests

10 guests
8 yes (1 virtually)
2 awaiting

- ldrabczy@emich.edu *
  Organizer
- dotto@emich.edu *
- Christina Hurley
- john.bucher@stantec.com *
- kwilhoff@emich.edu *
- mlige@emich.edu *
- rebecca.leitschuh@stantec.com *
- tohmer@emich.edu *
- cgrant@emich.edu *
- sstorrar@emich.edu *

* Calendar cannot be shown

Eastern Michigan University

Hazard Mitigation
Plan Update

Planning Team
Kickoff Meeting

EASTERN
MICHIGAN UNIVERSITY

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1

Stop & Talk: Arthritis Awareness Month - May

SaferTogether

May is recognized each year as National Arthritis Awareness Month. Arthritis is a disease that impacts more than 50 million Americans and 6 million Canadians, making it the number one cause of disability in both countries.

- Arthritis (arthro = joint, itis = inflammation) can involve almost any part of the body, most often affecting the hip, knee, spine or other weight-bearing joints, but also found in the fingers and other non-weight-bearing joints. Some forms of arthritis can also affect other parts of the body.
- Arthritis symptoms can range from mild to severe. Most people with arthritis experience chronic pain, fatigue, restricted mobility, lowered mood and other symptoms that can combine to erode their quality of life.
- Arthritis is a chronic condition: it affects people on an ongoing, constant or recurring basis over months, years, even a lifetime.
- Arthritis conditions are grouped into two broad categories: Osteoarthritis and Rheumatoid (Inflammatory) Arthritis
- Arthritis affects everyone differently so treatment planning should be tailored to individual needs with guidance from members of the treatment team (e.g. family doctor, rheumatologist, surgeon, physiotherapist, occupational therapist etc.)

Information provided by Arthritis Foundation and Arthritis Society

Did you Know?

Arthritis strikes people of every age, from infants to adults, and stays for life.

People of working age are affected by arthritis.

Over half of people with arthritis are under age 65.

If you have questions, please contact your supervisor, Office Safety and Environment Coordinator (OSEC), or local HSSE representative

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2

Hazard Mitigation Plan Sections

PLANNING PROCESS

Element A.	Planning Process
Element B.	Hazard Identification & Risk Assessment
Element C.	Mitigation Strategy
Element D.	Plan Maintenance
Element F.	Plan Adoption

3

Schedule

PLANNING PROCESS

Task	Completion
Flood Response Plan	February 2023
Liquid Damage Prevention Plan	April 2023
Hazard Risk Assessment Progress and Data Update	July 2023
Risk Assessment Results and Mitigation Strategy	September 2023
Mitigation Strategy Review	November 2023
Draft Plan Review	January 2024
Plan Adoption	March 2024

4

Mitigation Planning Committee Meetings

PLANNING PROCESS

- Kick-off Meeting (Completed)
- Flood Response Plan (Completed)
- Risk Assessment
- Mitigation Strategy
- Draft plan

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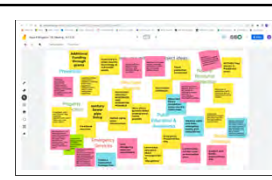
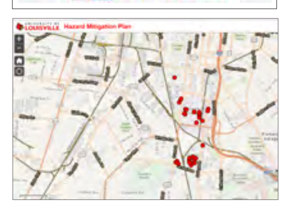
Successful Involvement

PLANNING PROCESS

- Well defined process and tools to support
- Clear communication regarding needs
- Online Engagement – Project Website, Interactive Web Map
- Virtual Workshops – Google Jamboard
- Survey
- Stakeholder interviews

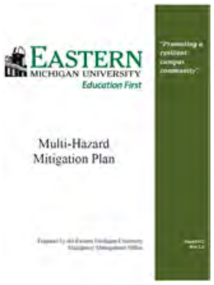




6

Draft Hazards List

RISK ASSESSMENT



2023 EMU Draft Hazards	Included in 2013 Plan?
Extreme Cold/Wind Chill	✓
Extreme Heat	
Hail	
Lightning	
Severe Winter Weather	✓
Severe Winds	✓
Tornadoes	✓
Dam Failure	
Drought	
Flood and Extreme Precipitation	✓
Earthquakes	✓
HAZMAT – fixed and transportation	✓
Nuclear Power Plant Incidents	
Petroleum and Natural Gas Pipeline Accidents	✓
Power Outages	✓
Structural and Industrial Fires	✓
Water Contamination	✓
Civil Disturbances	✓
Cyber-Attacks	✓
Public Health Emergencies	✓
Terrorism and Similar Criminal Activities	✓

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Other Hazards – Not Recommended

RISK ASSESSMENT

Michigan SHMP Identified Hazards	
Hazard	**Justification**
Ice and Sleet Storms	Covered by Severe Winter Weather
Snowstorms	
Great Lakes Shoreline Hazards	N/A
Wildfire	Very Low Risk
Subsidence	Very Low Risk
Invasive Species	Very Low Risk
Space Weather / Meteorites	Very Low Likelihood
Infrastructure Failures	Considered as a hazard impact
Energy Emergencies	Covered by Power Outages & Nuclear Emergencies
Major Transportation Accidents	Emergency Response Focus
Catastrophic Incidents (National Emergencies)	Emergency Response Focus
Nuclear Attack	Emergency Response Focus

2013 EMU Plan Identified Hazards	
Hazard	**Justification**
Mold	Covered by Public Health Emergencies
Biological Materials Incident	
Radiological Materials Incident	Covered by Nuclear Emergencies
Airplane Crash on Campus	Emergency Response Focus

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Risk Assessment Data Collection

RISK ASSESSMENT

- Building replacement values (have some data from 2017 5-year facility plan)
- Building content values (including research and research equipment)
- Critical Facility Designation
- Presence of Animals
- Building Occupancy Count
- Student Population per Building
- Presence of / Access to backup power
- IT Nodes or Communications Hubs
- Critical Campus Infrastructure Locations (ex. Energy production and distribution, chiller system, wastewater system, etc.)
- Stormwater Mapping (or specific components such as pump stations as relevant)
- Insurance Claims/ historic events for all hazards as available
- Transportation infrastructure maintained by EMU (ex. Roads, bridges, sidewalks)
- Tree Canopy Study

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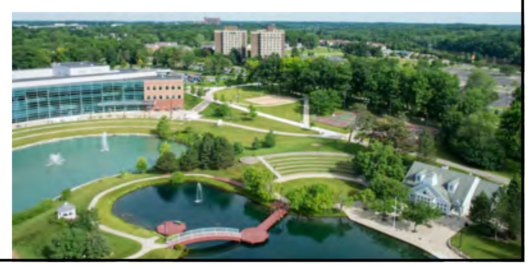
Risk Assessment Deliverables

RISK ASSESSMENT

- Updated risk assessment of EMU main campus and selected off campus facilities
- Updated maps and narrative in plan for main campus risk assessment
- Table summarizing off campus facilities



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Capability Assessment Data Collection

CAPABILITY ASSESSMENT

- EMU Planning Documents
- EMU Enrollment Projections/Trends
- Local Planning Documents that impact EMU
- Stakeholder Interviews (Internal and External as determined by EMU)

Incorporation into Existing Planning Mechanisms

Requirement §201.6(c)(4)(ii): [The plan **shall** include a] process by which local governments incorporate the requirements of the mitigation plan into other planning mechanisms such as comprehensive or capital improvement plans, when appropriate.

11

Mitigation Strategy Deliverables

MITIGATION STRATEGY

- Revised mitigation goals
- Draft mitigation strategy
- Mitigation Action prioritization
- Final mitigation strategy and implementation workbook

Mitigation Actions

Mitigation Actions	Goals/Objectives Supported	Responsibility
Provide outreach and awareness campaigns to the campus community to promote mitigation and preparedness efforts.	Goal 5, Obj.5-1 & 5-4	Emergency Management Office
Expand Mass Notification capabilities to high use/critical facilities such as the Student Center, Convocation Center, McKenny Union and Fletcher School.	Goal 1, Obj.1-1 Goal 2, Obj.2-2	Emergency Management Office
Identify structural fire suppression measures in residence halls.[10]	Goal 1, Obj.1-1	Physical Plant
Identify critical facilities/infrastructure needing backup power sources and means to provide backup power.	Goal 3, Obj.3-1 Goal 4, Obj.4-3	Physical Plant Emergency Management Office
Expand hazard identification and risk assessment and mitigation planning to Fish Lake and Parsons Center.	Goal 1, Obj.1-1 Goal 3, Obj.3-1	Emergency Management Office
Identify opportunity for the creation of a dual-use storm shelter for the athletic (West) campus.	Goal 1, Obj.1-1 Goal 3, Obj.3-1	Physical Plant Athletics Emergency Management Office
Identify opportunity for installation on an automated lightning detection system for the athletic (west) campus, main campus mall and Eagle Crest.	Goal 1, Obj.1-1 Goal 3, Obj.3-1	Emergency Management Office Physical Plant

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PLAN MAINTENANCE

Plan Maintenance Deliverables

- Draft Plan Maintenance Section, with an understanding of EMU's successes, including schedule for active participation with other state and local entities involved in hazard mitigation planning.
- Final Plan Maintenance Section

Plan Adoption Deliverables

- Plan Review Tool
- Draft plan
- Address recommended revisions
- Final plan
- Electronic files, including PDF, Microsoft Word, Excel, and GIS data

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PLAN MAINTENANCE

Next Steps

- Recruit additional team members – IT, Communications, ???
- Data collection and review
- Determine critical facilities – June 12 meeting
- Finalize hazard list – June 12 meeting
- Conduct risk and capability assessments
- Schedule Mitigation Planning Committee & Campus-wide Meetings
    1. Risk Assessment – target September
    2. Mitigation Strategy – target November
    3. Draft Plan – target January

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CONTACT INFORMATION

Contact Information

Christina Hurley
christina.hurley@stantec.com
910-540-9215

Danielle Curri
danielle.curri@stantec.com
919-865-7553

Matt Moy
matthew.moy@stantec.com
919-610-8175

Ben Schattschneider
ben.schattschneider@stantec.com
614 844-4019

Thank you!

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C2: MPC Meeting #2 Documentation

This appendix includes:

a) Invite and Attendee List
b) Meeting Presentation

Project Mgt Team Haz. Mitigation Plan Mtg

Created by: ldrabczy@emich.edu · Your response: ✔Yes, I'm going

Time

1pm - 2pm (Eastern Time - New York)

Date

Mon Jun 12, 2023

Guests

- ✔ Christina Hurley
- ✔ ldrabczy@emich.edu
- ✔ mlige@emich.edu
- ✔ rebecca.leitschuh@stantec.com
- ✔ rwoody@emich.edu
- ✔ sstorrar@emich.edu
- ✔ tohmer@emich.edu
- ⊘ dotto@emich.edu
  Declined because I am out of office
- ⊘ kwilhoff@emich.edu
- rjenkins@emich.edu

Description

Laura Drabczyk is inviting you to a scheduled Zoom meeting.

Topic: Laura Drabczyk's Personal Meeting Room

Join Zoom Meeting
https://emich.zoom.us/j/3118769447?pwd=bW1rL2FyZ3ppaG9wQ0wxVEcrYTNjQT09

Meeting ID: 311 876 9447
Passcode: 509270
One tap mobile
+16468769923,,3118769447# US (New York)
+16469313860,,3118769447# US

Dial by your location
+1 646 876 9923 US (New York)
+1 646 931 3860 US
+1 301 715 8592 US (Washington DC)
+1 309 205 3325 US
+1 312 626 6799 US (Chicago)
+1 408 638 0968 US (San Jose)
+1 564 217 2000 US
+1 669 444 9171 US
+1 669 900 6833 US (San Jose)
+1 719 359 4580 US

+1 253 215 8782 US (Tacoma)
+1 346 248 7799 US (Houston)
+1 360 209 5623 US
+1 386 347 5053 US
Meeting ID: 311 876 9447
Find your local number: https://emich.zoom.us/u/khe0x1DQz

My Notes

Eastern Michigan University

Hazard Mitigation Plan Update

Mitigation Planning Committee Kickoff Meeting

September 11, 2023

EASTERN MICHIGAN UNIVERSITY

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1

Agenda

1. Introductions
2. Mitigation Planning Overview
3. Project Overview
4. Progress to Date
5. Next Steps

EASTERN MICHIGAN UNIVERSITY

2

Safety Moment – Back to School Driving Safely

Following a school bus:
- Increase following distance
- Watch for flashing lights
- Allow plenty of space for entry or exit

Driving in a school zone:
- Don't load or unload across the street
- Avoid double parking
- Yield to pedestrians
- Watch for kids to appear in unexpected places
- Carpool when possible
- Never block as crosswalk

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3

Introductions

EMU Steering Committee

- **Laura Drabczyk**, Director of Risk and Emergency Management
- **Scott Storrar**, Director of Facilities Planning and Construction
- **Kathryn Wilhoff**, Director of Environmental Health and Safety
- **Todd Ohmer**, Executive Director Financial Planning and Budgets
- **Matthew Lige**, Chief of Police / Executive Directory of Public Safety

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- **Christina Hurley**, Hazard Mitigation Lead (Project Manager)
- **Ben Schattschneider,** Mitigation Strategy Lead
- **Danielle Curri,** Risk Assessment Lead
- **Matt Moy,** Capability and Capacity Assessment Lead
- **Shelby Chasteen,** GIS Lead

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4

Mitigation Planning Committee Roles

- University Outreach**:**
  - Participate in meetings
  - Share information regarding the planning process and campuswide engagement
- Share Knowledge and Feedback:
  - University hazards and impacts
  - University capability
  - Mitigation actions and plan goals
  - Plan review
- **Actively Participate** throughout process

EASTERN MICHIGAN UNIVERSITY

5

Hazard Mitigation Overview

6

What is Hazard Mitigation?

- **Hazard Mitigation:** Any sustained action taken to reduce or eliminate the long-term risk to human life and property from hazards.
- **Hazard Mitigation Plans:**
  - Identify hazard risk
  - Develop strategies to reduce it
  - Break the disaster cycle

FEMA

7

Why are we updating the plan?

- Meet FEMA Requirements for funding
- Build on previous plans and successes
  - 2013 EMU Multi-Hazard Mitigation Plan
  - 2023 Liquid Damage Prevention & Flood Response Plan
- REDUCE RISK!
- Continue to improve
  - Climate change integration
  - Understand asset and structure-level risk
  - Equity considerations

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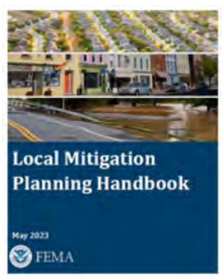
Hazard Mitigation Plan Sections

Element A.	Planning Process
Element B.	Hazard Identification & Risk Assessment
Element C.	Mitigation Strategy
Element D.	Plan Maintenance
Element F.	Plan Adoption



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Project Overview

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Project Overview

- Three main components:
  - Liquid Damage Prevention Plan
  - Flood Response Plan
  - FEMA-approved Hazard Mitigation Plan Update

EASTERN MICHIGAN UNIVERSITY

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Schedule

Task	Completion
Flood Response Plan	February 2023
Liquid Damage Prevention Plan	April 2023
Hazard Risk Data Collection Meeting	July 2023
Mitigation Planning (MP) Committee Kickoff Meeting	September 11, 2023
Risk Assessment and Capability Assessment Results • MP Committee & Campuswide Meeting	September 27, 2023
Mitigation Strategy Workshop #1 • MP Committee Meeting	November 2023
Mitigation Strategy Workshop #2 • MP Committee Meeting and Campuswide Meeting (in-person)	January 2024
Draft Plan Review Period	February-March 2024
Plan Adoption	April-May 2024

EASTERN MICHIGAN UNIVERSITY

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Plan Sections & Progress to Date

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Liquid Damage Prevention and Flood Response Plan

- ❖ Completed in April 2023
- ❖ Details actions to limit property damage and respond to flood events on EMU's campus
- ❖ Provides checklists for staff to follow to prevent and respond to liquid damage
- ❖ Defines roles and responsibilities of partners involved in responding to flood events

2024 EMU HAZARD MITIGATION PLAN

EASTERN MICHIGAN UNIVERSITY

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Engagement

- ❖ Formed Steering Committee (meets monthly)
- ❖ Formed Mitigation Planning Committee (today's kickoff)
- ❖ Draft Survey (will review today)

PUBLIC SURVEY FOR INPUT INTO THE EASTERN MICHIGAN UNIVERSITY
2024 HAZARD MITIGATION PLAN UPDATE

We need your help!

Eastern Michigan University is currently engaged in a planning process to become less vulnerable to natural, manmade, and technological disasters, and your participation is important to us!

EMU, along with partners, is working to update the University's campuswide hazard mitigation plan, developed in 2013. The purpose of this Plan is to identify and assess EMU's hazard risks and determine how to best minimize or manage those risks. Upon completion, the Plan will provide a comprehensive approach to managing hazards on the EMU campus.

This survey provides an opportunity for you to share your opinions and participate in the hazard mitigation planning process. The information you provide will help us better understand your hazard concerns and help us identify mitigation activities that should help lessen the impact of future hazard events, including natural and human-caused hazards.

Please help us by completing this survey by October 30, 2023 and returning it to:

2024 EMU HAZARD MITIGATION PLAN

EASTERN MICHIGAN UNIVERSITY

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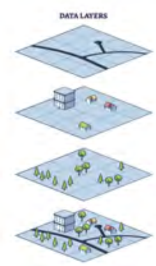
Data Collection

- ❖ Gathered EMU data for GIS analysis
  - ❖ Excel tables
  - ❖ Online sources
  - ❖ University sources
  - ❖ Campus Infrastructure (stormwater and sewer)
- ❖ Developed Buildings Database including:
  - ❖ Building footprints
  - ❖ Building and contents values (SOV)
  - ❖ HAZMAT presence
  - ❖ Historic designation
  - ❖ Criticality



2024 EMU HAZARD MITIGATION PLAN

EASTERN MICHIGAN UNIVERSITY

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Data Collection

- ❖ Buildings Database
  - ❖ EMU Building footprints
  - ❖ Tabular attributes

2024 EMU HAZARD MITIGATION PLAN

EASTERN MICHIGAN UNIVERSITY

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Hazard ID

- ❖ Buildings Database: tabular attributes

Building Name	Statement of Value	Hazardous Materials	Historic Marker	Critical Facility	Critical IT	Insurance Zone
Warner Gym, Bowen Fieldhouse, Rec-IM, and Jones Pool Complex	$88,797,785.00	High	Not Specified	No	No	High
Alexander Music Building	$21,606,488.00	Medium	Not Specified	No	No	Medium
Best Residence Hall	$11,911,051.00	Low	Not Specified	No	No	Low
Boone Hall	$13,202,858.00	Low	Historic	No	No	Low
Briggs Hall	$1,446,883.00	Medium	Not Specified	No	No	Low
The Commons	$8,781,556.00	Low	Not Specified	Yes	Yes	Low
Buell Residence Hall	$11,957,807.00	Low	Not Specified	No	No	High
Central Receiving/Mail Room	$620,248.00	Medium	Not Specified	No	No	Low
George Gervin GameAbove Center	$43,865,403.00	Medium	Not Specified	Yes	No	Low
Cornell Courts Apartments	$2,599,155.00	Low	Not Specified	No	No	Low
Cornell Courts Apartments	$2,599,155.00	Low	Not Specified	No	No	Low

2024 EMU HAZARD MITIGATION PLAN

EASTERN MICHIGAN UNIVERSITY

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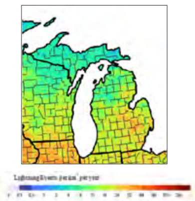
Risk Assessment

- Assessment of risk for natural, technological and human-caused hazards
- All hazards include a profile and a vulnerability assessment
- The hazard profiles include:
  - Description
  - Previous occurrences
  - Extent (or magnitude)
  - Probability
- Estimate the potential health, safety and property damages, and reputational risks attributable to hazards.



