GRATIOT COUNTY HAZARD MITIGATION PLAN

FEMA Approved on
June 3, 2020

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CHAPTER 1: INTRODUCTION

Gratiot County is located at the center of Michigan's Lower Peninsula between the industrial areas of the south and the recreational areas of the north. The County is bordered on the north by Isabella and Midland Counties, on the west by Montcalm County, on the south by Clinton County and on the east by Saginaw County. The County covers an approximate area of 365,081 acres or about 570 square miles. Using the 2010 US Census population figures of 42,476, the population density of the county is roughly 72 people per square mile. The County consists of sixteen townships, three cities, and three villages. The county seat is located in the City of Ithaca.

Predominantly regarded as a rural county, land use is as follows: agricultural (including cropland, pastures, and agricultural woodland) land is 78 percent of the total land area, forests account for 7 percent of the land area, and commercial, residential, industrial comprise nearly 15 percent of the land area.

North-south access is provided by US-127 in the central portion of the County. East-west access is provided by M-46 in the northern portion of the County and M-57 in the southern portion of the County.

National Preparedness Goal

The National Preparedness Goal defines what it means for the whole community to be prepared for all types of disasters and emergencies. The goal is: "A secure and resilient nation with the capabilities required across the whole community to prevent, protect against, mitigate, respond to, and recover from the threats and hazards that pose the greatest risk."[1] The five mission areas identified above are defined below:

- **Prevention**-prevent, avoid or stop an imminent threatened or actual act of terrorism.
- **Protection**-protect our citizens, residents, visitors, and assets against the greatest threats and hazards in a manner that allow our interests, aspirations, and way of life to thrive.
- **Mitigation**-reduce the loss of life and property by lessening the impact of future disasters.
- **Response**-respond quickly to save lives, protect property and the environment and meet basic human needs in the aftermath of a catastrophic incident.
- **Recovery**-recover through a focus on the timely restoration, strengthening and revitalization of infrastructure, housing and a sustainable economy, as well as the health, social, cultural, historic, and environmental fabric of communities affected by a catastrophic incident.[2]

For the purposes of this document, this plan will concentrate on one of the five mission areas: mitigation.

What is Hazard Mitigation?

Hazard Mitigation is any action taken before, during, or after a disaster to permanently eliminate or reduce the long- term risk to human life and property from natural, human-related, and technological hazards. There is a cyclical relationship between the five mission areas of emergency management; utilizing the whole community approach, efforts are made to prevent, prepare for, respond to, recover from, and mitigate disasters. Following any response, there is a transition into the recovery process, during

[1] Federal Emergency Management Agency
[2] Federal Emergency Management Agency

which hazard mitigation measures can be evaluated and adopted. This, in turn, improves the resilience of the community for the next incident, and so on. When successful, hazard mitigation will lessen future impacts to such a degree that succeeding occurrences will remain incidents and not become disasters.

Hazard mitigation strives to reduce the impact of hazards on people and property through the coordination of resources, programs, and authorities so that, at the very least, communities do not contribute to the increasing severity of the problem. When repairs and reconstruction are completed as quickly as possible to pre-disaster conditions, then pre-disaster conditions may simply result in a cycle of repeated damages. However, post-disaster repairs and reconstruction provide an opportunity to strengthen a community's resilience. Recovery projects can rebuild things in a safer manner, informed by the lessons of past disasters, so that future disasters will not have as much of an impact.

Hazard mitigation is needed to ensure that such cycles are broken, that post-disaster repairs and reconstruction take place after damages are analyzed, and that sounder, less vulnerable conditions are produced. Through a combination of regulatory, administrative, and engineering approaches, losses can be limited by reducing susceptibility to damage. Hazard mitigation provides the mechanism by which communities and individuals can break the cycle of damage, reconstruction, and damage again.

Recognizing the importance of reducing community vulnerability to natural and technological hazards, Gratiot County is actively addressing the issue through the development and subsequent implementation of this plan. The many benefits to be realized from this effort – protection of the public health and safety, preservation of essential services, prevention of property damage, and preservation of the local economic base, to mention just a few – will help ensure that Gratiot County remains a vibrant, safe, and enjoyable place in which to live, raise a family, and conduct business.

Under the Disaster Mitigation Act of 2000, state and local governments are required to develop local hazard mitigation plans in order to be eligible for pre- and post-disaster funding from the federal government. The plan was prepared in accordance with the Federal Emergency Management Agency (FEMA) documents: Local Mitigation Handbook and the Local Mitigation Plan Review Guide, and the Michigan State Police Emergency Management and Homeland Security Division (MSP/EMHSD) publication 207: Local Hazard Mitigation Planning Workbook.

The Gratiot County Hazard Mitigation Plan ("Plan") serves as the foundation for hazard mitigation activities within the community. Implementation of the plan's recommendations will assist in the reduction of injuries, loss of life, and destruction of property due to natural and technological hazards. The Plan provides a path toward continuous, proactive reduction of vulnerability to the most frequent hazards that result in repetitive and often severe social, economic and physical damage. The ideal end-state would be the total integration of hazard mitigation activities, programs, capabilities, and actions into normal, day-to-day governmental functions and management practices.

Gratiot County Emergency Management Coordinator and the Gratiot County Local Planning Team (GCLPT) worked with the East Michigan Council of Governments (EMCOG) and the MSP/EMHSD to develop this Plan. The intent of the Plan is to work with those familiar with Gratiot County to describe the County, and to create an action plan to protect the health, safety, and economic interests of residents through hazard mitigation, planning, awareness, and implementation.
In the Plan, the hazard analysis section describes the major categories of hazards that affect Gratiot

County (and provides some additional information about lesser hazards). The analysis of hazards makes use of community profile information that includes a description of community organization and potential resources. The major hazards have been identified as severe weather, geological threats, fires, floods/drought, hazardous materials, infrastructure problems, public health emergencies, transportation incidents, population shifts, and civil unrest and war. For each of the major hazards, the following is provided:

- Description of the hazard;
- Explanation of how it affects the County;
- Requirements/Rules affecting the County;
- Hazard mitigation Goal(s) that have been identified; and
- Description and explanation of the Action Item proposed.

This new Plan updates the previous Gratiot County Hazard Mitigation Plan that was approved in 2010. This process began in 2017, as FEMA requires that recertification of the Hazard Mitigation Plan shall take place at least once every five (5) years or result in the expiration of the county's eligibility to apply for or directly benefit from FEMA's hazard mitigation project grant funds. It has been modified so that it is easier to find and use information contained within it. This should be helpful for stakeholders to more easily find and review the information that is most relevant for their jurisdictions and areas of expertise/interest.

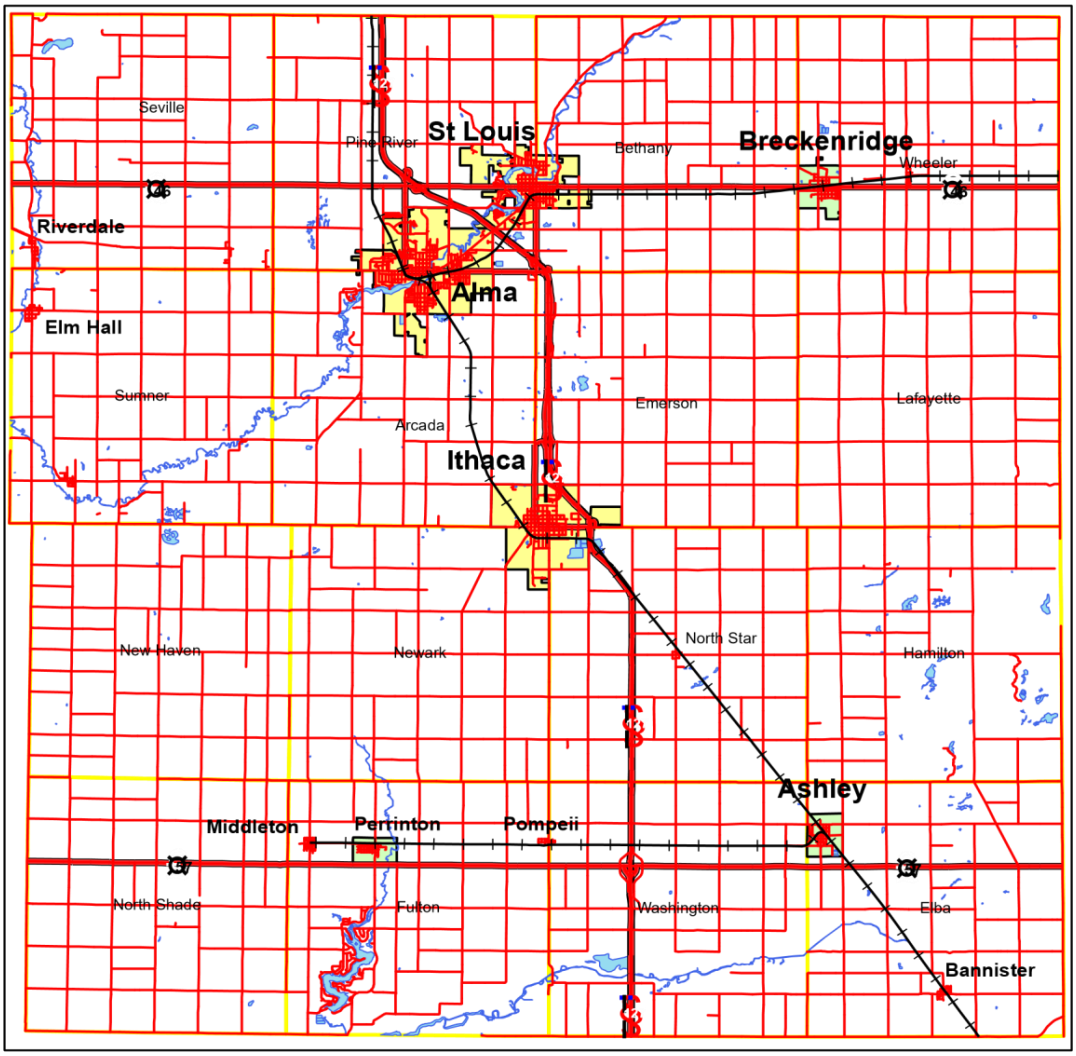
Certain information that is considered confidential or too sensitive for widespread public distribution has been kept out of this document and will only be distributed at the discretion of the Gratiot County Office of Emergency Management.