Source: Vaisala, Inc. Total Lightning Density (2016-2021)

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Vulnerability Assessment

- When GIS data is available, a structure-based risk assessment is performed
- When applicable, the vulnerability assessment will address the following potential vulnerabilities to each hazard:
  - Impact on buildings and critical facilities
  - Damage to critical infrastructure
  - Impacts to health and life safety
  - Economic and operations impacts
  - Future conditions

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Hazards List

2023 EMU Hazards	Included in 2013 Plan?
Extreme Cold/Wind Chill	✓
Extreme Heat	
Hail	
Lightning	
Severe Winter Weather	✓
Severe Winds	✓
Tornadoes	✓
Dam Failure	
Drought	
Flood and Extreme Precipitation	✓
Earthquakes	✓
HAZMAT – fixed and transportation	✓
Nuclear Power Plant Incidents	
Petroleum and Natural Gas Pipeline Accidents	✓
Power Outages	✓
Structural and Industrial Fires	✓
Water Contamination	✓
Civil Disturbances	✓
Cyber-Attacks	✓
Public Health Emergencies	✓
Terrorism and Similar Criminal Activities	✓

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Mentimeter Questions

https://www.menti.com/albw19dmy1p7

Code: **6224 9538**

22

Which hazards concern you the most on campus? (Free Response)

- Extreme Cold/Wind Chill
- Extreme Heat
- Hail
- Lightning
- Severe Winter Weather
- Severe Winds
- Tornadoes
- Dam Failure
- Drought
- Flood and Extreme Precipitation
- Earthquakes
- HAZMAT
- Petroleum and Natural Gas Pipeline Accidents
- Power Outages
- Structural and Industrial Fires
- Water Contamination
- Civil Disturbances
- Cyber-Attacks
- Public Health Emergencies
- Terrorism and Similar Criminal Activities
- **Other?**

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Mitigation Strategy

Forthcoming:

- Review and revise goals
- Review and revise existing actions
- Develop new actions
- Create mitigation action list

Mitigation Actions

Mitigation Actions	Goals/Objectives Supported	Responsibility
Provide outreach and awareness campaigns to the campus community to promote mitigation and preparedness efforts.	Goal 5, Obj.5-1 & 5-4	Emergency Management Office
Expand Mass Notification capabilities to high use/critical facilities such as the Student Center, Convocation Center, McKenny Union and Fletcher School.	Goal 1, Obj.1-1 Goal 2, Obj.2-2	Emergency Management Office
Identify structural fire suppression measures in residence halls.[10]	Goal 1, Obj.1-1	Physical Plant
Identify critical facilities/infrastructure needing backup power sources and means to provide backup power.	Goal 3, Obj.3-1 Goal 4, Obj.4-3	Physical Plant Emergency Management Office
Expand hazard identification and risk assessment and mitigation planning to Fish Lake and Parsons Center.	Goal 1, Obj.1-1 Goal 3, Obj.3-1	Emergency Management Office

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Plan Maintenance

Forthcoming:

- Works in conjunction with the mitigation strategy
- Monitoring
- Evaluating
- Updating

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Engagement Opportunities

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Draft Survey Review

1. **What is your affiliation with the University?**
   - Student
   - Faculty
   - Staff
   - Community Member
   - Other ______

Campus-Related Questions

2. **Please select the one hazard you think is the highest threat to campus:**
   - Civil Disturbances / Civil Unrest
   - Cyber Attack
   - Dam Failure
   - Drought
   - Earthquake
   - Extreme Cold / Wind Chill
   - Extreme Heat
   - Flood and Extreme Precipitation
   - Hail
   - Hazardous Materials Incident
   - Lightning
   - Petroleum and Natural Gas Pipeline Accidents
   - Power Outages
   - Public Health Emergencies
   - Severe Wind
   - Severe Winter Weather
   - Structural and Industrial Fires
   - Terrorism and Similar Criminal Activities (including Active Shooter and Special Event Disruptions)
   - Tornadoes
   - Water Contamination
   - Other (please describe)______

3. **Please select the one hazard you think is the highest threat to campus:**
   - Civil Disturbances / Civil Unrest
   - Cyber Attack
   - Dam Failure
   - Drought
   - Earthquake
   - Extreme Cold / Wind Chill
   - Extreme Heat
   - Flood and Extreme Precipitation
   - Hail
   - Hazardous Materials Incident
   - Lightning
   - Petroleum and Natural Gas Pipeline Accidents
   - Power Outages
   - Public Health Emergencies
   - Severe Wind
   - Severe Winter Weather
   - Structural and Industrial Fires
   - Terrorism and Similar Criminal Activities (including Active Shooter and Special Event Disruptions)
   - Tornadoes
   - Water Contamination
   - Other (please describe)______

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4. **Have you ever experienced or been impacted by a hazard event on campus?**
   - Yes
   - No

   If "Yes," please explain:

5. **How concerned are you about the possibility of your campus being impacted by a future hazard event?**

6. **In your opinion, what are some of the things the University is doing currently that should be continued in order to reduce or eliminate the risk of future hazards impacts on campus?**

7. **In your opinion, what are some steps the University could take to reduce or eliminate the risk of future hazard impacts on campus?**

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Draft Survey Review

9. **Are some areas of the campus particularly vulnerable to hazards, or is the campus equally vulnerable?**
   - Yes
   - No
   - I don't know

10. **If "Yes," what areas are most vulnerable, and what are their uses?**

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9. **Are some areas of the campus particularly vulnerable to hazards, or is the entire campus equally vulnerable?**

10. **If "Yes," what areas are most vulnerable, and what are their uses?**

11. **Are some buildings on campus particularly vulnerable to hazards?**

12. **If "Yes," what are the uses of the vulnerable buildings, and who occupies them?**

13. **What is the most effective way for you to receive information about campus safety procedures and how to make the University more resistant to hazards?**
    - Newspaper
    - Television
    - Radio
    - Social Media
    - Email
    - Mail
    - Phone
    - Public workshops/meetings
    - School meetings
    - Other (please explain): ______

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Upcoming Engagement Opportunities

- Survey – Once posted, take survey and distribute within network
- MP Committee & Public Meeting – September 27, 2023
  - Risk Assessment Results and Mitigation Strategy
- MP Committee Meeting – November 2023
  - Mitigation Strategy Workshop #1
- MP Committee Meeting and Campuswide Meeting (in-person) – January 2024
  - Mitigation Strategy Workshop #2

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Next Steps

- Prepare Risk Assessment Results
- Finalize Capability and Capacity Assessment
- Collect Survey Results
- Plan/prep for Mitigation Planning Committee and Public Meeting
  - September 27th

Diversity, Equity & Inclusion (emich.edu)

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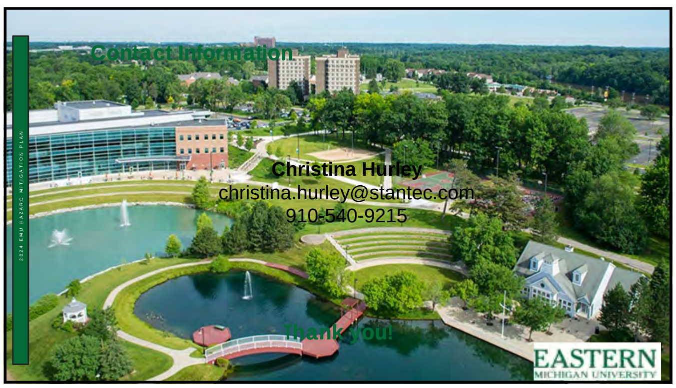

Contact Information

Christina Hurley
christina.hurley@stantec.com
910-540-9215

Thank you!

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Which goals from the 2013 plan are still relevant for the 2023 plan? (Select goals that still apply)

1. Create a safe and secure environment for students, faculty, staff, and visitors.
2. Enhance emergency communications systems to provide the campus community with appropriate protective action and mitigation information.
3. Strengthen University continuity of operations through integration with emergency response plans and procedures, including the mitigation plan.
4. Be proactive in identifying mitigation opportunities into capital improvement and infrastructure planning projects and other campus functions and programs.
5. Enhance emergency preparedness, increase awareness, and promote risk reduction activities through education of and outreach to the campus community.

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Goals from 2013 EMU HMP

1. Create a safe and secure environment for students, faculty, staff, and visitors.
2. Enhance emergency communications systems to provide the campus community with appropriate protective action and mitigation information.
3. Strengthen University continuity of operations through integration with emergency response plans and procedures, including the mitigation plan.
4. Be proactive in identifying mitigation opportunities into capital improvement and infrastructure planning projects and other campus functions and programs.
5. Enhance emergency preparedness, increase awareness, and promote risk reduction activities through education of and outreach to the campus community.

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Critical Facilities

- Critical facilities are identified as assets to the university, essential to its functioning and the destruction of which would cause a serious impact on the continued operation of the university.
- In general, critical facilities can normally be grouped into one of these FEMA Community Lifelines:
  - Safety and Security
  - Food, Water, Shelter
  - Health and Medical
  - Energy
  - Communications
  - Transportation
  - Hazardous Materials
- Assets selected under this definition include campus police, fire, emergency operations, major technology nodes, transportation, public health, and structures containing major campus power feeds/supplies.

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EMU Critical Facilities

2024 EMU HAZARD MITIGATION PLAN

- Medical Facilities
- Dining Facilities
- Plant
- Public Safety
- Sheltering / Staging?
- Salt / Brine Storage?
- Fuel Storage Tanks (under- and above-ground)?

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Critical Facilities

2024 EMU HAZARD MITIGATION PLAN

Building Name	Reasoning
Heating Plant / Energy Center	Plant
The Commons	Dining
Student Center	Dining /Student Center
Eastern Eateries	Dining
Physical Plant	Plant
Physical Plant Garage Building	Plant Facility/HAZMAT
Dept. of Public Safety	Public Safety/Dining
EMU Campus Wellness Center	Medical
Trinity Health	Medical
Pray-Harrold Classroom Building	Gathering / Reunification
George Gervin Game Above Center	Gathering / Reunification
Rynearson Football Stadium	Gathering / Reunification
Welch Hall/Administration Building	HAZMAT
Mark Jefferson Science Building	HAZMAT
Coatings Research Institute	HAZMAT
Sill Hall	HAZMAT

- Trinity Health is also called the IHA Health Center. Does EMU own and manage the structure? Is there a preferred name?
- Does Welch Hall / Administration Building have HAZMAT? Noted in the AGO with mechanical room comment.
- Does the Wellness Center also contain medical facilities?

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Not Critical Facilities (Residential)

2024 EMU HAZARD MITIGATION PLAN

Building Name
Tri Sig House
Jones Residence Hall
Munson Residence Hall
Goddard Residence Hall
Brown Apartments
Downing Residence Hall
Best Residence Hall
Buell Residence Hall
Wise Residence Hall
Sellers Residence Hall
Walton Residence Hall
Phelps Residence Hall
Putnam Residence Hall
May Remove - Westview Apartments
Cornell Courts Apartments
Village Residence Hall D
Village Residence Hall C
Cornell Courts Apartments
Cornell Courts Apartments
Village Residence Hall F
Hill Residence Hall
Pittman Residence Hall
Village Residence Hall E
Village Residence Hall Commons

Building Name
Cornell Courts Apartments
Cornell Courts Apartments
Village Residence Hall B
May Remove - Westview Apartments
Hoyt Tower
Cornell Courts Apartments
Cornell Courts Apartments
Village Residence Hall A
May Remove - Westview Apartments
Cornell Courts Apartments
Cornell Courts Apartments
Lakeview Residence Hall
Westview Residence Hall

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Not Critical Facilities

2024 EMU HAZARD MITIGATION PLAN

Building Name
EMU Foundation
Corporate Education Center
Eagle Crest Golf Club
Golf Course Maintenance Building
College of Business/Owen
Boone Hall
McKenny Hall
Ford Hall
Starkweather Hall
Pease Auditorium
Terrestrial & Aquatic Ecology Research Facility
Briggs Hall
Pierce Hall
Sherzer Hall
Hover Building
King Hall
Strong Physical Science Building
Roosevelt Hall
Marshall Building
Rackham Building
Halle Library
Geddes Town Hall School House
Porter College of Education Building
Judy Sturgis Hill Building
Alexander Music Building
Warner Gymnasium
Olds-Robb Student Recreation Center
Bowen Field House
University House

Building Name
University House
Jones Pool
526 St. Johns
Lake House
Fletcher
Softball Complex
Sculpture Studio
Softball Complex
Central Receiving/Mail Room
Student Athlete Performance Center
Oestrike Stadium
Indoor Practice Facility
The Honors College
Parking Structure
725 N Huron St
800 St Johns St

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C3: MPC Meeting #3: Risk Assessment and Capability Assessment Results Documentation

This appendix includes:

a) Invite and Attendee List
b) Meeting Presentation

Project Mitigation Planning Team Meeting

Created by: ldrabczy@emich.edu · Your response: ✔Yes, I'm going

Time
10am - 11:30am (Eastern Time - New York)

Date
Wed Sep 27, 2023

Description
Laura Drabczyk is inviting you to a scheduled Zoom meeting.

Topic: Laura Drabczyk's Personal Meeting Room

Join Zoom Meeting
https://emich.zoom.us/j/3118769447?pwd=bW1rL2FyZ3ppaG9wQ0wxVEcrYTNjQT09

Meeting ID: 311 876 9447
Passcode: 509270

One tap mobile
+13052241968,,3118769447# US
+13092053325,,3118769447# US

Dial by your location
• +1 305 224 1968 US
• +1 309 205 3325 US
• +1 312 626 6799 US (Chicago)

Guests
- ✔ brad.valley@compass-usa.com
- ✔ Christina Hurley
- ✔ dotto@emich.edu
- ✔ jphelp10@emich.edu
- ✔ kcorwin@emich.edu
- ✔ klawson@emich.edu
- ✔ kwilhoff@emich.edu
- ✔ ldrabczy@emich.edu
- ✔ rjenkins@emich.edu
- ? rwoody@emich.edu
  Laura - I'll be at the hospital at this time as a family member is having surgery. If I'm able to sneak away to a quiet place, I'll try to join.
- ⊘ tohmer@emich.edu
- allison.duceatt@compass-usa.com
- gsanchez@emich.edu
- mlige@emich.edu
- sstorrar@emich.edu

- +1 646 876 9923 US (New York)
- +1 646 931 3860 US
- +1 301 715 8592 US (Washington DC)
- +1 253 215 8782 US (Tacoma)
- +1 346 248 7799 US (Houston)
- +1 360 209 5623 US
- +1 386 347 5053 US
- +1 408 638 0968 US (San Jose)
- +1 507 473 4847 US
- +1 564 217 2000 US
- +1 669 444 9171 US
- +1 669 900 6833 US (San Jose)
- +1 689 278 1000 US
- +1 719 359 4580 US
- +1 253 205 0468 US

Meeting ID: 311 876 9447

Find your local number: https://emich.zoom.
us/u/khe0x1DQz

My Notes

Eastern Michigan University

Hazard Mitigation Plan Update

Risk Assessment and Capability Assessment Results

Mitigation Planning Committee
September 27, 2023

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Stantec

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Agenda

1. Introductions
2. Progress Updates
3. Capability and Capacity Assessment Results
4. Risk Assessment Results
5. Mitigation Strategies
6. Next Steps

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Stop & Talk: Additional Hazards in the Vehicle

SaferTogether

When talking about hazards that exist when driving a vehicle, great attention is paid to events and situations that happen outside the vehicle. In most cases, the dangers in the vehicle itself are ignored, but even with the slightest vehicle accident, the hazards inside the vehicle can lead to further injury to the car's driver or passengers.

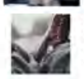
Lanyards/Keys – in a large number of car accidents, the driver sustained additional serious injuries (i.e., collapsed lung, perforated bowel) because they were wearing their lanyards/keys around their neck. It is recommended for the driver to remove their lanyard/keys or breakaway lanyards before driving.

Pens in Shirt Pocket – carrying a pen in a top pocket or any sharp objects – can be forced into the body or face in the event of a collision.

Mobile Phones – statistics in the UK show drivers using their mobile phones, are four times more likely to be involved in a crash.

Satellite Navigation Systems – Satellite navigation systems are invaluable, but when poorly used, the system can be a distraction. Know how to operate it before you get into the car to reduce uncertainly when driving. Position the satellite navigation out of the way of airbags and from blocking the driver's view.

Pets Roaming Free in the Car – this can be a driver distraction and smaller pets have been known to interfere with the driver's foot pedals. Keep animals restrained with a pet carrier or seat belt harness.



Legs up on the Dashboard – putting your feet up on the dashboard of the car can cause substantial injury during a collision. If the airbag deploys, it can propel your extended limbs into your face. Keep both feet on the floor when travelling in a car.