This plan is the culmination of our interdisciplinary and interagency planning effort that required the assistance and expertise of numerous agencies, organizations, and individuals. Without their technical assistance and contributions of time and ideas, this plan could not have been completed.

A map of Gratiot County identifying the population centers and local units of government follows.

Gratiot County

Map 1.1



Gratiot County
Population Centers

Legend

- RR
- Local Roads
- Highways
- Water
- Cities
- Villages
- Township Lines

Executive Summary

The Gratiot County Hazard Mitigation Plan was created to protect the health, safety, and economic interests of the Gratiot County residents and businesses by reducing the impacts of natural and technological hazards through hazard mitigation planning, awareness, and implementation. The plan serves as the foundation for hazard mitigation activities and actions within Gratiot County.

Implementation of recommendations will reduce loss of life, destruction of property, and economic losses due to natural, societal, and technological hazards. The plan provides a path toward continuous, proactive reduction of vulnerability to hazards which result in repetitive and often times severe social, economic, and physical damage. The ideal end state is full integration of hazard mitigation concepts into day-to-day governmental and business functions and management practices.

This plan employs a broad perspective in examining multi-hazard mitigation activities and opportunities in Gratiot County. Emphasis is placed on hazards which have resulted in threats to the public health, safety and welfare, as well as the social, economic and physical fabric of the community. This plan addresses such hazards as floods, tornadoes, windstorms, winter storms, forest fires, structural fires, hazardous material incidents and secondary technological hazards which result from natural hazard events. Each hazard is analyzed from a historical perspective, evaluated for potential risk, and considered for possible mitigative action. The plan also lays out the legal basis for planning and the tools to be used for its implementation.

Local Units of Government

While the Hazard Mitigation Plan was performed by Gratiot County, it involved the participation of most of the communities within the County. Gratiot County's communities consist of three cities, three villages, and 16 Townships. The communities are listed below:

Cities

Alma, Ithaca, and St. Louis

Villages

Ashley, Breckenridge, and Perrinton

Townships

Arcada, Bethany, Elba, Emerson, Fulton, Hamilton, Lafayette, New Haven, Newark, North Shade, North Star, Pine River, Seville, Sumner, Washington, and Wheeler

Gratiot County Community Information

Table 1.1

Community Name	2000 pop.	2010 pop.	Change	Participated in the 2010 Plan	Currently a participant in 2020 plan	NFIP participant	NFIP map date
Alma	9,275	9,383	1.16%	YES	YES	YES	10-18-11
Ithaca	3,098	2,910	-6.07%	YES	YES	YES	10-18-11
St. Louis	4,494	7,482	66.49%	YES	YES	YES	10-18-11
Ashley	526	563	7.03%	YES	YES	No	
Breckenridge	1,339	1,328	-0.82%	YES	YES	No	
Perrinton	439	406	-7.70%	YES	YES	No	
Arcada Twp.	1,708	1,681	-1.58%	YES	YES	YES	10-18-11
Bethany Twp.	3,492	1,407	-59.71%	YES	YES	YES	10-18-11
Elba Twp.	868	833	-4.03%	YES	YES	No	
Emerson Twp.	961	952	-0.94%	YES	YES	No	
Fulton Twp.	1,974	2,115	7.14%	YES	YES	YES	NSFHA
Hamilton Twp.	491	465	-5.30%	YES	YES	No	
Lafayette Twp.	656	591	-9.91%	YES	YES	No	
New Haven Twp.	1,016	1,004	-1.18%	YES	YES	No	
Newark Twp.	1,149	1,093	-4.87%	YES	YES	YES	NSFHA
North Shade Twp.	706	665	-5.81%	YES	YES	No	
North Star Twp.	996	888	-10.84%	YES	YES	No	
Pine River Twp.	2,451	2,279	-7.02%	YES	YES	No	
Seville Twp.	2,375	2,173	-8.51%	YES	YES	No	
Sumner Twp.	1,911	1,930	0.99%	YES	YES	YES	10-18-11
Washington Twp.	909	870	-4.29%	YES	YES	No	
Wheeler Twp.	1,446	1,458	0.83%	YES	YES	No	

NSFHA-Non-Special Flood Hazard Area

CHAPTER 2: THE PLANNING PROCESS

In 2017, the Gratiot County Emergency Management staff began the update process by hosting a meeting at the Gratiot County Emergency Operations Center in Ithaca with East Michigan Council of Governments (EMCOG) staff. The purpose of the meeting was to advise the public and Gratiot County representatives of the need to update the 2009 Gratiot County Hazard Mitigation Plan (Plan) and the process that would be utilized.

This update was made possible after the County was awarded a grant from the Federal Emergency Management Agency (FEMA) through the Michigan State Police (MSP) to update their hazard mitigation plan. EMCOG staff worked with the Gratiot County Emergency Management Coordinator (EMC), Dan Morden and the Gratiot County Local Emergency Planning Committee (LEPC).

The Gratiot County LEPC designated the Gratiot County Local Planning Team (GCLPT), which was formed with members of the LEPC along with other local representatives. It is composed of volunteers and professionals from county municipalities and various agencies located throughout the county/region, including the Michigan State Police, American Red Cross, Michigan Department of Health and Human Services, and the Department of Natural Resources.

To further promote the update and municipal participation, two written questionnaires were sent to the municipal governments for their input on the update process. The first questionnaire sought information on hazards and how they impacted the Municipality. The follow-up questionnaire sought information on the mitigation measures to address the hazards and what measures would be most beneficial for each municipality. Copies of the questionnaires are included in Appendix B, which also includes a summary of the municipalities' responses. In addition, the EMC and EMCOG staff on two separate occasions met with Gratiot County Township officials at their monthly meetings to further encourage their participation in the monthly update meetings as well as respond to the questionnaires. The responses from several municipal governments were incorporated into the final mitigation actions found in Chapter 5.

Through a series of open meetings to the public, the EMC and EMCOG staff directed an assessment of the Plan in order to determine what changes, if any, would be necessary for the update. The LPT and municipal officials were provided meeting agendas and any accompanying memos regarding the Plan update the week before each meeting, at which time the agendas were also posted on the public bulletin board at the Gratiot County Building. The following table (Table 2.1) identifies the meeting dates, locations, and subject matter for the LPT and township association meetings. At the end of this chapter, there are two tables identifying the agencies represented at the meetings (Table 2.2) and the individuals at each meeting (Table 2.3). Appendix A includes the sign-in sheets for all the public meetings for this update.

Gratiot County Hazard Mitigation Advisory Committee Meeting Schedule/Discussion Topic

TABLE 2.1

Meeting Date	Meeting Location	Discussion Topic(s)
8-8-17	Gratiot-Isabella Regional Education Service District Building 1131 Center St., Ithaca MI	Kick-off meeting to provide information to the public on the Hazard Mitigation Plan (Plan) update process.
9-12-17	Gratiot-Isabella Regional Education Service District Building	The initial meeting of LPT, they were provided an overview of the process, and a discussion was held on hazards occurring in Gratiot County.
11-14-17	Gratiot-Isabella Regional Education Service District Building	Identified the risk factors, ranked them in importance and weighed them accordingly.
12-12-17	Gratiot-Isabella Regional Education Service District Building	Began the risk assessment by assigning values to the hazards and the risk factors.
1-9-18	Gratiot-Isabella Regional Education Service District Building	Continued with the risk assessment process. Provided definitions of terms to assist in the assessment process.
2-13-18	Gratiot-Isabella Regional Education Service District Building	The risk assessment process was finalized and after some adjustments based on actual events, the assessment was agreed upon. The vulnerability assessment was completed. Community Survey was distributed for final review and approval.
3-13-18	Gratiot-Isabella Regional Education Service District Building	The hazards were prioritized based on their risk to the communities, how vulnerable the communities were, and the frequency with which the hazards occurred. Goals and objectives were also discussed and proposed.
4-10-18	Gratiot-Isabella Regional Education Service District Building	The hazard priority list was approved as presented. The goals and objectives were approved as presented. The LPT then proceeded to evaluate the status of the implementation strategy from the 2010 Plan and provided the status and outcomes for each of the projects. Significant hazardous events were identified from the past 25-30 years.

Meeting Date	Meeting Location	Discussion Topic(s)
5-22-18	Gratiot-Isabella Regional Education Service District Building	The 2010 Implementation Strategy items that were discussed in April were reviewed and approved. The events identified in April were elaborated upon and additional items were identified. Began identifying alternative mitigation strategies that are located in the Planning Workbook and 2014 State Plan. The purpose of the review is to identify those strategies that may be appropriate for Gratiot County.
6-12-18	Gratiot-Isabella Regional Education Service District Building	The discussion on mitigation alternative strategies continued. The LPT reduced the number of items by combining several items and eliminating several more items not appropriate for Gratiot County. A discussion was held on identifying projects to be included in the action list. The LPT was advised on types of projects that could be appropriate and they were provided a list of projects that have been identified in recently approved plans.
7-10-18	Gratiot-Isabella Regional Education Service District Building	Projects to be included on the action list were discussed and identified. It was determined that all projects identified in the 2010 Plan would also be included in the update. Items mentioned multiple times on the community surveys were also added to the project list.
9-11-18	Gratiot-Isabella Regional Education Service District Building	Discussion continued on the projects, beginning with plant and animal invasive species. After the plants were identified, participating agencies were identified for the existing projects. The LPT was then advised of a survey that was posted online to get feedback from county residents on hazard mitigation and on first responders' readiness and expected response time. Nearly 150 responses had been received after 3 weeks.

Meeting Date	Meeting Location	Discussion Topic(s)
10-9-18	Gratiot-Isabella Regional Education Service District Building	The invasive species were identified and confirmed. A discussion was then held on wildfires as information from the DNR was provided on the number of wildfires. Based on the information provided, the moderate priority was confirmed. After reviewing the list of projects identified in other plans, several more projects were added to the list.
11-13-18	Gratiot-Isabella Regional Education Service District Building	Went over the project items and refined them. Established priority criteria and then prioritized the projects based on the criteria. Asked for volunteers to proof chapters in order to send them to the MSP staff for preliminary review. Two volunteers came forward.
1-8-19	Gratiot-Isabella Regional Education Service District Building	The newly appointed Emergency Management Coordinator, Ashley Brenner was introduced to the attendees. Due to the small number of participants at the November meeting, the project list was sent out for final comments. Several comments were received on the final list of projects and they were discussed at the meeting. The list was finalized with the high priority projects being the projects found in Chapter 6 as the Action List, and all items being included in Appendix E. A discussion then began on measures that are taken to minimize damages resulting from floods. EMCOG staff then mentioned that the MSP staff recommended the capacity to address hazards be included in the plan. After a brief discussion, EMCOG staff was asked to clarify what is being asked by FEMA on this matter.
2-19-19	Gratiot-Isabella Regional Education Service District Building	Clarification was provided on the community commitment requirement, as well as the flood measure requirement. Emergency Management Coordinator will seek input from communities yet to commit to FEMA-eligible projects. EMCOG staff to contact MSP staff on clarification on community size for FEMA-eligible commitment.

Meeting Date	Meeting Location	Discussion Topic(s)
3-12-19	Gratiot-Isabella Regional Education Service District Building	The priority process was modified, and all FEMA-eligible projects were deemed a high priority. Previously identified high priority projects that were not FEMA-eligible were changed to medium priority. The priority process to identify the projects was modified in Chapter 6 to reflect the changes. EMCOG staff was asked to confirm FEMA-eligible projects with MSP staff.
6-11-19	Gratiot-Isabella Regional Education Service District Building	The LPT was given an update on getting community involvement with the FEMA-eligible projects with ideas sought for increasing community participation. Volunteers were sought to proof chapters.
8-13-19	Gratiot-Isabella Regional Education Service District Building	The Action List (Chapter 6) was updated with all completion dates moved back one year, DEQ changed to EGLE, and recommendations from MSP were included. Additional municipal information was also provided. Tentative approval timetable was discussed, as it is dependent upon MSP staff approval of chapters.
10-22-19	Gratiot-Isabella Regional Education Service District Building	Project proposed to be included in Plan was discussed. Additional municipal information was provided for Plan. Grant extension approval was announced.
1-14-2020	Gratiot-Isabella Regional Education Service District Building	New formats for chapters 4 and 6 presented to LPT. LPT members asked to review hazard impact table and confirm information. LPT also presented with the final draft and asked to proof document. Lastly, the LPT was provided with the tentative approval schedule beginning with the public hearing, which will be at a County Board of Commissioners meeting on February 11th (tentative, as it must be approved by the County Administrator).
2-4-2020	Public meeting to present Plan County Board Room 214 E. Center St, Ithaca, MI	The Gratiot County Hazard Mitigation Plan was presented at a meeting of the County Board of Commissioners. Commissioners commented that they were pleased with the Plan.

Through the meetings above, the chapters of the 2010 Plan were reconfigured to correspond to other plans that were modified accordingly. Below are the results of the chapter reviews for each chapter in the Plan.

- Reviewed the Preface and Executive Summary. The two introductory sections have been reviewed and revised. The two sections are now Chapter 1: Introduction and Chapter 2: Planning Process.
- Reviewed and updated Chapter 1: Community Profile. Reviewed and updated information on Gratiot County, as well as on the process. Information is included in Chapter 3: Community Profile.
- Reviewed and updated Chapter 2: Risk Assessment. Reviewed information in the chapter. Information from the Chapter can be found in Chapter 2: Planning Process and Chapter 4: Hazard Analysis.
- Reviewed and updated Chapter 3: Goals and Objectives/Mitigation Strategies. Information is included in Chapters 5: Analysis of Alternate Actions, Chapter 6: Action Plan, and Chapter 7: Follow-Up.

This update process included the review of the Gratiot County Master Plan, the 2014 Michigan Hazard Mitigation Plan, county maps and studies, municipal master plans, as well as ongoing activities. This included the review of informational sources such as: U.S. Census, National Weather Service, emergency management plans, Michigan Department of Transportation, Michigan Department of Natural Resources, and the local health department.

In January 2019, the action list was sent to the EMHSD staff for their review and comment. This list was then sent to FEMA staff for their comments. In February, the EMC and EMCOG staff were notified that FEMA staff suggested that a larger proportion of action items involve mitigation activities rather than education and preparedness activities.

In February 2019 EMCOG staff and EMC were then notified by MSP EMHSD staff on the need to provide additional information in the Hazard Mitigation Plan regarding the selection of actions by the Gratiot County municipalities. Over the next several months the LPT members discussed the identification of projects by municipalities and their participation with each project. Throughout 2019, the LPT worked with EMCOG staff to finalize Chapter 6: Action List and Chapter 4: Hazard Analysis.

On February 4, 2020 the final draft of the Gratiot County Hazard Mitigation Plan was presented to the Gratiot County Board of Commissioners. Notices were posted on the County's website, the Emergency Management website, and at the County Courthouse, regarding the presentation. Notices were also sent to the members of the Local Planning Team, neighboring county emergency managers, and to the local municipalities to promote local input in the draft of the hazard mitigation plan.

A thirty-day comment period followed the presentation to the County Board. During that time five comments from four people were received. Three of the comments were identifying correct addresses, as well as typographical errors. The fourth comment was a compliment and thought the plan was "well laid out". The fifth and final comment offered format suggestions such as shorter chapters, modifying the layout of several chapters, and comments on several maps.

Gratiot County Hazard Mitigation Advisory Committee Attendance Table

TABLE 2.2

Participating Agency or Jurisdiction	Returned Survey	Meeting Attended																			
		8-8	9-12	11-14	12-12	1-9-18	2-13	3-13	4-10	5-22	6-12	7-10	9-11	10-9	11-13	1-8-19	2-19	3-12	6-11	8-13	10-22	1-14-2020
East Michigan Council of Governments		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Gratiot County		X	X	X	X	X	X		X	X		X	X	X	X	X	X	X	X	X	X	X
City of Alma				X		X			X			X	X					X				
City of Ithaca	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X
City of St. Louis	X	X		X		X			X	X	X	X	X	X	X	X	X	X	X	X	X	X
Village of Ashley	X			X		X			X													
Village of Breckenridge	X																					
Village of Perrinton	X			X	X	X	X		X	X		X	X	X	X							
Arcada Township	X																					
Bethany Township	X																					
Elba Township	X																					
Emerson Township																						
Fulton Township	X																					
Hamilton Township																						

Participating Agency or Jurisdiction	Returned Survey	Meeting Attended																				
		8-8	9-12	11-14	12-12	1-9-18	2-13	3-13	4-10	5-22	6-12	7-10	9-11	10-9	11-13	1-8-19	2-19	3-12	6-11	8-13	10-22	1-14-2020
Lafayette Township	X																					
New Haven Township	X																					
Newark Township	X																					
North Shade Township																						
North Star Township	X																					
Pine River Township	X			X																		
Seville Township	X																					
Sumner Township	X																					
Washington Township																						
Wheeler Township	X																					
Gratiot County Sheriff's Office			X				X					X		X	X	X	X				X	X
Gratiot-Isabella RESD			X	X		X	X	X		X				X	X	X			X	X	X	X
Greater Gratiot Development		X	X		X						X	X	X		X		X	X				
Michigan DEQ (EGLE)			X																			
Pine River Superfund			X	X	X							X										
Consumers Energy			X																			
Michigan DOC			X				X				X					X						