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Progress Updates

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Hazard Mitigation Planning Process

- **Hazard Mitigation:** Any sustained action taken to reduce or eliminate the long-term risk to human life and property from hazards.
- **Hazard Mitigation Plans:**
  - Identify hazard risk
  - Develop strategies to reduce it
  - Break the disaster cycle

FEMA

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Hazard Mitigation Plan Sections

Element A.	Planning Process
Element B.	Hazard Identification & Risk Assessment
Element C.	Mitigation Strategy
Element D.	Plan Maintenance
Element F.	Plan Adoption

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Schedule

Task	Completion
Flood Response Plan	February 2023
Liquid Damage Prevention Plan	April 2023
Hazard Risk Data Collection Meeting	July 2023
Mitigation Planning (MP) Committee Kickoff Meeting	September 11, 2023
Risk Assessment and Capability Assessment Results • MP Committee & Campuswide Meeting	September 27, 2023
Mitigation Strategy Workshop #1 • MP Committee Meeting	November 2023
Mitigation Strategy Workshop #2 • MP Committee Meeting and Campuswide Meeting (in-person)	January 2024
Draft Plan Review Period	February-March 2024
Plan Adoption	April-May 2024

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Upcoming Engagement Opportunities

- Survey – **NOW OPEN** through October 30th: https://questionpro.com/t/AJ8lIZzqn4
- Public Kickoff Meeting – September 27, 2023
- MP Committee Meeting – November 2023
  - Mitigation Strategy Workshop #1
- MP Committee Meeting and Public Meeting #2 (in-person) – January 2024
  - Mitigation Strategy Workshop #2

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Capability and Capacity Assessment Results

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Capability Assessment

Purpose

- Understand EMU's ability to implement a mitigation strategy
- Understand strengths and challenges to implementing mitigation actions (e.g., planning, staffing, resources)
- Understand and build upon mitigation successes
- Identify opportunities to enhance mitigation-related policies, programs, and projects

Process

- Plans and programmatic documents collected and reviewed during data request period
- Input from Steering Committee to gain understanding of needs and abilities

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Capability Assessment

Plans Reviewed:

- 2013 Hazard Mitigation Plan
- 2023 Flood Response Plan
- 2023 Liquid Damage Prevention Plan
- 2023 Continuity of Operations Plan (COOP)
- 2018 Campus Evacuation Procedures Plan
- Building Emergency Plans (sample)
- Campus Master Plan
- Capital Outlay Plan 2024
- Pandemic Response Plan

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Capability Assessment

Findings:

- Fiscal Capability:
  - EMU has made fiscal commitments to mitigate hazard impacts on campus, but constraints exist (e.g., competitive grants)
  - EMU maintains insurance to cover hazard-related damages to buildings
- Planning Capability:
  - EMU has invested in plans aimed to reduce hazard impacts
  - Recommended plans - Stormwater Management Plan, Disaster Recovery Plan
- DISCUSSION:
  - Are there other plans or policy documents we should be aware of?
  - Staffing capacity needs?

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Risk Assessment Results

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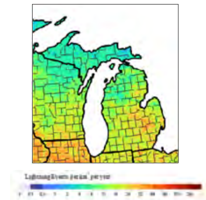
Risk Assessment

- Assessment of risk for natural, technological and human-caused hazards
- All hazards include a profile and a vulnerability assessment
- The hazard profiles include:
  - Description
  - Previous occurrences
  - Extent (or magnitude)
  - Probability
- Estimate the potential health, safety and property damages, and reputational risks attributable to hazards.



Source: Vaisala, Inc. Total Lightning Density (2016-2021)

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Vulnerability Assessment

- When GIS data is available, a structure-based risk assessment is performed
- When applicable, the vulnerability assessment will address the following potential vulnerabilities to each hazard:
  - Impact on buildings and critical facilities
  - Damage to critical infrastructure
  - Impacts to health and life safety
  - Economic and operations impacts
  - Future conditions

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Hazards List

2023 EMU Hazards
Extreme Cold/Wind Chill
Extreme Heat
Hail
Lightning
Severe Winter Weather
Severe Winds
Tornadoes
Dam Failure
Drought
Flood and Extreme Precipitation
Earthquakes
HAZMAT – fixed and transportation
Nuclear Power Plant Incidents
Petroleum and Natural Gas Pipeline Accidents
Power Outages
Structural and Industrial Fires
Water Contamination
Civil Disturbances
Cyber-Attacks
Public Health Emergencies
Terrorism and Similar Criminal Activities

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Natural Hazards – Hydrological Hazards

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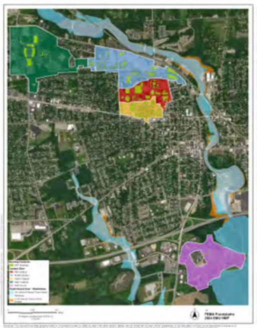
Flood and Extreme Precipitation

- Flooding Sources
  - Riverine Flooding
  - Stormwater
- Jones Pool Flood cost ~$3.2 million
- 35 incidents in Washtenaw County in the last 25 years

Were there flooding impacts from the August incident?

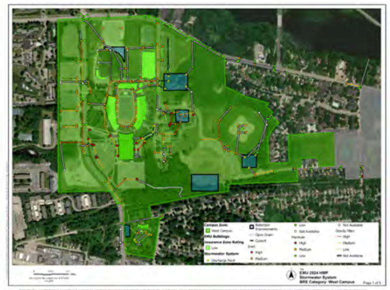
20

FEMA Flood Hazard Areas



21

Stormwater BRE scores and Insurance Zone Ratings



- Stormwater system along **Cornell Drive** and around **Rynearson Football Stadium**
- **Hill Residence Hall** and **Pittman Residence Hall**
- **Eastern Eateries** and **surrounding residence halls** are surrounded by stormwater systems that are medium to high risk.
- The gravity main along **McKinny Hall i**s shown as high risk.

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Flood and Extreme Precipitation

- **Vulnerability**
  - Building contents can be lost, damaged, or destroyed, and structures themselves can be compromised by floodwaters
  - Flooding can cause sewer overflows
  - Transportation impacts
- **Climate Projections**
  - Midwest has experienced a 42% increase in heavy precipitation between 1958 and 2016 (NOAA)
  - Ypsilanti will experience a 2-inch increase of rainfall a year by mid-century (GLISA)
  - Heavy rainfall events have increased
  - Precipitation is projected to be more concentrated

23

Dam Failure

- 3 HHPDs in proximity of the University
- City of Ypsilanti is working to remove the Peninsular Paper Dam
- 2 previous dam failure incidents (no casualties)
- **Building Risks**
  - No buildings in dam inundation areas
- **Infrastructure Risks**
  - Power outages and water contamination
  - Road blockage
- **Population Risks**
  - Students or staff off-campus
  - Injuries or loss of life
- **Climate Projections**
  - Prolonged rainfall can increase likelihood of dam failure
  - Extreme precipitation can increase likelihood of dam failure
  - Older dams are likely not designed for changing climate conditions

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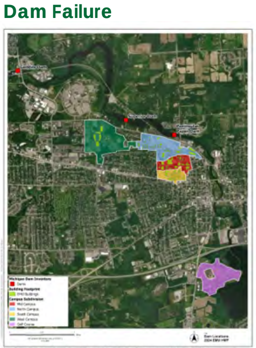
Dam Failure



* Mitigation action in the *2022 Ann Arbor HMP* is to update the dam inundation maps

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Drought

- US Drought Monitor 2000 – 2022
  - 5 years with severe drought
  - 20 years with drought
- 1963 – 1964 drought 35 weeks of severe to exceptional drought
- **Building Risks**
  - Disrupted water supply
  - Extreme cases, foundation damages
- **Infrastructure Risks**
  - Green infrastructure impacts
- **Population Risks**
  - Water conservation
  - Increased costs
  - Food services may be impacted
- **Climate Projections**
  - Summer temperatures expected to increase (GLISA)
  - Precipitation is variable and seasonal (GLISA)
  - Potential for an increase in seasonal summer drought conditions

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Natural Hazards – Weather Hazards

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Extreme Heat

- 12 reported heat waves in Washtenaw County since 1996
  - 17 reported injuries, 0 deaths
- **Building Risks**
  - Buildings, roads, parking lots, and turf fields contribute to urban heat island effect
  - Buckling in rare cases
- **Infrastructure Risks**
  - Pavement expansion and buckling
  - Power outages (indirect)
- **Population Risks**
  - Older adults, children, athletes, and outdoor workers are at higher risk
  - Populations without air conditioning are at higher risk
- **Climate Projections 2040 – 2059 (GLISA)**
  - 4.25 to 5°F increase in annual average temperature
  - 20 – 22.5 additional days over 90 °F

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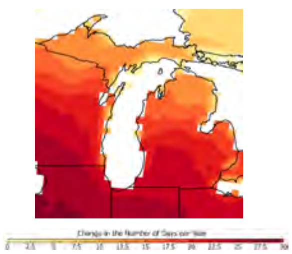
Extreme Heat



Projected Change in Days Over 90°F, 2040-2059

Source: GLISA

Projected Change in Average Temperature, 2040-2059

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Extreme Cold

- 3 reported events since 2000
- University water incident data
  - 10 of 32 incidents cited freezing
- **Building Risks**
  - Burst pipes
  - Power Outages
- **Infrastructure Risks**
  - Stress to concrete and asphalt
  - Broken water mains
- **Population Risks**
  - Frostbite and hypothermia
  - Elderly, young children, and those without heat are at high risk
  - Increase in carbon monoxide related deaths
- **Climate Projections** 2040 – 2059 (GLISA)
  - Number of days below 20°F will decrease by 2.5 to 5 days
  - EMU is still likely to experience extreme cold temperatures

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Hail

- 241 incidents in Washtenaw County between 1955 and 2021
  - 21 reported for Ypsilanti
  - Largest reported 1.75 inches in Ypsilanti
- **Building Risks**
  - Roofs
  - Building exteriors and exposed glass and metal
- **Infrastructure Risks**
  - Roads and sidewalks
  - Utilities
  - Bridges
- **Population Risks**
  - Injuries and loss of life
  - Unhouse populations at higher risk
  - Extensive property damages
- **Climate Projections** (National Climate Assessment)
  - Impacts on intensity are uncertain
  - Projected increase in the number of days with thunderstorm environment

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Lightning

- Campus area approximately 21 lightening flashes per square kilometer per year (Vaisala, Inc.)
- 21 events reported for Washtenaw County since 1996.
  - 1 death, 4 injuries
  - Over $3.4 million in property damages
- **Building Risks**
  - Structure fires
  - Loss of electrical equipment
- **Infrastructure Risks**
  - Electrical systems, infrastructure in open areas have higher vulnerability
  - Falling limbs can damage or block infrastructure
- **Population Risks**
  - Injury or death
  - People outside at higher risk
- **Climate Projections**
  - Projected increase in the number of days with thunderstorm environment

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Severe Winter Weather

2024 EMU HAZARD MITIGATION PLAN

- 64 reported incidents in Washtenaw County since 1996
  - 1 death, $16.2 million in property damages
  - Approximately 2.5 incidents a year
- **Building Risks**
  - Snow load, ice dams
  - Roof damage from debris
- **Infrastructure Risks**
  - Snow and ice accumulation
  - Power Outages

Have there been any notable incidents or impacts on campus?

- **Population Risks**
  - Slipping, falling
  - Falling ice, driving conditions
- **Climate Projections**
  - Increase in heavy precipitation (GLISA)
  - Warmer temperatures may lead to more rainfall or freezing rain (Graham Sustainability Institute)

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Severe Winds

2024 EMU HAZARD MITIGATION PLAN

- 501 winds events for Washtenaw County between 1957 and 2023
  - 3 deaths, 13 injuries
- Ypsilanti experience 27 – 36 thunderstorm days a year on average (NOAA)
- **Building Risks**
  - Blown shingles, sidings, awnings, and other building features
  - Damage from debris
  - Extreme cases buildings can be blown off foundation
- **Infrastructure Risks**
  - Downed communication lines and utilities
  - Debris
- **Population Risks**
  - People outside have higher vulnerability
  - Injuries, death
- Washtenaw County sounds sirens when winds are over 75 mph
- **Climate Projections**
  - Projected increase in the number of days with thunderstorm environment

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Tornadoes

2024 EMU HAZARD MITIGATION PLAN

- 1950 – January 2023, 28 tornadoes reported in Washtenaw County
  - 1 fatality, 12 injuries
- August 24, 2023 – 6 tornadoes in Southeast Michigan
- 1953 Tornado
  - 1 death, 5 injuries
  - Over $23 million in damaged (2023 dollars)
- **Building Risks**
  - Mobile homes/ units
  - Structures on crawlspaces
  - Buildings with large spans
- **Infrastructure Risks**
  - Above ground infrastructure – extensive damage/ complete destruction
  - HAZMAT spills or leaks
  - Debris blocking roads
- **Population Risks**
  - Injuries, deaths
  - Damaged housing

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Tornadoes

2024 EMU HAZARD MITIGATION PLAN

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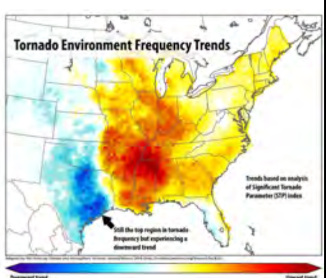
Tornadoes

2024 EMU HAZARD MITIGATION PLAN

- Climate Projections
  - Projected increase in the number of days with thunderstorm environment
  - Tornado Alley shifting (Northern Illinois University)



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Natural Hazards – Geological Hazards

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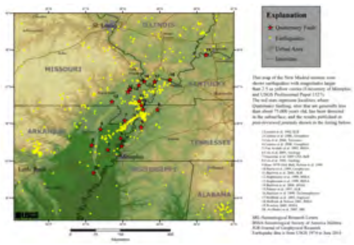
Earthquakes

- Grenville Front – dormant
- New Madrid Fault
  - Approximately 300 miles from EMU



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Earthquakes

- Charlevoix-Kamouraska Seismic Zone (CSZ)
  - Quebec, Canada
  - Approximately 400 miles from the University
- Fault between Kalamazoo and Coldwater, MI
  - Approximately 100 miles from the University

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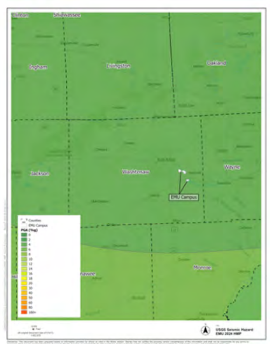
Earthquakes



41

Earthquakes

- Catastrophic event is unlikely
- **Building Risks**
  - Structural damage
  - Falling objects
- **Infrastructure Risks**
  - Structural damage
  - Burst pipes
  - Dam Failure
- **Population Risks**
  - Injuries/ Death
  - Public Health emergencies
  - High-density living situations

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Technological Hazards – Industrial Hazards

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HAZMAT

- 27 Toxic Release Inventory (TRI) sites in Washtenaw County
  - 2 TRI Sites in proximity to campus
  - Largest fixed site release 24,956 lbs. of zinc compounds in 2018
- Since 1975, 277 PHMSA reported incidents in Ypsilanti
  - 5 serious incidents
- 11 buildings on campus with HAZMAT rated high

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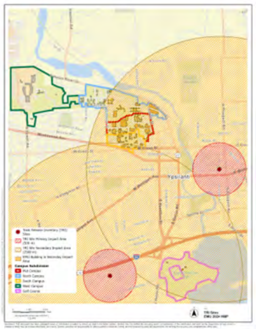
Fixed HAZMAT



- No campus buildings in Primary Impact Area
- 59 campus buildings in Secondary Impact Area

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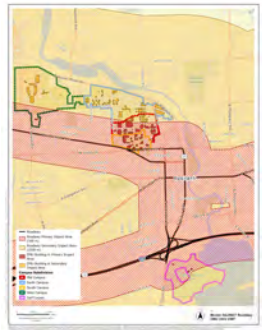
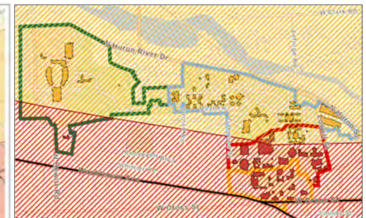
Mobile HAZMAT - Roads





- 35 campus buildings in Primary Impact Area
- 51 campus buildings in Secondary Impact Area

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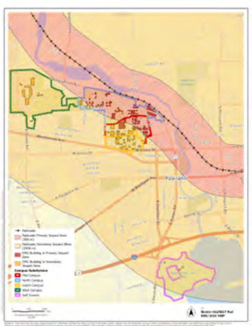
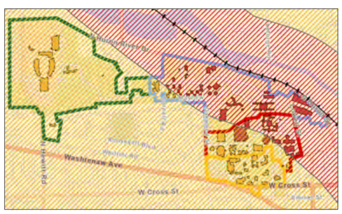
Mobile HAZMAT - Rail





- 47 campus buildings in Primary Impact Area
- 39 campus buildings in Secondary Impact Area

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HAZMAT

- Washtenaw County outdoor warning system
- **Building Risks**
  - Fires
  - Corrosive Materials
- **Infrastructure Risks**
  - At higher risk from HAZMAT transport
- **Population Risks**
  - Injuries or Fatalities
  - Exposure to contaminants
- **Climate Projections**
  - No direct impacts on HAZMAT
  - More frequent natural hazards could increase incidents

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Nuclear Power Plant Incidents

- EMU is approximately 27 miles from the Enrico Fermi II Plant
- Secondary Emergency Planning Zone (EPZ)
  - Avoid or reduce potential ingestion of radioactive materials (ban of contaminated food and water)
- Previous plant had 1 incident
- **Building Risks**
  - Unlikely in secondary EPZ
- **Infrastructure Risks**
  - Water supply shut down
  - Secondary impacts from evacuations in primary EPZ
- **Population Risks**
  - Food, water, or air supply may be contaminated
- **Climate Projections**
  - Growing energy needs may increase the number of nuclear power plants

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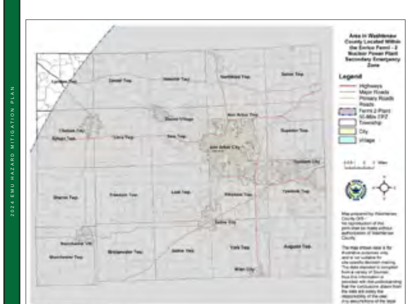
Nuclear Power Plant Incidents



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Petroleum and Natural Gas Pipeline Accidents

- **Building Risks**
  - Currently, no hazardous lines run through the University's campus
  - Any petroleum and natural gas leaks can damage buildings during construction, digging, or excavation
- **Infrastructure Risks**
  - A damaged pipeline can lead to roads and sidewalks needing to be dug up
- Pipeline leaks can pollute and contaminate water sources underground or cause shut offs
- **Population Risks**
  - Students living off-campus during winter months may have impacts if shut offs or leaks occur

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Power Outages

- EMU supplies over 90% of its own heat and electricity through its cogeneration system
  - DTE serves as a standby power source
- 4 notable power outages in Ypsilanti lasting several days since 2010 (local news articles)
- June 12, 2017 – classes canceled due to DTE power outages

Any notable events on campus?

Any sensitive research equipment?