Participating Agency or Jurisdiction	Returned Survey	Meeting Attended																			
		8-8	9-12	11-14	12-12	1-9-18	2-13	3-13	4-10	5-22	6-12	7-10	9-11	10-9	11-13	1-8-19	2-19	3-12	6-11	8-13	10-22	1-14-2020
Gratiot County Fire Chief's Association		X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X
Gratiot County Amateur Radio			X	X	X	X	X	X	X	X	X	X	X	X					X	X		X
Mobile Medical Response		X		X	X	X	X	X	X	X												X
Healthy Pine River		X																				
Friends of Pine River		X																				
Gratiot County Drain Commissioner		X					X				X	X										
Mid-Michigan District Health Department		X		X	X		X	X	X	X	X			X	X			X	X			X
Commission on Aging			X																			
Morning Sun		X																				
Gratiot County Road Commission				X																		
Michigan State Police EMHSD				X										X	X		X	X	X			X
Gratiot County Parks and Recreation				X	X	X	X	X	X	X	X		X	X		X	X	X				
Alma Dialysis								X														
MSU Extension										X		X				X						

Participating Agency or Jurisdiction	Returned Survey	Meeting Attended																			
		8-8	**9-12**	**11-14**	**12-12**	**1-9-18**	**2-13**	**3-13**	**4-10**	**5-22**	**6-12**	**7-10**	**9-11**	**10-9**	**11-13**	**1-8-19**	**2-19**	**3-12**	**6-11**	**8-13**	**10-22**	**1-14-2020**
Gratiot Conservation District										X												
Amalgam LLC												X										
Gratiot County 9-1-1													X		X	X	X	X	X		X	X
Gratiot County Building Permits														X				X				
American Red Cross																		X				
ZFS Ithaca																X	X		X	X		
Gratiot Integrated Health Network																						X

Jurisdictions in bold font have contributed in the plan update.

Gratiot County Local Planning Team Attendance Table

TABLE 2.3

Person	Agency	Number of Meetings Attended
Bernie Barnes	Gratiot County Drain Commissioner	4
Mary Jo Beal	Mid-Michigan Medical	1
Kevin Beeson	Pine River Township	1
Kim Boulier	Gratiot Integrated Health Network	1
Ashley Brenner	Gratiot County Emergency Management Coordinator	6
Hailey Brewer	Mid-Michigan District Health Department	12
Brian Chambers	American Red Cross	1
Marcus Cheatham	Mid-Michigan District Health Department	1
H. Jay Cooper	Mobile Medical Response	3
Tracey Cordes	Gratiot County Administration	2
Mark Duflo	Gratiot County 9-1-1	1
Scott Duncan	Zeeland Farm Services (ZFS), Ithaca, MI	4
Bill Ernat	East Michigan Council of Governments	21
Chris Frayre	Michigan State Police	1
John Gibson	Gratiot County Amateur Radio	15
Kurt Giles	City of St Louis	17
Linda Gittleman	County Resident/Morning Sun	1
Jim Hall	Pine River Superfund	4
Matt Hewitt	Gratiot County IT	0
Brian Hull	Mobile Medical Response	1
Earl Hunt	Gratiot County Sheriff's Department	2
Michael Johnston	Gratiot County IT	1
Sue Joyce	Healthy Pine River	1
Cheryl Kampf	Mobile Medical Response	2

Person	Agency	Number of Meetings Attended
Kay Kawasaki	Gratiot County Commission on Aging	2
Cathy Kelbey	Consumers Energy	1
Jane Keon	Friends of Pine River	1
Pat Knapp	County Resident	1
Ray Knapp	County Resident	1
William Leonard	Gratiot County Permits	2
Peter Little	Gratiot County Parks and Recreation	13
Debra Malley	Alma Dialysis	1
Steve Mann	Mobile Medical Response	4
Rick Martin	MSP-EMHSD	1
Sarah McClurg	Gratiot County Commission on Aging	1
Tony Miller	Gratiot County Permits	1
Dan Morden	Gratiot County Emergency Management/9-1-1	19
Michael Morris	Gratiot County Sheriff's Office	7
Dave Nelson	Ithaca Fire Department/Gratiot County Fire Chief's Association	20
John Ney	Village of Perrinton	1
David Nichol	Amalgam LLC	1
Scott Painter	Michigan State Police	1
Rich Ramereiz	St Louis Police Department	5
Gary Rayburn	Healthy Pine River	1
Erica Rogers	MSU Extension	3
Phil Rondy	Michigan DOC	5
Don Schurr	Greater Gratiot Development	1
Stefanie Studt	Village of Ashley	3
Joelle Snyder	Gratiot-Isabella Regional Education Service District	1

Person	Agency	Number of Meetings Attended
Steve Sopocy	Gratiot County Sheriff	2
Paul Spata	American Red Cross	1
Julie Spencer	Gratiot Conservation District	1
Kelli Thompson	Gratiot-Isabella Regional Education Service District	13
Timm Thorson	Gratiot Amateur Radio	7
Eric Van Riper	Michigan DEQ (EGLE)	1
Kim Vetter	Michigan State Police	1
Greg Walterhouse	County Resident	11
Ray Welke	Gratiot County Road Commission	1
Mark Williams	City of Alma	6
Chris Yonker	City of Ithaca	1
Jeff Yonker	Michigan State Police EMHSD	3
Casey Zangaro	MSU Extension	3
Kasey Zehner	Greater Gratiot Development	9

Bold print denotes a person on the Gratiot County LPT

CHAPTER 3: COMMUNITY PROFILE

NATURAL FEATURES OF GRATIOT COUNTY

Gratiot County was established in 1855. Gratiot County is located at the center of Michigan's Lower Peninsula between the industrial areas of the south and the recreational area of the north. Much of the county is rural and dependent upon agriculture, producing dry beans, sugar beets, corn, wheat, oats, poultry, pigs, cattle, and dairy products. The commercial and industrial development in the county is centered primarily along the U.S. 127 corridor around the cities of Ithaca, Alma, and St. Louis. Manufactured products in five Certified Business Parks include aircraft parts, auto parts, and plastics. The county also relies on retail trade and service industries. The Pine and Maple Rivers and three State Game Areas offer recreational opportunities in the county. Alma College is located in the City of Alma. Highway U.S. 127 passes through the county roughly north to south. It is intersected to the north by M-46 and to the south by M-57 for east-west access.

The area occupies approximately 568.5 square miles[3] and serves a population of 42,476[4]. Gratiot County's 363,816 acres are broken down into 71.3% crop land, 4.2% forest, 1.5% pasture, 2.5% wetlands and other farmland uses. The remaining 20.5% comprises commercial, industrial, residential, and roads[5]. While the population density of the area is low compared to the densely populated Southeast Michigan, it is typical of the other counties in the region.

Gratiot County is mainly a rural county that contains a large percentage of agricultural land. There is not a great deal of developmental pressure on the County based on the Gratiot County Permits Office. Most residential developments are single family projects unlike the subdivision pressures that are typically seen to the South and East of Gratiot County. This information can be used to influence decisions regarding future development in vulnerable areas. A great deal of this information was already contained in the Gratiot County Master Plan.

Gratiot County is covered by District 1 of the Emergency Management & Homeland Security Division of the Michigan State Police.

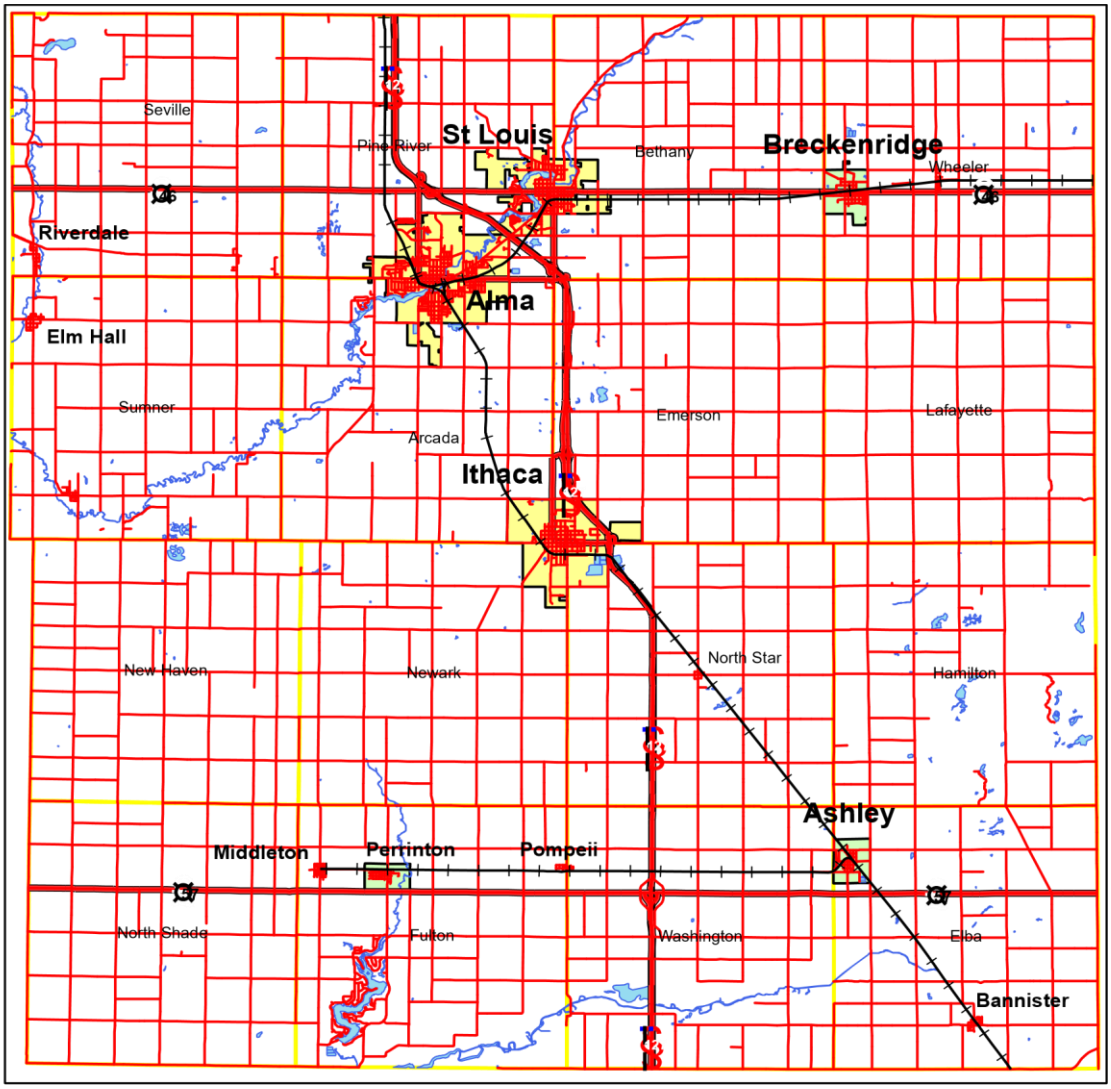
[3] 2018 Gratiot County Master Plan-Greater Gratiot Development, Inc

[4] Gratiot County/2010 census

[5] 2018 Gratiot County Master Plan-Greater Gratiot Development, Inc.

Gratiot County [6]

Map 3.1



Gratiot County Population Centers

Legend

- RR
- Local Roads
- Highways
- Water
- Cities
- Villages
- Township Lines

μ

[6] 2018 Gratiot County Master Plan-Greater Gratiot Development, Inc.

Gratiot County Population[7]

TABLE 3.1

Municipality	2010 population	2000 population	Change in population
Cities			
Alma	9,383	9,275	1.20%
Ithaca	2,910	3,098	-6.07%
St. Louis	7,482	4,494	60.06%
Villages			
Ashley	563	526	7.03%
Breckenridge	1,328	1,399	-5.08%
Perrinton	406	439	-7.52%
Township			
Arcada Township	1,681	1,708	-1.58%
Bethany Township	1,407	3,492	-59.71%
Elba Township	833	858	-2.91%
Emerson Township	952	966	-1.45%
Fulton Township	2,115	1,924	9.23%
Hamilton Township	465	491	-5.30%
Lafayette Township	591	656	-9.91%
Newark Township	1,093	1,149	-4.87%
New Haven Township	1,004	1,016	-1.18%
North Shade Township	665	706	-5.81%
North Star Township	888	996	-10.84%
Pine River Township	2,279	2,451	-7.02%
Seville Township	2,173	2,375	-8.51%
Sumner Township	1,930	1,911	0.99%
Washington Township	870	909	-4.29%
Wheeler Township	1,458	1,446	0.82%
GRATIOT COUNTY TOTAL	42,476	42,285	0.45%

Gratiot County had a moderate increase in population from 2000 to 2010, with an increase of 191 people. There were two municipalities that had significant changes in their populations during the period, St. Louis and Bethany Township. However, the changes were not due an influx or outflow of people, but rather a change in accounting for the prison population.

[7] 2010 US Census

Gratiot County Top Employers[8]

TABLE 3.2

Company Name	Location	# of Employees
Mid-Michigan Medical Center-Gratiot	Alma	495
Central Michigan Correctional Facilities	St Louis	485
Masonic Pathways	Alma	426
International Automotive Components	Alma	398
St Louis Correction Facility	Bethany	387
Avalon & Tahoe Manufacturing	Alma	372
Alma College	Alma	330
Alma Public Schools	Alma	235.5
Gratiot-Isabella RESD	Ithaca	204
Hutchinson Aerospace & Industry	Ithaca	178

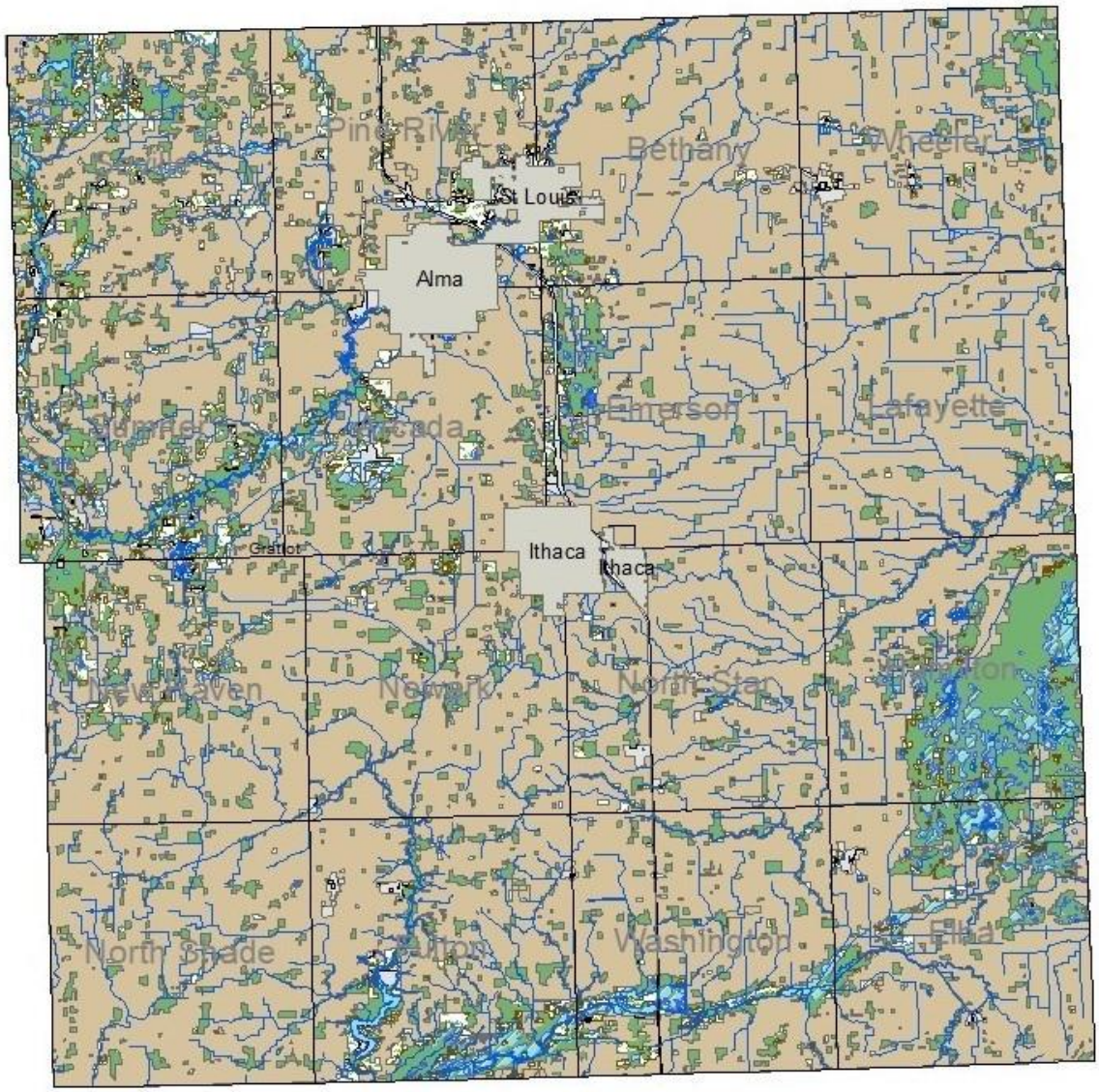
LAND USE

Gratiot County covers approximately 568.5 square miles or 363,816 acres. Gratiot County's 363,816 acres are broken down into 71.3% crop land, 4.2 forest, 1.5% pasture, 2.5% wetlands and other farmland uses. The remaining 20.5% comprises commercial, industrial, residential, and roads[9]. While the population density of the area is low compared to the densely populated Southeast Michigan, it is typical of the other counties in the region.