- **Building/Infrastructure Risks**
  - Surges could damage electrical systems
  - Loss of heating / cooling
- **Population Risks**
  - Evacuation during summer / winter
  - Medical equipment
  - Off campus housing
- **Climate Projections**
  - Increased storm activity may cause more frequent outages
  - Demand for electricity (extreme heat) may result in blackouts or brownouts

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Structural and Industrial Fires

- EMU's Annual Security & Fire Safety Report (2022)
  - 8 structural fires (2019 – 2021)
  - No deaths, injuries
- 6 events near/ on EMU's campus
  - 1 student fatality (off campus)
  - 5 student injuries 1987 Hoyt Center fire
- **Building Risk**
  - Significant damage, loss of property
  - Densely populated buildings
- **Population Risks**
  - Injuries, death
  - Dorms, apartments at higher risk
  - Students living off-campus may live in housing at higher risk
  - 50% of deaths are in homes without working smoke detectors (Michigan HMP)
- **Climate Projections**
  - No anticipated direct risks

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Water Contamination

- 4 previous incidents in Ypsilanti from news articles
- Ann Arbor dioxane plume
- Growing risks from PFAs
- 2004 report from GLWA rated the Detroit River as highly susceptible to contamination
- **Building Risks**
  - Loss of water source

Any notable events on campus?

- **Infrastructure Risks**
  - Modification of treatment processes
  - Loss of service
- **Population Risks**
  - Illness, impairments, fatalities
  - Bacteria exposure
  - Economic constraints
- **Climate Projections**
  - Increased water temperatures may allow bacteria and viral contaminants to thrive

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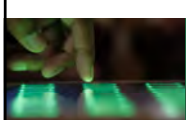

Human-Caused Hazards

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Civil Disturbances

- Universities at higher risk
- 1969 Pierce Hall Protest
  - 50 students locked themselves in Pierce Hall
  - 14 students arrested
- **Building Risks**
  - Damage and vandalism
  - Evacuations may be needed
- **Infrastructure Risks**
  - Damage and vandalism
  - Traffic disruptions
- **Population Risks**
  - Injuries, fatalities
  - Access to critical facilities may be blocked
  - Unsafe conditions
- **Future Conditions**
  - Positive correlation between warmer temperatures and crime
  - Unrest due to changes in climate policy
  - Social media and real-time media coverage may allow civil disturbances to form faster

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Cyber-Attacks

- Universities have increasingly become targets of cyberattacks.
  - In 2022, 44 college/ universities were impacted by ransomware
  - Large number of people on personal devices
  - Valuable research on personal devices
- **Building and Infrastructure Risks**
  - Cyber attacks could be targeted at critical IT buildings on campus
- **Population Risks**
  - Personal information lost
  - Lost research
  - Reputational risks

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Public Health Emergencies

- University campuses are highly susceptible
- Summer 2023 – Air quality Alerts
- Covid-19 Pandemic
- Additional concerns for Universities
  - Measles
  - Ebola (2014)
  - Zika (2016)
  - Norovirus
  - Salmonella
  - Influenza
- **Building / Infrastructure Risks**
  - Sterilization or decontamination
  - Operational changes
- **Population Risks**
  - Illness, fatalities
  - Students in close living quarters
  - Diseases from other counties or regions
- **Climate Projections**
  - Warmer temperatures more favorable environment for vector-born infectious diseases
  - Habitat shifts

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Terrorism and Similar Criminal Activities

- Universities more likely to be targeted
- 2012 fake bomb threat at EMU graduation
- University Communications System and active shooter response guidelines
- **Vulnerability**
  - High profile events
  - Public spaces
  - Open buildings
- Since 1966, 12 mass shootings at US colleges
  - 75% have been in the last 16 years

Any notable events on campus?

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Mentimeter Questions

https://www.menti.com/alf5vvybamus

Code: **2141 5807**

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Which 3 hazards concern you the most on campus? (Free Response)

- Extreme Cold/Wind Chill
- Extreme Heat
- Hail
- Lightning
- Severe Winter Weather
- Severe Winds
- Tornadoes
- Dam Failure
- Drought
- Flood and Extreme Precipitation
- Earthquakes
- HAZMAT
- Petroleum and Natural Gas Pipeline Accidents
- Power Outages
- Structural and Industrial Fires
- Water Contamination
- Civil Disturbances
- Cyber-Attacks
- Public Health Emergencies
- Terrorism and Similar Criminal Activities
- **Other?**

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Mitigation Strategies

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Mitigation Strategy

To discuss at Workshop #1 in November

- ❖ Review and revise goals
- ❖ Review and revise existing actions
- ❖ Develop new actions
- ❖ Create mitigation action list

Mitigation Actions

Mitigation Actions	Goals/Objectives Supported	Responsibility
Provide outreach and awareness campaigns to the campus community to promote mitigation and preparedness efforts.	Goal 5, Obj.5-1 & 5-4	Emergency Management Office
Expand Mass Notification capabilities to high use/critical facilities such as the Student Center, Convocation Center, McKenny Union and Fletcher School.	Goal 1, Obj.1-1 Goal 2, Obj.2-2	Emergency Management Office
Identify structural fire suppression measures in residence halls.[10]	Goal 1, Obj.1-1	Physical Plant
Identify critical facilities/infrastructure needing backup power sources and means to provide backup power.	Goal 3, Obj.3-1 Goal 4, Obj.4-3	Physical Plant Emergency Management Office
Expand hazard identification and risk assessment and mitigation planning to Fish Lake and Parsons Center.	Goal 1, Obj.1-1 Goal 3, Obj.3-1	Emergency Management Office

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Goals from 2013 Plan

1. Create a safe and secure environment for students, faculty, staff, and visitors.
2. Enhance emergency communications systems to provide the campus community with appropriate protective action and mitigation information.
3. Strengthen University continuity of operations through integration with emergency response plans and procedures, including the mitigation plan.
4. Be proactive in identifying mitigation opportunities into capital improvement and infrastructure planning projects and other campus functions and programs.
5. Enhance emergency preparedness, increase awareness, and promote risk reduction activities through education of and outreach to the campus community.

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Mitigation Actions

- ❖ Identify
  - ❖ Mitigation successes!
  - ❖ Ongoing progress/updates
  - ❖ New mitigation needs
  - ❖ Outdated/low priority

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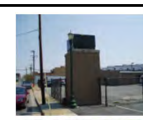
Group Activity

Hazard Mitigation Planning Techniques

- ❖ Prevention
- ❖ Property Protection
- ❖ Natural Resource Protection
- ❖ Structural Projects
- ❖ Emergency Services
- ❖ Public Education and Awareness



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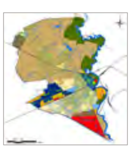
Prevention





- ❖ Planning and zoning
- ❖ Building codes
- ❖ Open space preservation requirements
- ❖ Floodplain regulations
- ❖ Stormwater management regulations
- ❖ Drainage system maintenance
- ❖ Capital improvements programming
- ❖ Setbacks
- ❖ Social Cohesion (e.g., community storm drain cleanup)

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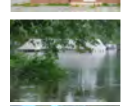
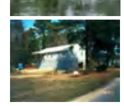
Property Protection





- ❖ Property acquisition / relocation
- ❖ Structure elevation
- ❖ Retrofitting
- ❖ Critical facilities protection
- ❖ Flood insurance

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Natural Resource Protection

- Floodplain protection
- Watershed management
- Riparian buffers
- Forest management

- Erosion and sediment control
- Wetland / stream preservation and restoration
- Habitat preservation

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Structural Projects

- Reservoirs
- Dams, levees, dikes
- Floodwalls
- Stormwater diversions
- Detention/retention basins
- Channel modification
- Storm sewers

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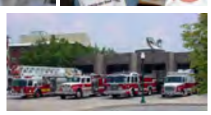
Emergency Services



- Warning systems and monitoring
- Emergency response equipment
- Shelter Operations
- Evacuation planning and management
- Emergency response training and exercises
- Sandbagging for flood protection
- Installing temporary shutters

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Public Education and Awareness

- Outreach projects
- Social media
- Speaker series/ demonstration events
- Hazard map information
- Real estate disclosure
- Library materials
- School children educational programs
- Hazard expositions

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Mentimeter Questions

https://www.menti.com/alf5vvybamus

Code: **2141 5807**

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Mitigation Actions Poll Question

- How would you spend $100 on the 6 mitigation categories?

Prevention	Property Protection	Natural Resource Protection	Structural Projects	Emergency Services	Public Education/ Awareness
Planning and zoning Building codes Open space preservation requirements Floodplain regulations Stormwater management regulations Drainage system maintenance Capital improvements programming Setbacks Social Cohesion (e.g., community storm drain cleanup)	Property acquisition / relocation Structure elevation Retrofitting Critical facilities protection Flood insurance	Floodplain protection Watershed management Riparian buffers Forest management Erosion and sediment control Wetland / stream preservation and restoration Habitat preservation	Reservoirs Dams, levees, dikes Floodwalls Stormwater diversions Detention/retention basins Channel modification Storm sewers	Warning systems and monitoring Emergency response equipment Shelter Operations Evacuation planning and management Emergency response training and exercises Sandbagging for flood protection Installing temporary shutters	Outreach projects Social media Speaker series/ demonstration events Hazard map information Real estate disclosure Library materials School children educational programs Hazard expositions

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Next Steps

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Next Steps

2024 EMU HAZARD MITIGATION PLAN

- ❖ Finalize Risk Assessment Results
- ❖ Finalize Capability and Capacity Assessment
- ❖ Collect Survey Results
- ❖ Develop Mitigation Strategy
  - ❖ Participate in upcoming workshops!
- ❖ Draft Plan

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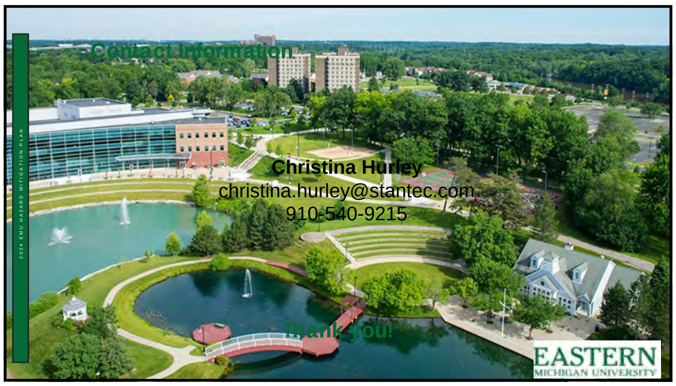

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C4: MPC Mitigation Strategy Meeting #1 Documentation

This appendix includes:

a) Invite and Attendee List
b) Meeting Presentation

From:	Hurley, Christina
To:	Laura Drabczyk
Subject:	EMU HMP - Mitigation Strategy Workshop materials
Date:	Monday, November 13, 2023 9:50:00 AM
Attachments:	EMU_Mitigation_Strategy_Workbook_Wksp1.xlsx EMU_HMP_MPC_Meeting_20230927.pdf

Hi Laura,

Please see attached Mitigation Strategy Workbook and the PowerPoint PDF from our last MPC meeting, and draft email text below to send out to the group ahead of tomorrow's workshop. Sending the survey results in a separate email due to file size.

Good morning,

At tomorrow's Mitigation Strategy Workshop in support of EMU's Hazard Mitigation Plan update, we will be working to develop the plan's Mitigation Strategy Workbook. The draft Workbook is attached – please review as time permits, and come to the workshop ready to brainstorm and discuss your mitigation ideas!

The mitigation actions currently listed in the Workbook are either from the 2013 mitigation plan, or are those identified to-date through the planning process. The first tab of the spreadsheet includes instructions for completing the columns in the spreadsheet. The "Actions List" tab lists all mitigation actions. We will discuss the pre-identified actions and work to include additional actions during the workshop on November 14th.

Please see the attached slide deck from our last Mitigation Planning Committee Meeting, focusing on the risk assessment. This document includes the goals and mitigation action categories that are on the spreadsheet. In addition, the FEMA Mitigation Ideas document can be used as a reference for potential mitigation actions (fema-mitigation-ideas_02-13-2013.pdf).

We look forward to your participation in tomorrow's Workshop!

Thank you,

Christina Hurley AICP
Senior Hazard Mitigation Planner

Direct: 910 540-9215
Christina.Hurley@stantec.com

Stantec
801 Jones Franklin Road Suite 300
Raleigh NC 27606-3394

Haz Mitigation Project Management Meeting

Created by: ldrabczy@emich.edu · Your response: ✔Yes, I'm going

Time

1pm - 2:30pm (Eastern Time - New York)

Date

Tue Nov 14, 2023

Description

Laura Drabczyk is inviting you to a scheduled Zoom meeting.

Topic: Laura Drabczyk's Personal Meeting Room

Join Zoom Meeting
https://emich.zoom.us/j/3118769447?pwd=bW1rL2FyZ3ppaG9wQ0wxVEcrYTNjQT09

Meeting ID: 311 876 9447
Passcode: 509270

One tap mobile
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+13092053325,,3118769447# US

Dial by your location
• +1 305 224 1968 US
• +1 309 205 3325 US
• +1 312 626 6799 US (Chicago)

Guests

- ✔ allison.duceatt@compass-usa.com
- ✔ brad.valley@compass-usa.com
- ✔ Christina Hurley
- ✔ dotto@emich.edu
- ✔ jphelp10@emich.edu
- ✔ kwilhoff@emich.edu
- ✔ ldrabczy@emich.edu
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- ✔ tohmer@emich.edu
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- +1 253 215 8782 US (Tacoma)
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- +1 360 209 5623 US
- +1 386 347 5053 US
- +1 408 638 0968 US (San Jose)
- +1 507 473 4847 US
- +1 564 217 2000 US
- +1 669 444 9171 US
- +1 669 900 6833 US (San Jose)
- +1 689 278 1000 US
- +1 719 359 4580 US
- +1 253 205 0468 US

Meeting ID: 311 876 9447

Find your local number: https://emich.zoom.
us/u/khe0x1DQz

My Notes

Eastern Michigan University

Hazard Mitigation Plan Update

Mitigation Strategy Workshop #1

Mitigation Planning Committee
November 14, 2023

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Stantec

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Agenda

1. Progress Updates
2. Public Survey Results
3. Mitigation Strategies
4. Next Steps

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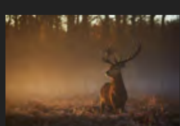
STANTEC MOMENT

HSSE: Safety

Hunting Season



Before entering the woods for work or recreation, be aware of the open hunting season(s) or ceremonial hunts in your area.

Make sure you are highly visible when walking around in the outdoors. Wear high visibility vests and bright-colored hard hats.

Make lots of noise – noise travels further than you can often see, pre-warning animals and hunters of your presence.

If you feel that hunting activities are occurring in close proximity to your work area, enact your Stop Work Authority and leave immediately.

SaferTogether™

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Progress Updates

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Schedule

Task	Completion
Flood Response Plan	February 2023
Liquid Damage Prevention Plan	April 2023
Hazard Risk Data Collection Meeting	July 2023
Mitigation Planning (MP) Committee Kickoff Meeting	September 11, 2023
Risk Assessment and Capability Assessment Results • MP Committee & Campuswide Meeting	September 27, 2023
Mitigation Strategy Workshop #1 • MP Committee Meeting	November 14, 2023
Mitigation Strategy Workshop #2 • MP Committee Meeting and Campuswide Meeting (in-person)	January 24, 2024
Draft Plan Review Period	February-March 2024
Plan Adoption	April-May 2024

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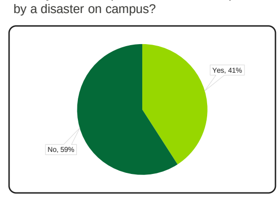
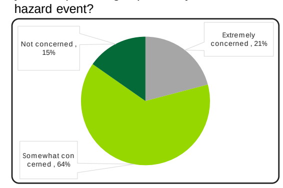
Public Survey Results

- Survey – Ran from September 18, 2023 to October 31, 2023
  - 372 responses

Have you ever experienced or been impacted by a disaster on campus?



How concerned are you about the possibility of your campus being impacted by a future hazard event?



2024 EMU HAZARD MITIGATION PLAN

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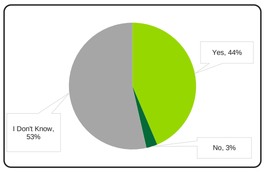
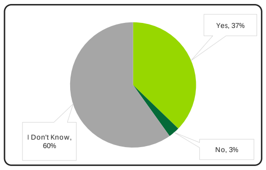
Public Survey Results

Are some areas of the campus particularly vulnerable to hazards?



Are some buildings on campus particularly vulnerable to hazards?



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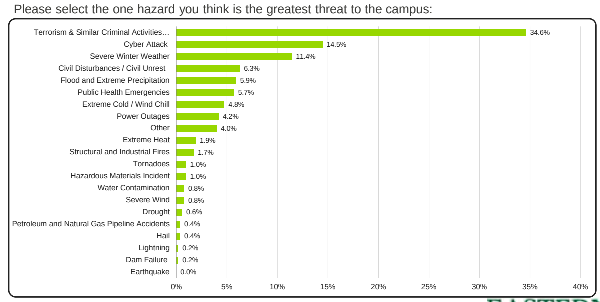
Public Survey Results

Please select the one hazard you think is the greatest threat to the campus:



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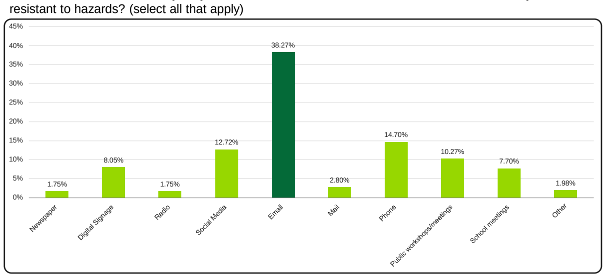
Public Survey Results

What is the most effective way for you to receive information about how to make the University more resistant to hazards? (select all that apply)



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Mitigation Strategies

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Mitigation Strategy

- Review and revise goals and objectives
- Review and revise existing actions
- Develop new actions
- Create mitigation action list

Mitigation Actions

Mitigation Actions	Goals/Objectives Supported	Responsibility
Provide outreach and awareness campaigns to the campus community to promote mitigation and preparedness efforts.	Goal 5, Obj.5-1 & 5-4	Emergency Management Office
Expand Mass Notification capabilities to high use/critical facilities such as the Student Center, Convocation Center, McKenny Union and Fletcher School.	Goal 1, Obj.1-1 Goal 2, Obj.2-2	Emergency Management Office
Identify structural fire suppression measures in residence halls.[10]	Goal 1, Obj.1-1	Physical Plant
Identify critical facilities/infrastructure needing backup power sources and means to provide backup power.	Goal 3, Obj.3-1 Goal 4, Obj.4-3	Physical Plant Emergency Management Office
Expand hazard identification and risk assessment and mitigation planning to Fish Lake and Parsons Center.	Goal 1, Obj.1-1 Goal 3, Obj.3-1	Emergency Management Office

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Definitions

- **Goals** are broad, long-term policy and vision statements that explain what is to be achieved by implementing the mitigation strategy.
- **Objectives** are strategies or implementation steps to attain mitigation goals. Unlike goals, objectives are specific and measurable, where feasible.
- A **mitigation action** is a measure, project, plan or activity proposed to reduce current and future vulnerabilities described in the risk assessment.