[8] 2018 Gratiot County Master Plan-Greater Gratiot Development, Inc.
[9] 2018 Gratiot County Master Plan-Greater Gratiot Development, Inc.

Gratiot County Land Use

Map 3.2



FUTURE LAND USE[10]

Greater Gratiot Development, Inc. in partnership with the municipalities in Gratiot County has developed the following "Future Land Use Recommendations". The future land use categories for this Plan were originally developed by compiling language from individual master plans and concepts presented in the Goals, Objectives, & Strategies chapter of the Gratiot County Master Plan. The Steering Committee then refined the language through a review process along with additional public feedback. The Future Land Use Maps show where these land uses are preferred.

The County has been divided into nineteen (19) land use districts. They can be summarized as follows:

Agriculture District-the Agriculture category includes farming, livestock, farming related business, wind farms, and related farmsteads. The County contemplates the development of commercial solar as appropriate for agricultural areas. Residential development within this category will be limited to preserve the overall rural character and prevent the fragmentation of farmland.

Rural Residential District-the Rural Residential category is an intermediate land use between agricultural and urban areas. In general, Rural Residential units are low-density residential developments. However, cluster design is encouraged as a design option in this category for the creation of common open space that helps preserve natural areas and agricultural lands. For example, a clustered residential development with committed open space for recreation, trails, or a unique environmental feature would be compatible with this category. In addition, cluster design is encouraged to allow for the most cost-effective expansion of urban services if these services are deemed necessary within a Rural Residential area.

Neighborhood Residential-the Neighborhood Residential category includes primarily single-family residential developments that generally have the characteristics of traditional urban neighborhoods, such as a grid street system, sidewalks, small lots, and shallow setbacks. In-fill housing and integrated expansion at the edges is encouraged in existing Neighborhood Residential areas. In addition, a modest mix of non-residential uses is allowed in these areas to address the needs of neighborhood residents.

Multi-Family Residential-the Multi-Family Residential category provides for existing and future duplexes, attached single-family townhomes, and multi-family apartments. In addition, a modest mix of non-residential uses is allowed in these areas to address the needs of neighborhood residents.

Manufactured Housing Community-the Manufactured Housing Community land use category provides for existing and future manufactured housing communities.

Public/Quasi-Public-Public and Quasi-Public land uses include facilities that are designed to serve the public interest, such as education (with the exception of Alma College, which is under the campus category), cultural, government, religious, health, correction, military, cemeteries, airports, senior care centers, utilities, and public safety.

[10] 2018 Gratiot County Master Plan-Greater Gratiot Development, Inc.

Campus-the Campus land use category includes campus style facilities, such as Alma College, the Masonic Home, and the Sisters of Mercy. Residential and commercial uses associated with the facility are permitted in the Campus land use area.

Downtown /Mixed Use-the Downtown/Mixed Use category provides for areas where combinations of employment, housing, shopping, and services are integrated in a compact, pedestrian oriented, urban form, which encourages community interaction. Small shops, offices, restaurants, entertainment establishments, second story apartments and condominiums, and public areas are characteristic uses of this land use category.

General Mixed Use-the General Mixed-Use category provides for areas outside of the downtowns where combinations of employment, housing, shopping, and services are integrated. In some cases, these areas may serve as the basis of a hamlet-style hub. In these instances, compact, pedestrian oriented development is desired.

General Commercial-the General Commercial land use designation includes large-scale businesses that provide shopping and services at a regional level. New and renovated buildings within this district will be subject to standards that support current access management techniques, environmentally sensitive landscaping, and quality design standards.

Waterfront Development-the Waterfront Development category provides for redevelopment opportunities along the Pine River. This category allows for a mix of residential, commercial, and recreational land uses and emphasizes pedestrian circulation, environmental protection, and both private and public waterfront access.

Office/Research/Technical-the Office/Research/Technical category provides for industrial uses oriented toward research, design, prototype development, and technical training. Ideally, these areas will be of a campus-style character, with pedestrian amenities, attention to landscaping, and environmental protection.

Office Park-the Professional Office Park provides for office clusters that solely offer professional services, including, but not limited to, executive, administrative, clerical, accounting, engineering, architecture and medical functions.

Light Industrial-the Light Industrial category provides for industrial activities that pose minimal environmental impacts upon surrounding areas and uses, such as warehousing and storage; wholesale establishments; tool, die and machine shops; manufacturing; and limited processing of materials. Screening of outside storage in these areas is encouraged.

Heavy Industrial-the Heavy Industrial category provides for general or heavy industrial activities such as those which involve the use of heavy machinery, regular traffic by larger trucks, extensive amounts of contiguous land, service by railroad lines or major thoroughfares, processing of chemical or raw materials, assembly, and generation of industrial waste, noise, odor, or traffic problems. Given their potential environmental impacts, screening and buffering of heavy industrial uses is encouraged.

Excavation-the Excavation category provides for lands that are or will be commercially excavated.

Natural & Open Space-*Forested*-This category includes lands that serve as wildlife habitat or that are used for timber harvesting. Other uses may include forest related recreational activities, such as hunting, fishing, skiing and hiking. *Conservation*-This category includes undeveloped land that contributes ecological, scenic or recreational value. Due to potential problems associated with flooding and water quality, lands adjacent to existing watercourses are particularly important. This category may also include open space buffers between various land uses.

Recreation-*Neighborhood Park*-This category includes lands that provide recreational opportunities at the neighborhood level, as opposed to large, more specialized parks meant for community-wide use. *Community Wide Park*-This category includes lands that provide large-scale or specialized recreational opportunities designed for use by the broader community. These facilities may be either public or private.

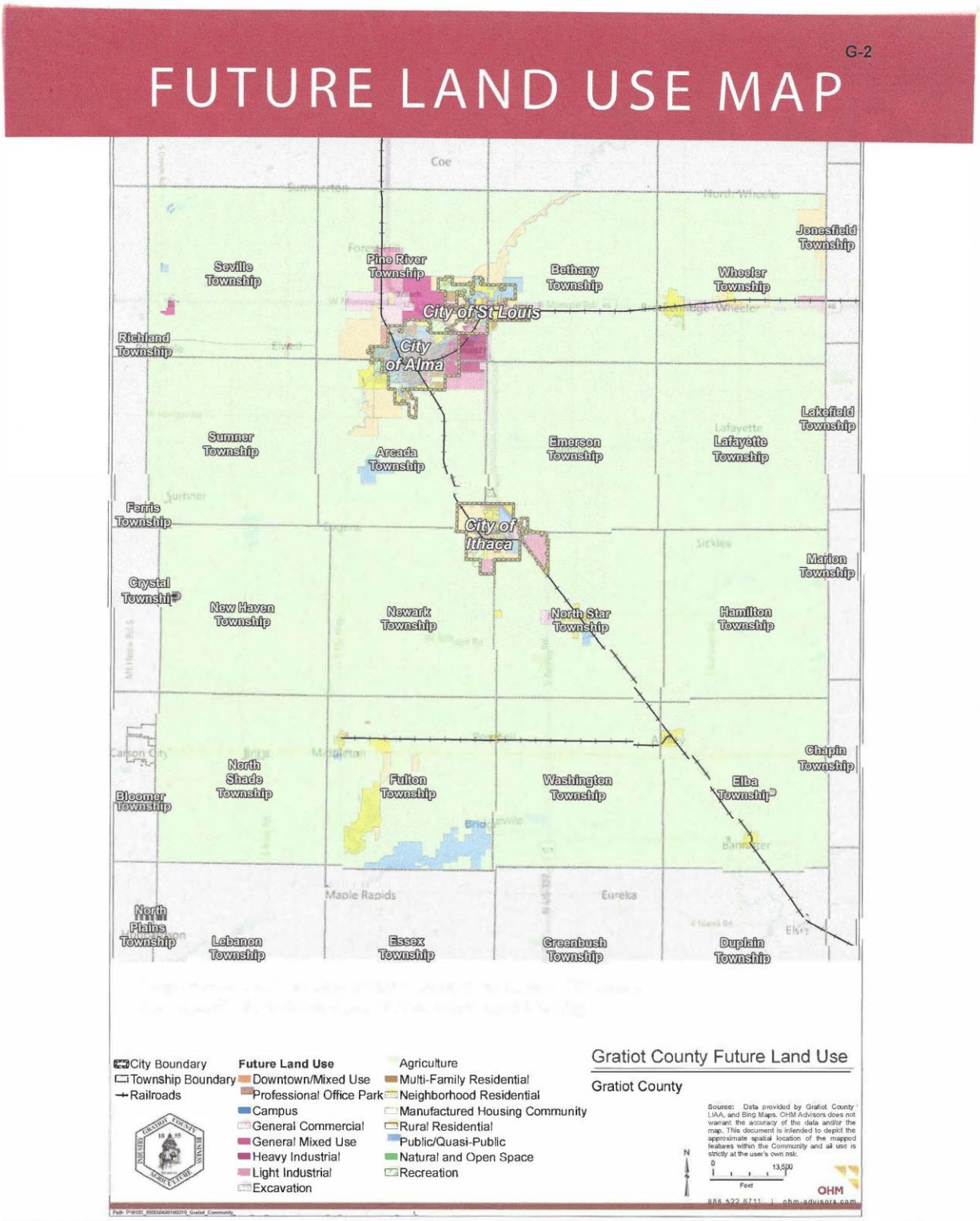
Urban Growth Areas-the Urban Growth Area are not specifically a land use but are areas where the community would like to direct more intense development and where the potential extension of services, such as water and sewer, would be the most cost effective. Urban Growth Areas are determined by the affected jurisdictions and often involve a written agreement to appropriately manage the expansion of services. Typically, these agreements are "425" agreements, based on Act 425 of 1984, which is also known by the title Intergovernmental Conditional Transfer of Property by Contract Act. At the time of this Plan, all the cities in Gratiot County have negotiated 425 agreements with many of their neighboring townships. The agreements provide for the transfer of land to the cities in turn for sharing the increased tax revenue received from intensive development of the property. Alma has agreements with Arcada Township, Pine River Township, and one with both the City of St. Louis and Pine River Township. Ithaca has 425 agreements with Newark Township and North Star Township. St. Louis has agreements with Bethany Township, Pine River Township, and the City of Alma.