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Goals from 2013 EMU Plan

1. Create a safe and secure environment for students, faculty, staff, and visitors.
2. Enhance emergency communications systems to provide the campus community with appropriate protective action and mitigation information.
3. Strengthen University continuity of operations through integration with emergency response plans and procedures, including the mitigation plan.
4. Be proactive in identifying mitigation opportunities into capital improvement and infrastructure planning projects and other campus functions and programs.
5. Enhance emergency preparedness, increase awareness, and promote risk reduction activities through education of and outreach to the campus community.

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Mitigation Actions

- Identify
  - Mitigation successes!
    - Underground stormwater detention
    - Flood Response and Liquid Damage Prevention Plans
  - Ongoing progress/updates
  - New mitigation needs
  - Outdated/low priority

Any other mitigation successes since last plan update in 2013?

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Hazards List

What are the priority hazards?

2023 EMU Hazards
Extreme Cold/Wind Chill
Extreme Heat
Hail
Lightning
Severe Winter Weather
Severe Winds
Tornadoes
Dam Failure
Drought
Flood and Extreme Precipitation
Earthquakes
HAZMAT – fixed and transportation
Nuclear Power Plant Incidents
Petroleum and Natural Gas Pipeline Accidents
Power Outages
Structural and Industrial Fires
Water Contamination
Civil Disturbances
Cyber-Attacks
Public Health Emergencies
Terrorism and Similar Criminal Activities

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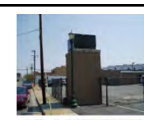
Mitigation Action Types

- Prevention
- Property Protection
- Natural Resource Protection
- Structural Projects
- Emergency Services
- Public Education and Awareness



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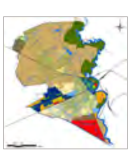
Prevention



- Planning and zoning
- Building codes
- Open space preservation requirements
- Floodplain regulations
- Stormwater management regulations
- Drainage system maintenance
- Capital improvements programming
- Setbacks
- Social Cohesion (e.g., community storm drain cleanup)

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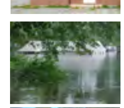
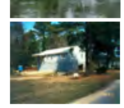
Property Protection





- Property acquisition / relocation
- Structure elevation
- Retrofitting
- Critical facilities protection
- Flood insurance

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Natural Resource Protection

- ❖ Floodplain protection
- ❖ Watershed management
- ❖ Riparian buffers
- ❖ Forest management

- ❖ Erosion and sediment control
- ❖ Wetland / stream preservation and restoration
- ❖ Habitat preservation

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Structural Projects




- ❖ Reservoirs
- ❖ Dams, levees, dikes
- ❖ Floodwalls
- ❖ Stormwater diversions
- ❖ Detention/retention basins
- ❖ Channel modification
- ❖ Storm sewers

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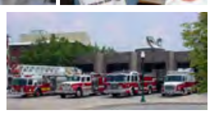
Emergency Services



- ❖ Warning systems and monitoring
- ❖ Emergency response equipment
- ❖ Shelter Operations
- ❖ Evacuation planning and management
- ❖ Emergency response training and exercises
- ❖ Sandbagging for flood protection
- ❖ Installing temporary shutters

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Public Education and Awareness


- ❖ Outreach projects
- ❖ Social media
- ❖ Speaker series/ demonstration events
- ❖ Hazard map information
- ❖ Real estate disclosure
- ❖ Library materials
- ❖ School children educational programs
- ❖ Hazard expositions

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Mitigation Action Examples from Other Universities

All Hazards

- ❖ Develop continuity contingencies within supply chain operations impacting student housing and dining facilities (food, laundry services, research gases, medications, etc.)
- ❖ Expand and enhance coordinated evacuation planning between the city, county, and university.
- ❖ Develop/enhance emergency power capabilities, protocols, and procedures for campus buildings in the event power is compromised.
- ❖ Develop a plan for sheltering students living in university housing in the event they are displaced for greater than 12 hours
- ❖ Develop emergency preparedness guidance for assisting people with disabilities as needed when hazards arise.

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Mitigation Action Examples from Other Universities

Severe Winter Weather, Extreme Cold, Flooding

- ❖ Increase bulk salt storage capacity from 1200 tons to 2200 tons.
- ❖ Enhance campus winter maintenance operations (i.e., resources, equipment, and snow waste locations).
- ❖ Provide an inventory of heaters in a single stored/secure location for freeze up response. Establish an inventory of space heaters, maintain a backstock and check heaters annually.
- ❖ Conduct a pluvial flood study (heavy rainfall/surface flooding).
- ❖ Further evaluate the current storage and safeguarding of rare or historic collections, materials, and artifacts to protect from flooding, burst pipes, fires, and other disasters.

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Mitigation Action Examples from Other Universities

Terrorism and Similar Criminal Activities

- ❖ Outfit critical facilities or vulnerable structures with security cameras; expand security camera coverage across campus.
- ❖ Obtain portable vehicle barriers (such as bollards) for placement around special event venues or other large gathering spaces.
- ❖ Continue to expand and conduct on-going multi-agency training and exercises on managing large-scale civil unrest situations.
- ❖ Assess and consider the installation of shatter-resistant and/or bullet-resistant windows throughout campus, in both new buildings as well as potentially retrofitting existing buildings.

2024 EMU HAZARD MITIGATION PLAN

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Mitigation Action Examples from Other Universities

Cybersecurity

- ❖ Develop a comprehensive WISP – Written information Security Program – detailing administrative, technical, and physical safeguards to protect personal information stored within the University's systems.
- ❖ Consider use of encryption for transmitting sensitive data and information.
- ❖ Implement a training program for students, faculty, and staff regarding phishing scams, proper use of public computers, and social engineering ploys.

2024 EMU HAZARD MITIGATION PLAN

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Mitigation Action Types

Prevention	Property Protection	Natural Resource Protection	Structural Projects	Emergency Services	Public Education/ Awareness
Planning and zoning Building codes Open space preservation requirements Floodplain regulations Stormwater management regulations Drainage system maintenance Capital improvements programming Setbacks Social Cohesion (e.g., community storm drain cleanup)	Property acquisition / relocation Structure elevation Retrofitting Critical facilities protection Flood insurance	Floodplain protection Watershed management Riparian buffers Forest management Erosion and sediment control Wetland / stream preservation and restoration Habitat preservation	Reservoirs Dams, levees, dikes Floodwalls Stormwater diversions Detention/retention basins Channel modification Storm sewers	Warning systems and monitoring Emergency response equipment Shelter Operations Evacuation planning and management Emergency response training and exercises Sandbagging for flood protection Installing temporary shutters	Outreach projects Social media Speaker series/ demonstration events Hazard map information Real estate disclosure Library materials School children educational programs Hazard expositions

2024 EMU HAZARD MITIGATION PLAN

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Next Steps

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Next Steps

- ❖ Develop Mitigation Strategy
  - ❖ Participate in upcoming workshop on January 24th!
- ❖ Draft Plan

2024 EMU HAZARD MITIGATION PLAN

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Goals from 2019 State of Michigan Plan

1. Promote Life Safety: Minimize disaster-related injuries and loss of life through public education, hazard analysis, and early warning.
2. Reduce Property Damage: Incorporate hazard mitigation considerations into land use planning, resource management, land development processes, and disaster-resistant structures.
3. Build Alliances: Forge partnerships with other public safety agencies and organizations to enhance and improve the safety and wellbeing of all Michigan communities.
4. Provide Leadership: Provide leadership, direction, coordination, guidance, and advocacy for hazard mitigation in Michigan.

2024 EMU HAZARD MITIGATION PLAN

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Goals from 2019 University of Michigan Plan

1. Create a **disaster-resilient campus** by protecting the life and safety of the campus community and reducing potential damage to **population and property, including critical facilities, natural resources, and infrastructure.**
2. Secure the university's critical facilities and infrastructure, including medical facilities, communications systems, and information technology nodes to maintain **operational capacity and safety** during a natural or human-caused hazard event.
3. **Maintain the university's mission** of education, research, leadership, and service while planning for hazard mitigation, preparedness and response, and recovery activities.
4. Develop and enhance **partnerships** across university departments, regional campuses, local and state governmental entities, and private sector entities to provide effective, comprehensive, and collaborative mitigation measures.
5. Increase resiliency by pursuing hazard mitigation and disaster **funding**.

2024 EMU HAZARD MITIGATION PLAN

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Goals from 2022 City of Ann Arbor Plan

1. Utilize personal experiences and sciences to inform strategies and decision-making to increase resilience.
2. Develop tailored solutions that result in community members being equitably represented and protected from hazards, focusing on those that are most vulnerable to hazards and climate change.
3. Integrate hazard risk reduction activities into city practices including policy development, procedural implementation, operations, and funding mechanisms.
4. Expand and enhance partnerships between government, businesses, the public, and education to foster more effective mitigation action and build community resilience.
5. Promote public awareness of hazard risk and mitigation actions and sustain public engagement through community champions.

2024 EMU HAZARD MITIGATION PLAN

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C5: MPC Mitigation Strategy Meeting #2 (in-person) Documentation

This appendix includes:

a) Invite and Attendee List
b) Physical Sign-In Sheet
c) Meeting Presentation

From:	Laura Drabczyk
To:	Kathryn Wilhoff; Todd Ohmer; Scott Storrar; Matthew Lige; Kevin Lawson; Jordan Phelps; Jeanette Zalba; Rocky Jenkins; Ron Woody; Dieter Otto; Christopher Grant; Gretchen Sanchez; Kara Corwin; Schattschneider, Ben; Hurley, Christina
Subject:	Hazard Mitigation Project Update
Date:	Thursday, January 4, 2024 12:38:20 PM
Attachments:	Goals.docx EMU_Mitigation_Strategy_Workbook_Wksp1 1_4_2024.xlsx

Hi All and Happy New Year,

I hope everyone had a wonderful holiday and restful break.

Our Hazard Mitigation Project is quickly winding down and our submission to the State will be in April.

You will be receiving two invitations for Jan 24: One is for an in-person committee meeting where we will put the finishing touches on our planning efforts before we present them to the campus community at the forum. The second is the campus forum. Weather permitting, Stantec will also be on site.

In preparation for the Jan 24 campus forum we still have a lot of work to do. Therefore, you will find two documents attached for your review that we will discuss at our Jan 8 meeting - invitation forthcoming.

I appreciate everyone's support and assistance as we move forward.

If you have any questions please let me know.

Laura

--
Laura L. Drabczyk
Director of Risk & Emergency Management
Eastern Michigan University
Welch Hall, Room 11G
Ypsilanti, MI 48197
Office: 734-487-2270

supplémentaires.

Atención: Este correo electrónico proviene de fuera de Stantec. Por favor, tome precauciones adicionales.

Hazard Mitigation Project Team Meeting

Created by: ldrabczy@emich.edu · Your response: ✔Yes, I'm going

Time
12:30pm - 1:30pm (Eastern Time - New York)

Date
Wed Jan 24, 2024

Where
SC 302

My Notes

Guests
- ✔ cgrant@emich.edu
- ✔ Christina Hurley
- ✔ dotto@emich.edu
- ✔ jphelp10@emich.edu
- ✔ ldrabczy@emich.edu
- ✔ mlige@emich.edu
- ✔ rjenkins@emich.edu
- ✔ rwoody@emich.edu
- ✔ tohmer@emich.edu
- ? allison.duceatt@compass-usa.com
- ? term2024_ds_aduceatt@emich.edu
- ⊘ ds_gsanchez@emich.edu
- ⊘ jzalba@emich.edu
- ⊘ kcorwin@emich.edu
- ⊘ kwilhoff@emich.edu
- ⊘ sstorrar@emich.edu
- ben.schattschneider@stantec.com
- klawson@emich.edu

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EMU Hazard Mitigation Plan

Hazard Mitigation Project Team Meeting, SC 302

January 24, 2024, 12:30 pm – 1:30 pm

Stantec

No.	Name	Organization	Title	Email	Phone Number
1	Dieter Otto	Physical Plant	Ex Dir	dotto@emich.edu	7-0306
2	Chris Grant	Physical Plant	Grounds Manager	cgrant@ emich . edu	7-0435
3	KEVIN LAWSON	Student Center	Director	klawson @ emich	7-1199
4	ALi Duceatt	Chartwells/Dining	Director	ds_aduceatt@emich	773-957-8562
5	TODD Ohmer		Ex DIR		
6	LAURA DRABCZYK		DIRECTOR		
7					
8	RON WOODY		CIO		
9					
10					
11					
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Eastern Michigan University

Hazard Mitigation Plan Update

Mitigation Planning Committee Meeting

January 24, 2024

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Stantec

1

Stop & Talk: Types of Snow Conditions

Health, Safety, Security, & Environment

SaferTogether

When road markings are obscured , slow down and leave lots of stopping distance. Always clear snow from your vehicle, including the roof (as a courtesy to the cars behind you). Clear off your hood, lights, mirrors and windows. The following are various types of snow conditions you should be aware of and take precautions against:

- **Pavement Frost** – a buildup of frost that reduces braking power
- **Drifting Snow** – blowing snow due to winds; may cause snow to stick to road surfaces and lower visibility
- **Swirling Snow** – snow that is circling on road surfaces; caused by wind and traffic
- **Loose Snow** – less than 8 centimeters (approximately 3 inches) of unpacked flakes covering the driving surface
- **Heavy Snow** – more than 8 centimeters (approximately 3 inches) of denser snow that can cause problems when stopping or passing
- **Snow Packed** – the entire road is coated in densely packed snow
- **Snowdrifts** – small peaks of snow at intermittent intervals
- **Visibility Reduced** – drivers can see less than 800 meters (0.5 mile) ahead

Information provided by CAA Magazine, Winter 2020

Stantec

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Agenda

1. Introductions
2. Hazard Rankings Review
3. Mitigation Strategy Review
4. Next Steps

2024 EMU HAZARD MITIGATION PLAN

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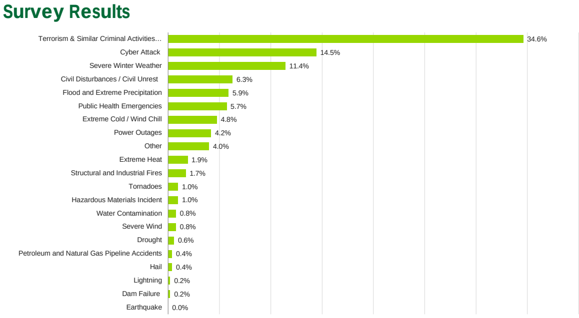
Hazard Rankings

4

Survey Results



2024 EMU HAZARD MITIGATION PLAN

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Preliminary Hazard Risk Categories

Hazards are presented in alphabetical order within each category. Hazards are not ranked within each category.

2024 EMU HAZARD MITIGATION PLAN

	2023 EMU Hazards
High	Active Shooter / Terrorism and Similar Criminal Activities
	Cyber-Attacks
	Flood and Extreme Precipitation
	Severe Winter Weather
	Severe Winds
	Tornadoes
	Unlawful Protest / Civil Disturbances
Moderate	Extreme Cold/Wind Chill
	Extreme Heat
	HAZMAT – fixed and transportation
	Public Health Emergencies
	Power Outages
	Structural and Industrial Fires
	Water Contamination
Low	Dam Failure
	Drought
	Earthquakes
	Hail
	Lightning
	Nuclear Power Plant Incidents
	Petroleum and Natural Gas Pipeline Accidents

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Mitigation Strategies

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Goals from 2013 EMU Plan

2024 EMU HAZARD MITIGATION PLAN

1. Create a safe and secure environment for students, faculty, staff, and visitors.
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4. Be proactive in identifying mitigation opportunities into capital improvement and infrastructure planning projects and other campus functions and programs.
5. Enhance emergency preparedness, increase awareness, and promote risk reduction activities through education of and outreach to the campus community.

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Mitigation Strategy

2024 EMU HAZARD MITIGATION PLAN

- Informed by stakeholder input, capability assessment and risk assessment findings
- Review and/or revise goals
- Review and revise existing actions
- Develop new actions
- Create mitigation action list

Mitigation Actions

Mitigation Actions	Goals/Objectives Supported	Responsibility
Provide outreach and awareness campaigns to the campus community to promote mitigation and preparedness efforts.	Goal 5, Obj.5-1 & 5-4	Emergency Management Office
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Identify structural fire suppression measures in residence halls.[10]	Goal 1, Obj.1-1	Physical Plant
Identify critical facilities/infrastructure needing backup power sources and means to provide backup power.	Goal 3, Obj.3-1 Goal 4, Obj.4-3	Physical Plant Emergency Management Office
Expand hazard identification and risk assessment and mitigation planning to Fish Lake and Parsons Center.	Goal 1, Obj.1-1 Goal 3, Obj.3-1	Emergency Management Office

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Mitigation Strategy

2024 EMU HAZARD MITIGATION PLAN

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Expand hazard identification and risk assessment and mitigation planning to Fish Lake and Parsons Center.	Goal 1, Obj.1-1 Goal 3, Obj.3-1	Emergency Management Office

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What mitigation actions should EMU pursue?

2024 EMU HAZARD MITIGATION PLAN

Prevention	Property Protection	Natural Resource Protection	Structural Projects	Emergency Services	Public Education/ Awareness
Planning and zoning Building codes Open space preservation requirements Floodplain regulations Stormwater management regulations Drainage system maintenance Capital improvements programming Setbacks Social Cohesion (e.g., community storm drain cleanup)	Property acquisition / relocation Structure elevation Retrofitting Critical facilities protection Flood insurance	Floodplain protection Watershed management Riparian buffers Forest management Erosion and sediment control Wetland / stream preservation and restoration Habitat preservation	Reservoirs Dams, levees, dikes Floodwalls Stormwater diversions Detention/retention basins Channel modification Storm sewers	Warning systems and monitoring Emergency response equipment Shelter Operations Evacuation planning and management Emergency response training and exercises Sandbagging for flood protection Installing temporary shutters	Outreach projects Social media Speaker series/ demonstration events Hazard map information Real estate disclosure Library materials School children educational programs Hazard expositions

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Next Steps

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2024 EMU HAZARD MITIGATION PLAN

Next Steps

- ❖ Draft Plan Review
  - ❖ Lookout for opportunity to provide feedback!
- ❖ Plan Adoption

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2024 EMU HAZARD MITIGATION PLAN

Contact Information

Laura Drabczyk
Director of Risk and Emergency Management
ldrabczy@emich.edu

Christina Hurley
Project Manager, Stantec
christina.hurley@stantec.com

Thank you!

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C6: Public Kickoff Meeting Documentation

This appendix includes:

a) Invite and Announcement
b) Attendance Documentation and Meeting Notes
c) Meeting Presentation

From:	Laura Drabczyk
To:	Hurley, Christina
Subject:	Fwd: Public Input Needed for EMU Hazard Mitigation Plan Update
Date:	Monday, September 25, 2023 3:43:15 PM

FYI

---------- Forwarded message ---------
From: **University Communications** <emu-employees@atari.emich.edu>
Date: Mon, Sep 25, 2023 at 3:34 PM
Subject: Public Input Needed for EMU Hazard Mitigation Plan Update
To: <EMU-Registered-Students@emich.edu>, <emu-employees@emich.edu>, <emu-ptl-adjunct-lecturers@atari.emich.edu>

Message from Hazard Mitigation Committee to students, faculty and staff:

Eastern Michigan University is currently seeking public input to help update its Hazard Mitigation Plan. A virtual public meeting has been scheduled for **Wednesday, Sept. 27 from 1 p.m. - 2:30 p.m.** This will be the first official planning meeting of the process and will allow students, faculty, staff, and other community stakeholders to participate. The meeting will give an overview of the planning process and an opportunity to share opinions on hazards of concern, such as excessive heat and flooding, as well as potential projects that could reduce the impact of hazards on the campus community.

Please note that registration is required to attend the virtual Zoom meeting. To register for the meeting, please access the registration link.

For more information about the Hazard Mitigation Committee, please reach out to the committee lead, Laura Drabczyk at ldrabczy@emich.edu.

Campuswide Kickoff Meeting - 9/27/2023

Meeting Participants:

Laura Drabczyk, Director, Emergency and Risk Management Services, EMU

Marie White - Editor in Chief, Eastern Echo

Raed Jarrah

Liam Reidy

Chris Varney

Anthony Webster

James McEvers

Auggie Mckevicius

Christina Hurley, Hazard Mitigation Lead (Project Manager), Stantec

Shelby Hatfield, GIS Lead, Stantec

Danielle Curri, Risk Assessment Lead, Stantec

Ben Schattschneider, Mitigation Strategy Lead, Stantec

Notes

- Laura introduced the Eastern Michigan University (EMU) Hazard Mitigation Plan (HMP) update. Christina provided the project background and schedule. Danielle provided an overview of several hazards included in the risk assessment. Ben provided an overview of upcoming work on the mitigation strategies.
- Marie asked a question about why the plan is being updated now since it has expired 10 years ago. Laura responded that the plan is now being updated in response to hazard events, such as flooding impacts at the pool.
- Marie asked what is Stantec? Christina provided a brief overview of Stantec and recent projects with EMU such as the flood response and liquid damage prevention plans.
- Marie asked if the risk assessment considers hazard impacts for new construction on the EMU campus? Laura responded that detention/retention ponds will be added to address flooding impacts from new construction.
- Marie asked if there is anything that can be reviewed for the plan at this time. Christina responded that the draft plan will be available for public review in 2024.

Eastern Michigan University

Hazard Mitigation Plan Update

Campuswide Kickoff Meeting

September 27, 2023

EASTERN MICHIGAN UNIVERSITY

Stantec

1

Safety Moment – Avoiding Laptop Theft

2024 EMU HAZARD MITIGATION PLAN

Laptops, and other small personal electronic devices are desirable for thieves. Since laptops can be easily resold, thieves often target them to make a quick profit.

Here are some practical tips for keeping your laptop safe from theft:

1. Use strong passwords, change passwords frequently and avoid setting up automatic sign-ins.
2. Don't write down your passwords. If you must write your passwords down, don't keep the list close to your laptop.
3. Never leave your laptop in an unlocked car.
4. Never leave your laptop in plain sight in your locked car. Lock it in the trunk and make sure no one sees you put it there.
5. Carry your laptop in something other than a laptop bag. Use something more inconspicuous, such as a backpack or messenger bag.
6. Lock up your laptop with a security cable. Attach it to a desk or other heavy stationary object.
7. Always keep your laptop in your sight. Don't leave a meeting or a conference room without your laptop—always bring it with you.
8. Be especially diligent when traveling—airports are a common place for laptop theft. Also be careful in taxis, hotel rooms, restaurants and coffee shops.
9. Encrypt and back up data and information. The loss of important data and information would probably be more devastating than the physical loss of the laptop.
10. If your laptop is stolen, report it right away. Tell police the make, model and serial number so a complete report can be filed and the chances of getting your laptop back are greater.

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Agenda

2024 EMU HAZARD MITIGATION PLAN

1. Introductions
2. Mitigation Planning & Project Overview
3. Risk Assessment Results
4. Mitigation Strategies
5. Next Steps

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3

Introductions

2024 EMU HAZARD MITIGATION PLAN

EMU Steering Committee

- **Laura Drabczyk**, Director of Risk and Emergency Management
- **Scott Storrar**, Director of Facilities Planning and Construction
- **Kathryn Wilhoff**, Director of Environmental Health and Safety
- **Todd Ohmer**, Executive Director Financial Planning and Budgets
- **Matthew Lige**, Chief of Police / Executive Directory of Public Safety

Stantec

- **Christina Hurley**, Hazard Mitigation Lead (Project Manager)
- **Ben Schattschneider,** Mitigation Strategy Lead
- **Danielle Curri,** Risk Assessment Lead
- **Matt Moy,** Capability and Capacity Assessment Lead
- **Shelby Chasteen,** GIS Lead

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Icebreaker Exercise – How are you affiliated with EMU?

2024 EMU HAZARD MITIGATION PLAN

- Student
- Faculty
- Staff
- Other?

Please drop your answer into the chat!

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Hazard Mitigation & Project Overview

6

What is Hazard Mitigation?

- **Hazard Mitigation:** Any sustained action taken to reduce or eliminate the long-term risk to human life and property from hazards.
- **Hazard Mitigation Plans:**
  - Identify hazard risk
  - Develop strategies to reduce it
  - Break the disaster cycle

FEMA

7

Why are we updating the plan?

- Meet FEMA Requirements for funding
- Build on previous plans and successes
  - 2013 EMU Multi-Hazard Mitigation Plan
  - 2023 Liquid Damage Prevention & Flood Response Plan
- REDUCE RISK!
- Continue to improve
  - Climate change integration
  - Understand asset and structure-level risk
  - Equity considerations

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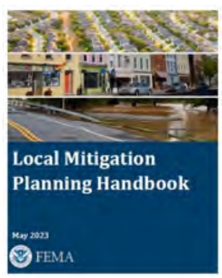
8

Hazard Mitigation Plan Sections

Element A.	Planning Process
Element B.	Hazard Identification & Risk Assessment
Element C.	Mitigation Strategy
Element D.	Plan Maintenance
Element F.	Plan Adoption



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Schedule

Task	Completion
Flood Response Plan	February 2023
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Engagement Opportunities

- Survey – **NOW OPEN** through October 30th: https://questionpro.com/t/AJ8IIZzqn4
- Campuswide Meeting #1 – September 27, 2023
- Campuswide Meeting #2 – January 2024

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Risk Assessment Results

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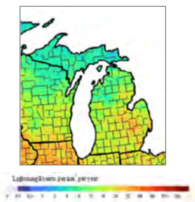
Risk Assessment

- Assessment of risk for natural, technological and human-caused hazards
- All hazards include a profile and a vulnerability assessment
- The hazard profiles include:
  - Description
  - Previous occurrences
  - Extent (or magnitude)
  - Probability
- Estimate the potential health, safety and property damages, and reputational risks attributable to hazards.



Source: Vaisala, Inc. Total Lightning Density (2016-2021)

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Hazards List

2023 EMU Hazards
Extreme Cold/Wind Chill
Extreme Heat
Hail
Lightning
Severe Winter Weather
Severe Winds
Tornadoes
Dam Failure
Drought
Flood and Extreme Precipitation
Earthquakes
HAZMAT – fixed and transportation
Nuclear Power Plant Incidents
Petroleum and Natural Gas Pipeline Accidents
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Terrorism and Similar Criminal Activities

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  - Future conditions

15

Flood and Extreme Precipitation

- Flooding Sources
  - Riverine Flooding
  - Stormwater
- Jones Pool Flood cost ~$3.2 million
- 35 incidents in Washtenaw County in the last 25 years

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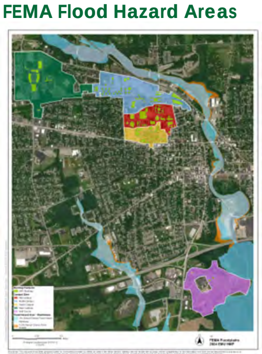
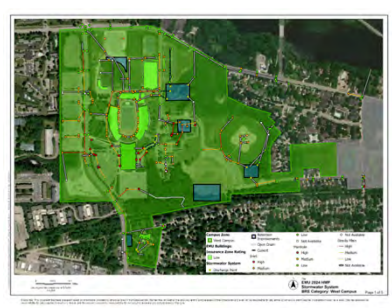
FEMA Flood Hazard Areas



17

Stormwater BRE scores and Insurance Zone Ratings



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- **Hill Residence Hall** and **Pittman Residence Hall**
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- The gravity main along **McKinny Hall i**s shown as high risk.

18

Flood and Extreme Precipitation

- ❖ **Vulnerability**
  - ❖ Building contents can be lost, damaged, or destroyed, and structures themselves can be compromised by floodwaters
  - ❖ Flooding can cause sewer overflows
  - ❖ Transportation impacts
- ❖ **Climate Projections**
  - ❖ Midwest has experienced a 42% increase in heavy precipitation between 1958 and 2016 (NOAA)
  - ❖ Ypsilanti will experience a 2-inch increase of rainfall a year by mid-century (GLISA)
  - ❖ Heavy rainfall events have increased
  - ❖ Precipitation is projected to be more concentrated

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Extreme Heat

- ❖ 12 reported heat waves in Washtenaw County since 1996
  - ❖ 17 reported injuries, 0 deaths
- ❖ **Building Risks**
  - ❖ Buildings, roads, parking lots, and turf fields contribute to urban heat island effect
  - ❖ Buckling in rare cases
- ❖ **Infrastructure Risks**
  - ❖ Pavement expansion and buckling
  - ❖ Power outages (indirect)
- ❖ **Population Risks**
  - ❖ Older adults, children, athletes, and outdoor workers are at higher risk
  - ❖ Populations without air conditioning are at higher risk
- ❖ **Climate Projections 2040 – 2059 (GLISA)**
  - ❖ 4.25 to 5°F increase in annual average temperature
  - ❖ 20 – 22.5 additional days over 90 °F

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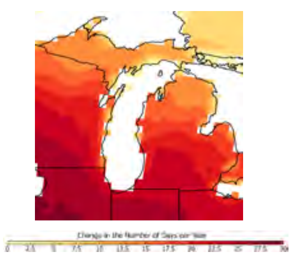
Extreme Heat



Projected Change in Days Over 90°F, 2040-2059

Projected Change in Average Temperature, 2040-2059

Source: GLISA

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Tornadoes

- ❖ 1950 – January 2023, 28 tornadoes reported in Washtenaw County
  - ❖ 1 fatality, 12 injuries
- ❖ August 24, 2023 – 6 tornadoes in Southeast Michigan
- ❖ 1953 Tornado
  - ❖ 1 death, 5 injuries
  - ❖ Over $23 million in damaged (2023 dollars)
- ❖ **Building Risks**
  - ❖ Mobile homes/ units
  - ❖ Structures on crawlspaces
  - ❖ Buildings with large spans
- ❖ **Infrastructure Risks**
  - ❖ Above ground infrastructure – extensive damage/ complete destruction
  - ❖ HAZMAT spills or leaks
  - ❖ Debris blocking roads
- ❖ **Population Risks**
  - ❖ Injuries, deaths
  - ❖ Damaged housing

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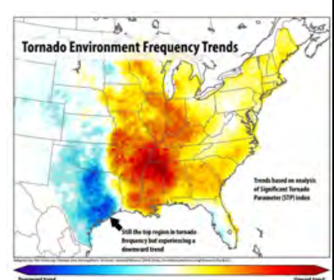
Tornadoes

23

Tornadoes

- ❖ Climate Projections
  - ❖ Projected increase in the number of days with thunderstorm environment
  - ❖ Tornado Alley shifting (Northern Illinois University)



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HAZMAT

- 27 Toxic Release Inventory (TRI) sites in Washtenaw County
  - 2 TRI Sites in proximity to campus
  - Largest fixed site release 24,956 lbs. of zinc compounds in 2018
- Since 1975, 277 PHMSA reported incidents in Ypsilanti
  - 5 serious incidents
- 11 buildings on campus with HAZMAT rated high

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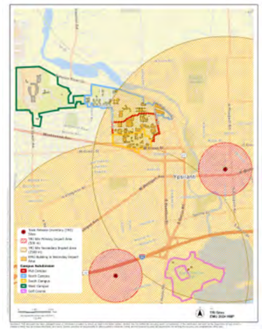
Fixed HAZMAT



- No campus buildings in Primary Impact Area
- 59 campus buildings in Secondary Impact Area

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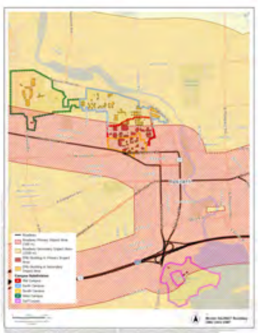
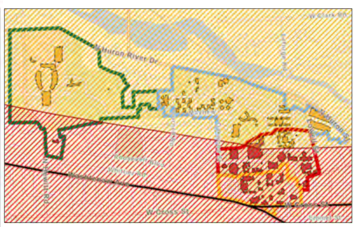
Mobile HAZMAT - Roads





- 35 campus buildings in Primary Impact Area
- 51 campus buildings in Secondary Impact Area

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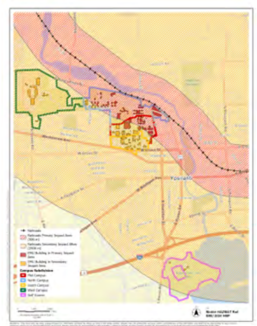
Mobile HAZMAT - Rail



- 47 campus buildings in Primary Impact Area
- 39 campus buildings in Secondary Impact Area

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HAZMAT

- Washtenaw County outdoor warning system
- **Building Risks**
  - Fires
  - Corrosive Materials
- **Infrastructure Risks**
  - At higher risk from HAZMAT transport
- **Population Risks**
  - Injuries or Fatalities
  - Exposure to contaminants
- **Climate Projections**
  - No direct impacts on HAZMAT
  - More frequent natural hazards could increase incidents

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Mentimeter Questions

https://www.menti.com/algbm1ojuh8w

Code: **4305 8539**

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Which 3 hazards concern you the most on campus? (Free Response)

- Extreme Cold/Wind Chill
- Extreme Heat
- Hail
- Lightning
- Severe Winter Weather
- Severe Winds
- Tornadoes
- Dam Failure
- Drought
- Flood and Extreme Precipitation
- Earthquakes
- HAZMAT
- Petroleum and Natural Gas Pipeline Accidents
- Power Outages
- Structural and Industrial Fires
- Water Contamination
- Civil Disturbances
- Cyber-Attacks
- Public Health Emergencies
- Terrorism and Similar Criminal Activities
- **Other?**

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Mitigation Strategies

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Mitigation Strategy

Forthcoming:

- Review and revise goals
- Review and revise existing actions
- Develop new actions
- Create mitigation action list

Mitigation Actions

Mitigation Actions	Goals/Objectives Supported	Responsibility
Provide outreach and awareness campaigns to the campus community to promote mitigation and preparedness efforts.	Goal 5, Obj.5-1 & 5-4	Emergency Management Office
Expand Mass Notification capabilities to high use/critical facilities such as the Student Center, Convocation Center, McKenny Union and Fletcher School.	Goal 1, Obj.1-1 Goal 2, Obj.2-2	Emergency Management Office
Identify structural fire suppression measures in residence halls.[10]	Goal 1, Obj.1-1	Physical Plant
Identify critical facilities/infrastructure needing backup power sources and means to provide backup power.	Goal 3, Obj.3-1 Goal 4, Obj.4-3	Physical Plant Emergency Management Office
Expand hazard identification and risk assessment and mitigation planning to Fish Lake and Parsons Center.	Goal 1, Obj.1-1 Goal 3, Obj.3-1	Emergency Management Office

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Mentimeter Questions

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Code: **4305 8539**

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Mitigation Actions Poll Question

- How would you spend $100 on the 6 mitigation categories?

Prevention	Property Protection	Natural Resource Protection	Structural Projects	Emergency Services	Public Education/ Awareness
Planning and zoning Building codes Open space preservation requirements Floodplain regulations Stormwater management regulations Drainage system maintenance Capital improvements programming Setbacks Social Cohesion (e.g., community storm drain cleanup)	Property acquisition / relocation Structure elevation Retrofitting Critical facilities protection Flood insurance	Floodplain protection Watershed management Riparian buffers Forest management Erosion and sediment control Wetland / stream preservation and restoration Habitat preservation	Reservoirs Dams, levees, dikes Floodwalls Stormwater diversions Detention/retention basins Channel modification Storm sewers	Warning systems and monitoring Emergency response equipment Shelter Operations Evacuation planning and management Emergency response training and exercises Sandbagging for flood protection Installing temporary shutters	Outreach projects Social media Speaker series/ demonstration events Hazard map information Real estate disclosure Library materials School children educational programs Hazard expositions

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Next Steps

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2024 EMU HAZARD MITIGATION PLAN

Next Steps

- Finalize Risk Assessment Results
- Finalize Capability and Capacity Assessment
- Collect Survey Results
  - Take the survey!
- Develop Mitigation Strategy
  - Participate in the next campuswide meeting!
- Draft Plan Review

Diversity, Equity & Inclusion (emich.edu)

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2024 EMU HAZARD MITIGATION PLAN

Contact Information

Laura Drabczyk
Director of Risk and Emergency Management
ldrabczy@emich.edu

Christina Hurley
Project Manager, Stantec
christina.hurley@stantec.com

Thank you!

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C7: Public Meeting #2 (in-person) Documentation

This appendix includes:

a) Invite and Announcement
b) Physical Sign-In Sheet
c) Meeting Presentation

From: Laura Drabczyk
To: Schattschneider, Ben; Hurley, Christina
Subject: Fwd: Public input needed for EMU Hazard Mitigation Plan update
Date: Wednesday, January 17, 2024 2:27:19 PM

FYI

---------- Forwarded message ---------
From: **University Communications** <emu-employees@atari.emich.edu>
Date: Wed, Jan 17, 2024 at 2:03 PM
Subject: Public input needed for EMU Hazard Mitigation Plan update
To: <EMU-Registered-Students@emich.edu>, <emu-employees@emich.edu>, <emu-ptl-adjunct-lecturers@atari.emich.edu>

A message from the EMU Risk Management Office to students, faculty and staff:

Eastern Michigan University is asking for input from students, faculty, staff and the public to help update the University's Hazard Mitigation Plan. A public meeting will be held on Wednesday, Jan. 24 from 2 p.m. to 3:30 p.m. at the Student Center Room 310A. Attending via Zoom also is an option. The meeting will provide an overview of the planning process and an opportunity to weigh in on potential projects to reduce the impact of hazards on campus.