For purposes of simplicity and consistency, the definition of each classification was taken generally from the Gratiot County Master Plan (2018). The master plan developed for Gratiot County, through Greater Gratiot Development, is a very valuable document for growth of Gratiot County. Following is a map of the future land use found in the Master Plan.[11]

[11] 2018 Gratiot County Master Plan-Greater Gratiot Development, Inc.

Gratiot County Future Land Use Map

MAP 3.3



TOPOGRAPHY

Soils that are commonly associated with water and wetlands have been shown on Map 3.4 on page 31. Some of these areas have been drained and farmed since the 1800's. Therefore, some soils that would be considered wetlands are highly productive farmlands due to the sophisticated drainage system currently utilized and maintained in Gratiot County. Due to the relatively flat topography and gentle slopes and grades within the county, the current drains and water ways are able to adequately divert surface water from run-off water away properly.

SOILS[12]

The Soil Survey of Gratiot County, Michigan identifies soils across the County. Map 3.4 identifies the locations of the soil map units, which are described below. The soil map provides a broad perspective of the soils, but due to the small scale it is not good for site specific soils. The Soil Survey Manual of Gratiot County can be referred to for further details. Below are the many soil types and their classifications.

Fine Sand

Afa-Aquents-Udorthents complex, 0 to 3 percent slopes
Bf-Belleville fine sand
Gr-Granby fine sand
OaB-Oakville fine sand, 0 to 6 percent slopes

Sand

AhB-Arkona sand, 0 to 4 percent slopes
CvB-Covert sand, 1 to 6 percent slopes
GaC-Grattan sand, 4 to 12 percent slopes
Gs-Granby sand, loamy substratum
PlfaeB-Plainfield-Spinks sands, 0 to 6 percent slopes
PlfaeD-Plainfield-Spinks sands, 6 to 18 percent slopes
PnA-Pipestone sand, Erie-Huron Lake Plain, 0 to 3 percent slopes
PoA-Pipestone sand, loamy substratum, 0 to 3 percent slopes

Loamy Very Fine Sand

La-Lamson loamy very fine sand

Loamy Fine Sand

ArB-Arkport loamy fine sand, 1 to 6 percent slopes
ArC-Arkport loamy fine sand, 6 to 12 percent slopes
MrcaaA-Morocco-Brems sands, 0 to 3 percent slopes

Loamy Sand

AkA-Arkona loamy sand, 0 to 2 percent slopes
Be-Belleville loamy sand
BmB-Boyer loamy sand, 2 to 6 percent slopes
BoB-Boyer loamy sand, 2 to 6 percent slopes
Ke-Kingsville loamy sand
MhB-Metea loamy sand, 2 to 6 percent slopes
MtB-Metea loamy sand, 0 to 6 percent slopes
PrA-Pipestone-Tedrow loamy sands, loamy substratum, 0 to 2 percent slopes
PpA-Pipestone-Tedrow loamy sands, 0 to 2 percent slopes
PtB-Plainfield loamy sand, 0 to 6 percent slopes
PtC-Plainfield loamy sand, 6 to 18 percent slopes
PxB-Poseyville-Londo complex, 0 to 4 percent slopes
RdA-Riverdale loamy sand, 0 to 2 percent slopes
WxA-Selfridge loamy sand, 0 to 3 percent slopes
SeA-Selfridge loamy sand, till plain, 0 to 2 percent slopes
Sk-Sickles loamy sand
SpB-Spinks loamy sand, 0 to 6 percent slopes

[12] Soil Survey of Gratiot County, Michigan, 1978.

SpC-Spinks loamy sand, 6 to 12 percent slopes
TdA-Tedrow loamy sand, 0 to 2 percent slopes
TeA-Tedrow loamy sand, loamy substratum, 0 to 2 percent slopes
Ve-Vestaburg loamy sand

Fine Sandy Loam

Ce-Ceresco fine sandy loam, gravelly substratum
Cf-Ceresco fine sandy loam
Ch-Cohoctah fine sandy loam, gravelly substratum
Co-Cohoctah- Ceresco fine sandy loams, gravelly substratum
DxA-Dixboro fine sandy loam, 0 to 3 percent slopes

Sandy Loam

Cr-Corunna sandy loam
Gd-Gilford sandy loam, 0 to 2 percent slopes, gravelly subsoil
MaB-Marlette sandy loam, 2 to 6 percent slopes
MeA-Metamora-Capac sandy loams, 0 to 2 percent slopes
SuA-Sumava sandy loam, 0 to 3 percent slopes
Wa-Wauseon sandy loam

Cobbly Sandy Loam

CcA-Capac variant-Parkhill complex, 0 to 2 percent slopes

Cobbly Loamy Sand

MvB-Metea variant cobbly loamy sand, 2 to 6 percent slopes

Loam

CaA-Capac loam, 0 to 4 percent slopes
CsraaA- Crosier loam, 0 to 2 percent slopes
GuB-Guelph-Londo loams, 1 to 6 percent slopes
ItA-Ithaca loam, 0 to 3 percent slopes
MaC-Marlette sandy loam, 6 to 12 percent slopes
MbB-Marlette loam, 2 to 6 percent slopes
MbC-Filer loam, 6 to 12 percent slopes
PcB-Parkhill-Selfridge complex, 0 to 2 percent slopes
Ph-Parkhill loam, 0 to 1 percent slopes
PhA-Parkhill loam, non-dense till subsoil, 0 to 2 percent slopes
PkB-Perrinton loam, Saginaw Lobe, 2 to 6 percent slopes
PkC-Onekama loam, Saginaw Lobe, 6 to 12 percent slopes
Sn-Sloan loam, wet
So-Sloan loam

Silt Loam

Cp-Chesaning-Cohoctah complex, frequently flooded
HuB-Huntington silt loam, 1 to 5 percent slopes
Sm-Sloan silt loam, frequently flooded
ZfsaaA- Ziegenfuss silt loam, 0 to 1 percent slopes

Silty Clay Loam

Lg-Lenawee silty clay loam, 0 to 1 percent slopes
Sa-Saranac silty clay loam, frequently flooded