Join Zoom Meeting

https://emich.zoom.us/j/3118769447?pwd=bW1rL2FyZ3ppaG9wQ0wxVEcrYTNjQT09

Meeting ID: 311 876 9447

Pass code: 509270

By updating the Hazard Mitigation Plan, EMU increases its resilience to hazards and also maintains eligibility for state and federal hazard mitigation funding. This plan is required to be updated every five years.

--
Laura L. Drabczyk
Director of Risk & Emergency Management
Eastern Michigan University
Welch Hall, Room 11G
Ypsilanti, MI 48197
Office: 734-487-2270

supplémentaires.

Atención: Este correo electrónico proviene de fuera de Stantec. Por favor, tome precauciones adicionales.

11:23

Post

Eastern Michigan
@EasternMichU

Follow

EMU is seeking public input to update our Hazard Mitigation Plan via a meeting on Jan.24 from 2-3:30 p.m. in the Student Center, room 310A. An updated plan helps us increase hazard resilience and maintain state and federal funding eligibility.

3:00 PM · 1/21/24 From Earth · **669** Views

3 Likes

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EMU Hazard Mitigation Plan
Hazard Mitigation Project Campus Forum, SC 310A
January 24, 2024, 2 pm – 3:30 pm

Stantec

No.	Name	Organization	Title	Email	Phone Number
1	[illegible]	EMU	Director	LDRZBCZY@EMICH.EDU	734-487-2270
2	KEVIN LAWSON	EMU	Director	Klawson@emich.edu	487-1199
3	Chris Grant	EMU	Manager	cgrant@emich.edu	7-0435
4	DARYL BARTON	EMU - FACULTY SENATE	FACULTY	dbarton@emich.edu	—
5	MATT LIGE	EMU	Chief of Police	mlige@ " "	7-1222
6	Matt Gregory	EMU	TIX Coord.	mgregory@e—	7-2202
7	Ben Schattscheider	Stantec			
8	Christina Hurley	Stantec			
9					
10					
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16					
17					

Eastern Michigan University

Hazard Mitigation Plan Update

Campuswide Public Meeting

January 24, 2024

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Stantec

1

Stop & Talk: Types of Snow Conditions

Health, Safety, Security, & Environment

SaferTogether

When road markings are obscured , slow down and leave lots of stopping distance. Always clear snow from your vehicle, including the roof (as a courtesy to the cars behind you). Clear off your hood, lights, mirrors and windows. The following are various types of snow conditions you should be aware of and take precautions against:

- **Pavement Frost** – a buildup of frost that reduces braking power
- **Drifting Snow** – blowing snow due to winds; may cause snow to stick to road surfaces and lower visibility
- **Swirling Snow** – snow that is circling on road surfaces; caused by wind and traffic
- **Loose Snow** – less than 8 centimeters (approximately 3 inches) of unpacked flakes covering the driving surface
- **Heavy Snow** – more than 8 centimeters (approximately 3 inches) of denser snow that can cause problems when stopping or passing
- **Snow Packed** – the entire road is coated in densely packed snow
- **Snowdrifts** – small peaks of snow at intermittent intervals
- **Visibility Reduced** – drivers can see less than 800 meters (0.5 mile) ahead


Information provided by CAA Magazine, Winter 2020

Stantec

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6. Mitigation Action Activity and Open House

2024 EMU HAZARD MITIGATION PLAN

EASTERN MICHIGAN UNIVERSITY

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FEMA

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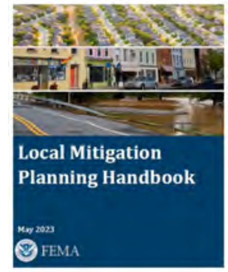

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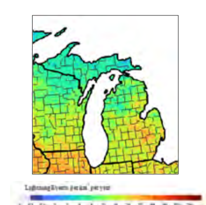

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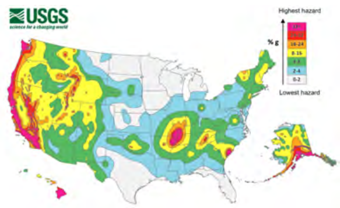

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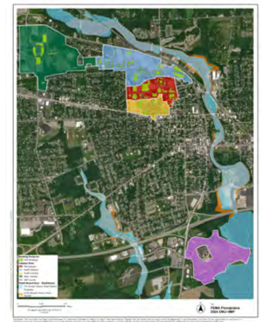

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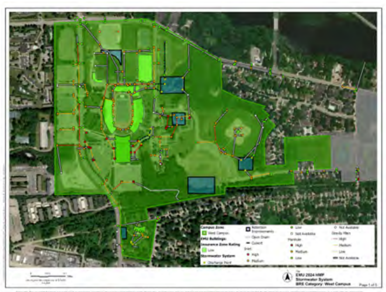
Stormwater BRE scores and Insurance Zone Ratings



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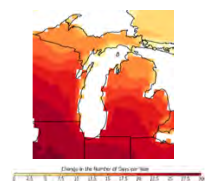

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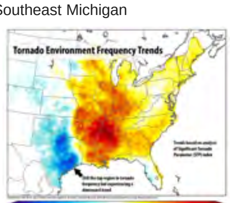
Tornadoes

- 1950 – January 2023, 28 tornadoes reported in Washtenaw County
  - 1 fatality, 12 injuries
  - $23M in damages from one 1953 event
- August 24, 2023 – 6 tornadoes in Southeast Michigan



18

Severe Winter Weather

- Blizzard, freeze, ice storm, heavy snow storm
- Impacts
  - Water damage to buildings (burst pipes, ice dams, roof leaks)
  - Travel impediments and dangerous driving conditions
  - Damage to roadways and sidewalks
  - Slips, falls, falling ice

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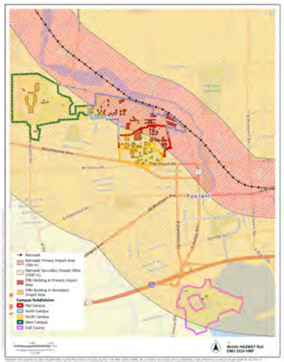
HAZMAT

- 27 Toxic Release Inventory (TRI) sites in Washtenaw County
- Since 1975, 277 PHMSA reported incidents in Ypsilanti
- 11 buildings on campus with HAZMAT rated high
- Risk posed to campus by chemicals at fixed sites, and by rail and road transportation nearby



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Hazard Rankings

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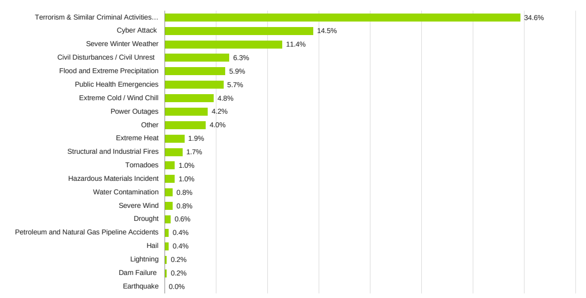
Survey Results



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Preliminary Hazard Risk Categories

Hazards are presented in alphabetical order within each category. Hazards are not ranked within each category.

	2023 EMU Hazards
High	Active Shooter / Terrorism and Similar Criminal Activities
	Cyber-Attacks
	Flood and Extreme Precipitation
	Severe Winter Weather
	Severe Winds
	Tornadoes
	Unlawful Protest / Civil Disturbances
Moderate	Extreme Cold/Wind Chill
	Extreme Heat
	HAZMAT – fixed and transportation
	Public Health Emergencies
	Power Outages
	Structural and Industrial Fires
	Water Contamination
Low	Dam Failure
	Drought
	Earthquakes
	Hail
	Lightning
	Nuclear Power Plant Incidents
	Petroleum and Natural Gas Pipeline Accidents

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Capability Assessment

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Capability Assessment

- The Capability Assessment helps identify and target meaningful mitigation actions for incorporation in the Mitigation Strategy.
- Items reviewed for the Capability Assessment:
  - Local plans
  - University policies and programs
  - Stakeholder interviews
  - Fiscal resources
  - Campus climate / support for mitigation

EMU Plans Reviewed for Capability Assessment
Liquid Damage Prevention Plan and Flood Response Incident Annex
Existing EMU Hazard Mitigation Plan
Comprehensive Emergency Management Plan
Disaster Recovery Plan
Comprehensive Emergency Management Plan
Business Continuity Plan and Continuity of Operations Plans (Business Impact Analysis underway)
Evacuation Plan
Building Emergency Plans
Sporting and Special Events Plans
Pandemic Response Plan
Capital Outlay Plan

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Mitigation Strategies

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Goals from 2013 EMU Plan

1. Create a safe and secure environment for students, faculty, staff, and visitors.
2. Enhance emergency communications systems to provide the campus community with appropriate protective action and mitigation information.
3. Strengthen University continuity of operations through integration with emergency response plans and procedures, including the mitigation plan.
4. Be proactive in identifying mitigation opportunities into capital improvement and infrastructure planning projects and other campus functions and programs.
5. Enhance emergency preparedness, increase awareness, and promote risk reduction activities through education of and outreach to the campus community.

2024 EMU HAZARD MITIGATION PLAN

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Mitigation Strategy

- Informed by stakeholder input, capability assessment and risk assessment findings
- Review and/or revise goals
- Review and revise existing actions
- Develop new actions
- Create mitigation action list

Mitigation Actions

Mitigation Actions	Goals/Objectives Supported	Responsibility
Provide outreach and awareness campaigns to the campus community to promote mitigation and preparedness efforts.	Goal 5, Obj.5-1 & 5-4	Emergency Management Office
Expand Mass Notification capabilities to high use/critical facilities such as the Student Center, Convocation Center, McKenny Union and Fletcher School.	Goal 1, Obj.1-1 Goal 2, Obj.2-2	Emergency Management Office
Identify structural fire suppression measures in residence halls.[10]	Goal 1, Obj.1-1	Physical Plant
Identify critical facilities/infrastructure needing backup power sources and means to provide backup power.	Goal 3, Obj.3-1 Goal 4, Obj.4-3	Physical Plant Emergency Management Office
Expand hazard identification and risk assessment and mitigation planning to Fish Lake and Parsons Center.	Goal 1, Obj.1-1 Goal 3, Obj.3-1	Emergency Management Office

2024 EMU HAZARD MITIGATION PLAN

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Mitigation Strategy

- Informed by stakeholder input, capability assessment and risk assessment findings
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- Develop new actions
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Mitigation Actions

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What mitigation actions should EMU pursue?

Prevention	Property Protection	Natural Resource Protection	Structural Projects	Emergency Services	Public Education/ Awareness
Planning and zoning Building codes Open space preservation requirements Floodplain regulations Stormwater management regulations Drainage system maintenance Capital improvements programming Setbacks Social Cohesion (e.g., community storm drain cleanup)	Property acquisition / relocation Structure elevation Retrofitting Critical facilities protection Flood insurance	Floodplain protection Watershed management Riparian buffers Forest management Erosion and sediment control Wetland / stream preservation and restoration Habitat preservation	Reservoirs Dams, levees, dikes Floodwalls Stormwater diversions Detention/retention basins Channel modification Storm sewers	Warning systems and monitoring Emergency response equipment Shelter Operations Evacuation planning and management Emergency response training and exercises Sandbagging for flood protection Installing temporary shutters	Outreach projects Social media Speaker series/ demonstration events Hazard map information Real estate disclosure Library materials School children educational programs Hazard expositions

2024 EMU HAZARD MITIGATION PLAN

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Next Steps

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2024 EMU HAZARD MITIGATION PLAN

Next Steps

- ❖ Draft Plan Review
  - ❖ Lookout for opportunity to provide feedback!
- ❖ Plan Adoption

Diversity, Equity & Inclusion (emich.edu)

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2024 EMU HAZARD MITIGATION PLAN

Contact Information

Laura Drabczyk
Director of Risk and Emergency Management
ldrabczy@emich.edu

Christina Hurley
Project Manager, Stantec
christina.hurley@stantec.com

Thank you!

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C8: Student Center Table Documentation

This appendix includes:

a) Poster Results
b) Sign-In Sheet

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EMU Hazard Mitigation Plan

Booth at the Student Union, January 24, 2024, 10 am – 12 pm

Stantec

No.	Name	Organization	Title	Email	Phone Number
1	Meriam Ilhabire		Student	milkhorb2005@ gmail	
2	Mai McNeal		Student	mmcneal13@emich.edu	
3	Lawson Vaughn		student	lvaugh10@emich.edu	~~8~~ 734-883-0
4	avandyk1@emich.edu		Student	Audri VanDyke	
5	Ethan Zick		Student	erick@emich.edu	
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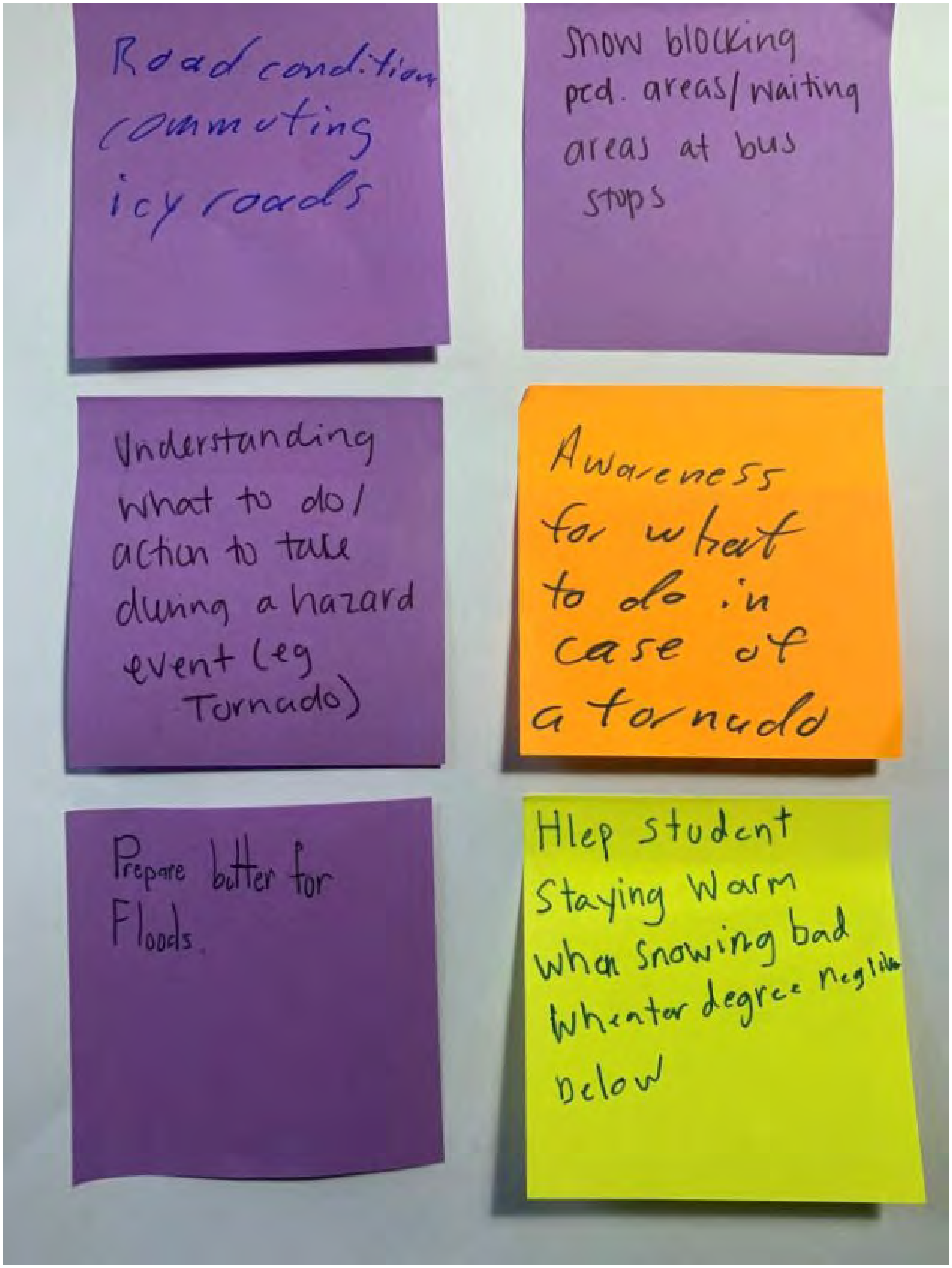
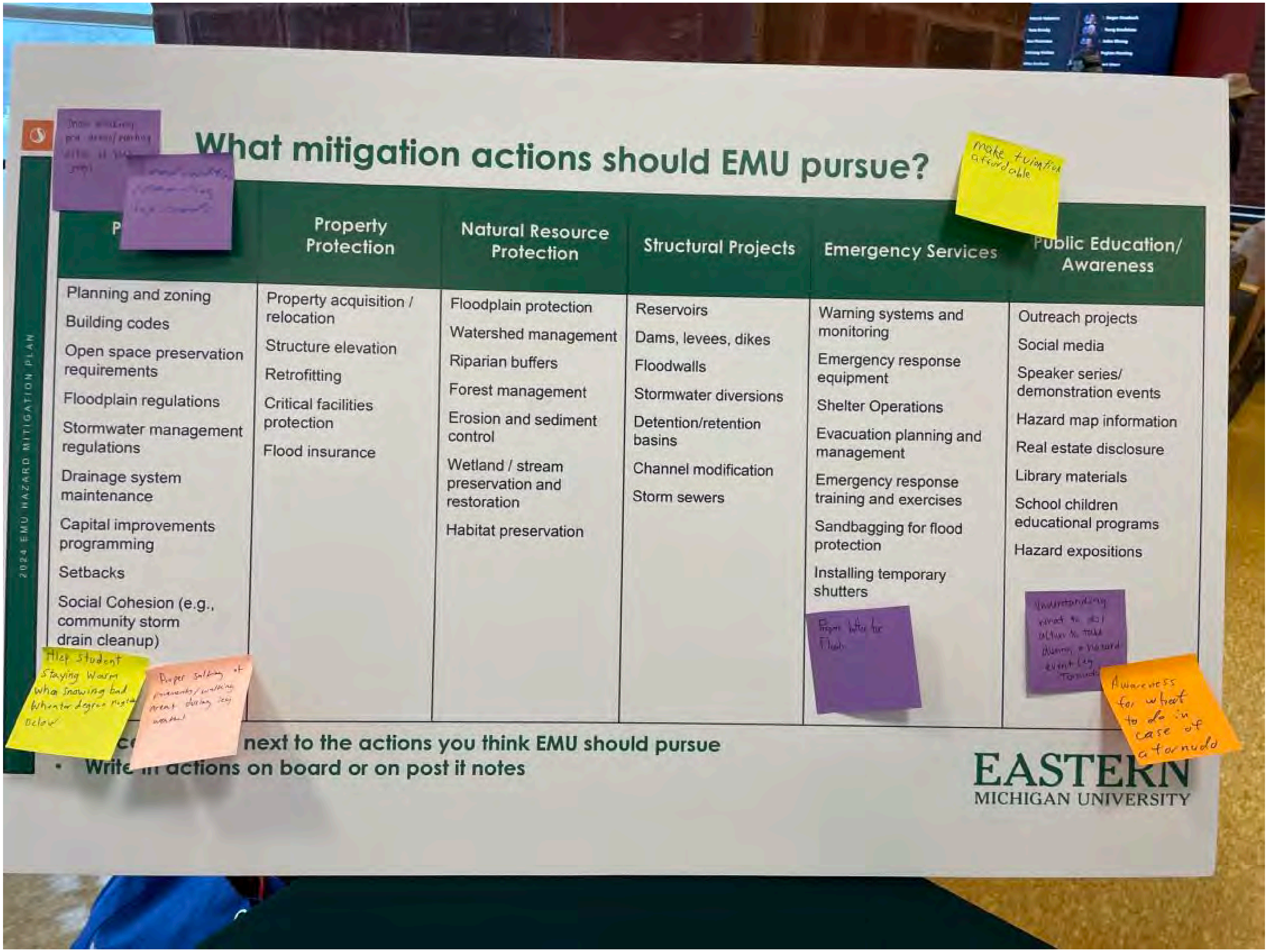

Road condition
commuting
icy roads
Snow blocking
ped. areas/ waiting
areas at bus
stops
Understanding
what to do/
action to take
during a hazard
event (eg
Tornado)
Awareness
for what
to do in
case of
a tornado
Prepare better for
Floods.
Hlep student
Staying Warm
when snowing bad
Wheater degree
below

Proper salting of pavements/walking areas during icy weather

make tuiontion affordable


2024 EMU HAZARD MITIGATION PLAN
What mitigation actions should EMU pursue?
Property Protection
Natural Resource Protection
Structural Projects
Emergency Services
Public Education/ Awareness
Planning and zoning
Building codes
Open space preservation requirements
Floodplain regulations
Stormwater management regulations
Drainage system maintenance
Capital improvements programming
Setbacks
Social Cohesion (e.g., community storm drain cleanup)
Property acquisition / relocation
Structure elevation
Retrofitting
Critical facilities protection
Flood insurance
Floodplain protection
Watershed management
Riparian buffers
Forest management
Erosion and sediment control
Wetland / stream preservation and restoration
Habitat preservation
Reservoirs
Dams, levees, dikes
Floodwalls
Stormwater diversions
Detention/retention basins
Channel modification
Storm sewers
Warning systems and monitoring
Emergency response equipment
Shelter Operations
Evacuation planning and management
Emergency response training and exercises
Sandbagging for flood protection
Installing temporary shutters
Outreach projects
Social media
Speaker series/ demonstration events
Hazard map information
Real estate disclosure
Library materials
School children educational programs
Hazard expositions
make tuition affordable
Awareness for what to do in case of a tornado
next to the actions you think EMU should pursue
Write in actions on board or on post it notes
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C9: Public Survey Documentation

This appendix includes:

a) Public Survey Announcement / Posting
b) Public Survey Summary Results

From:	Laura Drabczyk
To:	Hurley, Christina
Subject:	Fwd: Take 10 minutes to share your thoughts on EMU"s Hazard Mitigation Plan
Date:	Monday, October 2, 2023 8:37:52 AM

Good Morning Christina,

I hope you had a great weekend. I am forwarding the survey communication that was sent to campus on Friday.

Talk to you soon.

Laura

---------- Forwarded message ---------
From: **University Communications** <emu-employees@atari.emich.edu>
Date: Fri, Sep 29, 2023 at 12:36 PM
Subject: Take 10 minutes to share your thoughts on EMU's Hazard Mitigation Plan
To: <EMU-Registered-Students@emich.edu>, <emu-employees@emich.edu>, <emu-ptl-adjunct-lecturers@atari.emich.edu>

Message from Hazard Mitigation Committee to students, faculty and staff:

Eastern Michigan University is currently engaged in a planning process to become less vulnerable to natural, human-made, and technological disasters, and your participation is important to us!

EMU and our partner Stantec are working to update the University's campus-wide hazard mitigation plan, developed in 2013. The objective of the plan is to evaluate and identify EMU's potential hazards and determine how to minimize or manage those risks. Once completed, the plan will provide a comprehensive approach to managing hazards across the EMU campus.

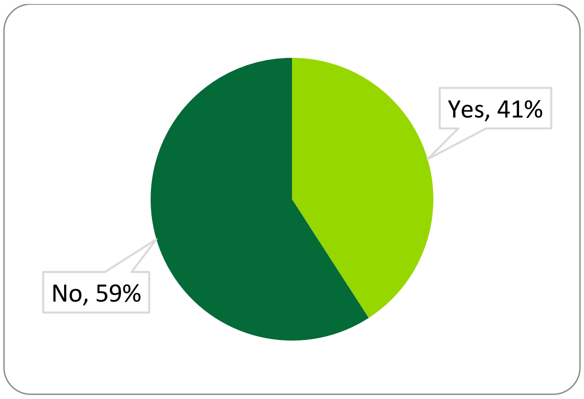
This survey allows you to share your opinions and participate in the hazard mitigation planning process. Your input will help us better understand your concerns regarding hazards and enable us to identify mitigation activities that can help reduce the impact of future hazard events, including natural and human-caused hazards.

All responses will be kept confidential and will only be used to inform Eastern Michigan University's Hazard Mitigation Plan and the associated planning process. The estimated time to complete the survey is approximately 10 minutes. You can access the survey through this link here.

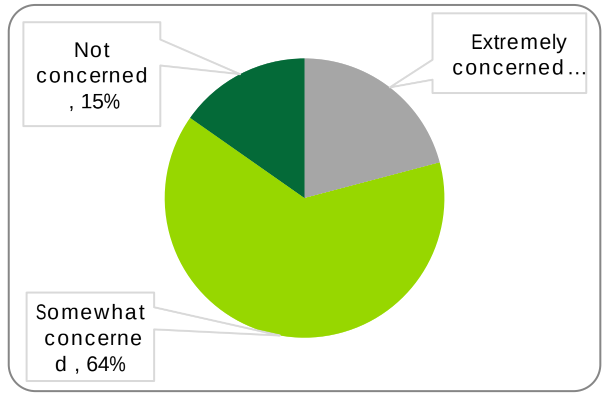
For more information about the Hazard Mitigation Committee, please reach out to the committee lead, Laura Drabczyk at ldrabczy@emich.edu.

--
Laura L. Drabczyk
Director of Risk & Emergency Management
Eastern Michigan University
Welch Hall, Room 11G
Ypsilanti, MI 48197
Office: 734-487-2270

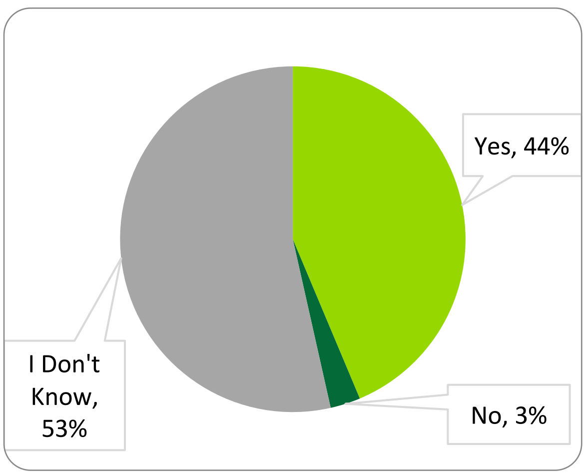
Have you ever experienced or been impacted by a disaster on campus?



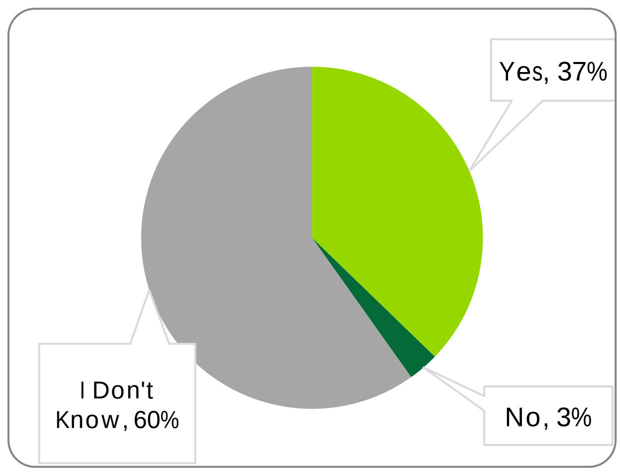
How concerned are you about the possibility of your campus being impacted by a future hazard event?



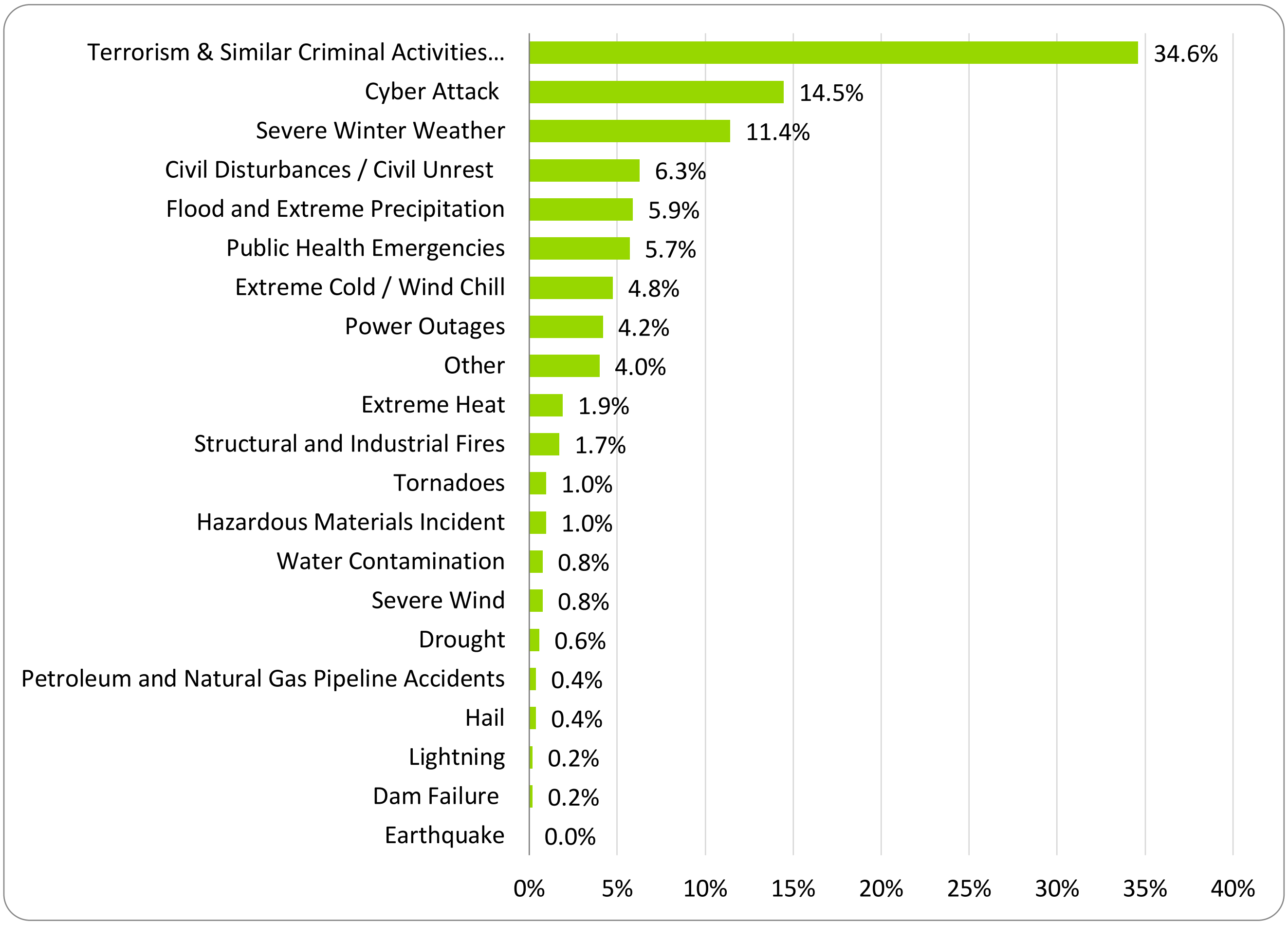
Are some areas of the campus particularly vulnerable to hazards?



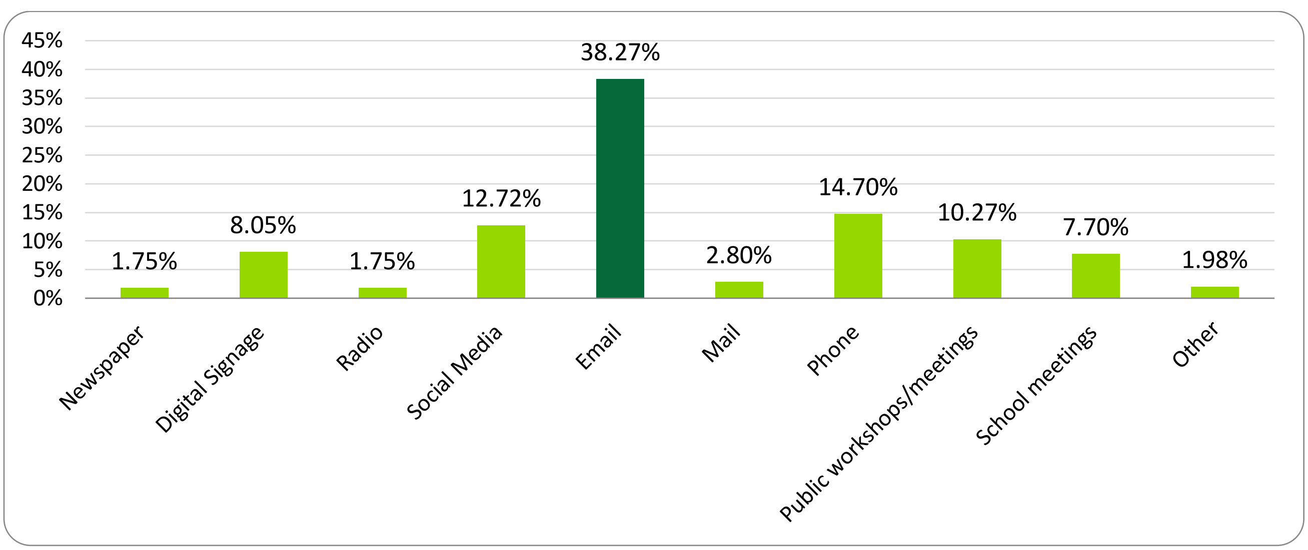
Are some buildings on campus particularly vulnerable to hazards?



Please select the one hazard you think is the greatest threat to the campus:



What is the most effective way for you to receive information about initiatives to make the University more resilient to hazards?



C10: Plan Landing Webpage Documentation

Emergency Plans

EMU Emergency Management uses a network of emergency plans that work together to create a comprehensive, all-hazards plan for the University.

Using the Comprehensive Emergency Management Plan, Continuity of Operations Plan, Building Emergency Plans, and Multi-Hazard Mitigation Plan, we create a well rounded planning operation to prepare the campus community to respond during emergency situations.

Please explore our plans and learn what to do in an emergency. If you are interested in developing emergency plans for a specific situation, building or event, please contact us and we'd be happy to help.

Comprehensive Emergency Management Plan +

Continuity of Operations Plan (COOP) & Downloadable Emergency Planning Templates +

Building Emergency Plans +

Multi-Hazard Mitigation Plan −

Thank you for your interest in Eastern Michigan University's Hazard Mitigation Plan. The plan will be updated during the 2023-2024 academic year, and we need your help.

What is a Hazard Mitigation Plan?

Hazard mitigation planning reduces loss of life and property by minimizing the impact of disasters. It begins with identifying natural disaster risks and vulnerabilities that are common in the area. After identifying these risks, long-term strategies are developed for protecting people and property from similar events. Mitigation plans are key to breaking the cycle of disaster damage and reconstruction. Some plans include human-caused hazards, too, such as hazardous materials, cyber threats, and pandemics.

Hazard mitigation plans are required to receive FEMA hazard mitigation grants and must be updated and approved every five (5) years. To be approved, plans must be in compliance with federal hazard mitigation planning standards defined in the Disaster Mitigation Act of 2000. EMU's most recent plan was approved in 2013, therefore the plan must be updated to be in compliance.

How can I help?

EMU wants your involvement in the hazard mitigation planning process. Please return to this web page often for project updates, event schedules, surveys, and other opportunities to share your knowledge and ideas.

Learn More

EMU is currently updating its Hazard Mitigation Plan which will identify natural and human-caused hazards that may impact people, buildings, infrastructure, and research at the University and identify a set of actions that will reduce the likelihood those hazards will impact the University. Actions may include education programs, policy changes, emergency equipment, and structural projects.

The Hazard Mitigation Plan will be developed through the completion of four planning phases:

1. **Planning Process** – The process guides how the plan is developed and who is involved. A mitigation planning committee implements the planning process with participation from stakeholders that have relevant information, which includes students, faculty, and staff.
2. **Risk Assessment** – The risk assessment identifies the characteristics and potential consequences of hazards. This includes understanding where the hazard may occur and what people, property or community assets may be in harm's way.
3. **Mitigation Strategy** – The mitigation strategy sets priorities and develops long-term strategies for avoiding or minimizing the undesired effects of disasters. The strategy and mitigation actions are informed by the planning process, the risk assessment and the University's capability to implement the strategy.
4. **Plan Maintenance** – The method and process for monitoring, evaluating, and updating the plan.

Emergency Plans - Eastern Michigan University (emich.edu)

C11: Public Plan Review

This appendix includes:

a) Plan Review Announcements

C11: Public Plan Review

Placeholder for Public Plan Review Announcements

APPENDIX D: REVIEW TOOL

Placeholder for Review Tool