Clay Loam

PlA-Pert clay loam, 0 to 2 percent slopes

Clay

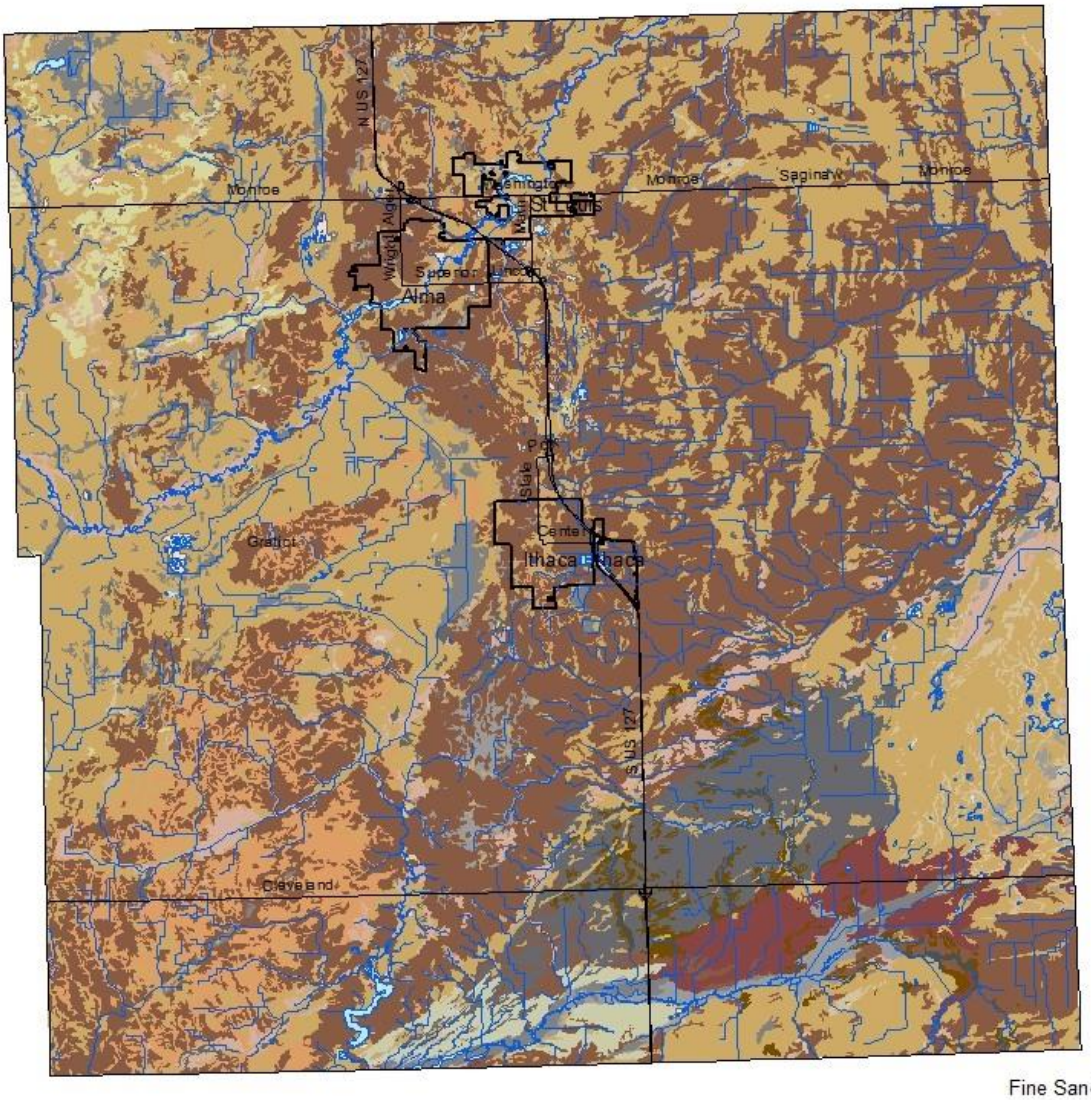
ZfsabA- Ziegenfuss clay, 0 to 1 percent slopes

Muck

Ad-Adrian muck, 0 to 1 percent slopes
Ed-Edwards muck, 0 to 1 percent slopes
Ho-Houghton muck
Mc-Martisco muck
Oe-Olentangy muck
Pa-Palms muck, 0 to 1 percent slopes
Th-Thomas muck
Tm-Tobico muck

Gratiot County Soils Map

MAP 3.4



Fine Sand
Sand
Loamy Very Fine Sand
Loamy Fine Sand
Loamy Sand
Fine Sandy Loam
Sandy Loam
Cobbly Sandy Loam
Cobbly Loamy Sand
Loam
Silt Loam
Silty Clay Loam
Clay Loam
Clay
Muck

Date: 5/7/2018

Prepared with assistance from USDA-Natural Resources Conservation Services

Coordinate System: NAD 1983 UTM Zone 16N
Projection: Transverse Mercator
Datum: North American 1983
False Easting: 500,000.0000
False Northing: 0.0000
Central Meridian: -87.0000
Scale Factor: 0.9996
Latitude Of Origin: 0.0000
Units: Meter

0 0.5 1 2 3 4 Miles

CLIMATE

Climate has a strong influence on the way of life and the activities of the people of Gratiot County. In the Koppen climate classification system, Gratiot county is considered to have a continental type of climate, which is characterized by having no dry season, and a hot summer. This is similar to many of the counties in the Lower Peninsula of Michigan. Like the rest of the State of Michigan, the County has four distinct seasons that allow for a wide variety of outdoor activities. In the table below is a breakdown of the average high and low temperatures for each month along with the monthly average precipitation (rainfall) and snowfall.

Gratiot County Climate[13]

TABLE: 3.3

Month	Average Temperatures (in degrees)		Monthly Average Rainfall (in inches)	Monthly Average Snowfall (in inches)
	High Average (degrees in Fahrenheit)	Low Average (degrees in Fahrenheit)		
January	29	15	1.89	11.0
February	32	16	1.61	9.0
March	42	24	2.09	6.0
April	56	35	3.07	2.0
May	68	45	3.50	0.0
June	78	55	3.46	0.0
July	82	59	2.076	0.0
August	80	58	3.46	0.0
September	72	49	3.43	0.0
October	59	39	2.91	0.0
November	45	30	2.95	3.0
December	33	20	2.09	9.0
Annual Totals			33.22	40.0

WATER FEATURES AND WETLANDS

Gratiot County has a multitude of water resources. It is located within two major watersheds: the Saginaw River Watershed and the Grand River Watershed. The Saginaw River Watershed empties into Saginaw Bay in Lake Huron, while the Grand River Watershed empties into Lake Michigan. There are three smaller distinct drainage basins or watersheds within the County, with the Bad River Watershed and the Pine River Watershed being part of the Saginaw River Watershed. The Maple River Watershed is part of the Grand River Watershed.

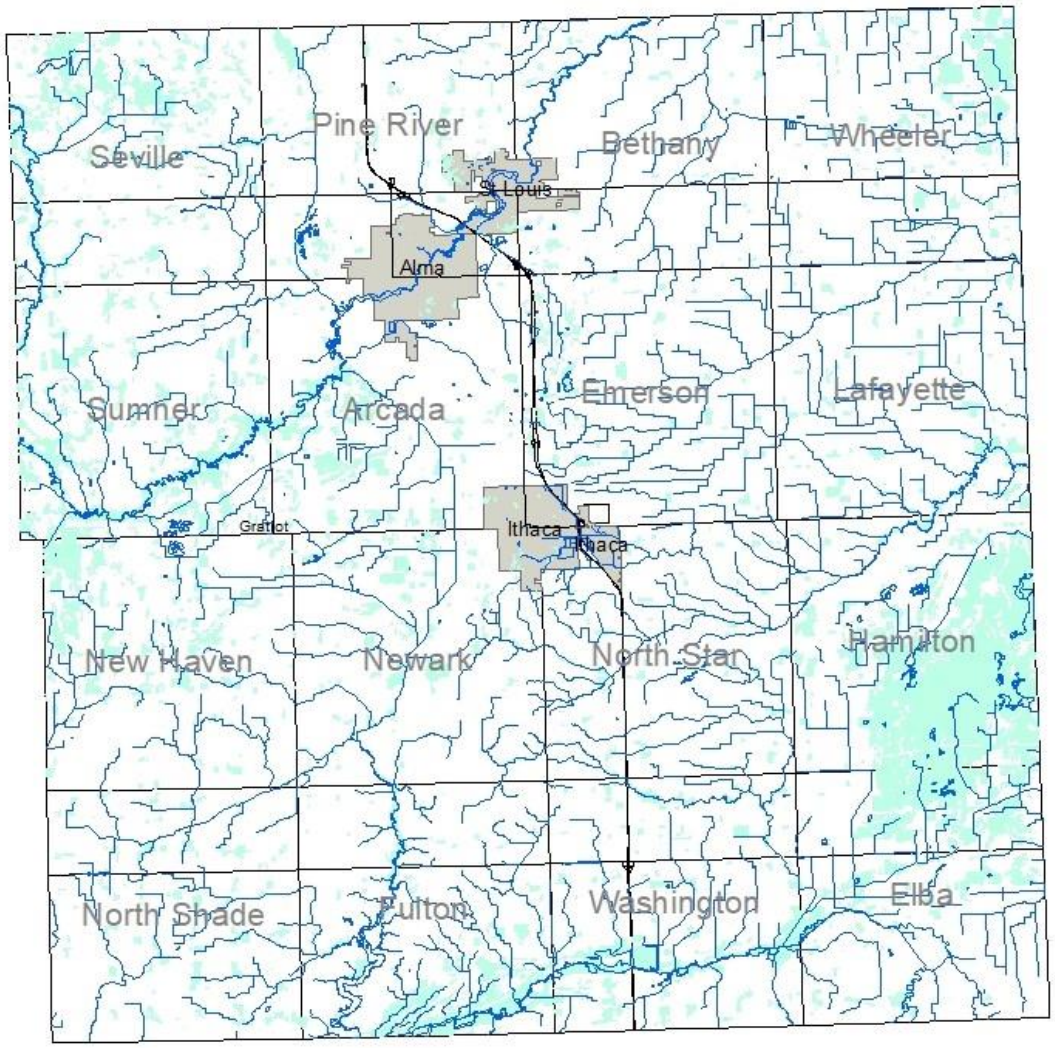
There are 15 lakes 10 acres or larger, with the two largest lakes each being over 300 acres. Saginaw Lake is the largest lake at 360 acres and is located in North Star Township, in the southeastern portion of the

[13] National Weather Service

County. Rainbow Lake is 304 acres in size and is located west of the Maple River State Game Area in Arcada Township in the west central portion of the County.

Gratiot County Wetlands

MAP 3.5



Prepared with assistance from USDA-Natural Resources Conservation Services

Coordinate System: NAD 1983 UTM Zone 16N
Projection: Transverse Mercator
Datum: North American 1983
False Easting: 500,000.0000
False Northing: 0.0000
Central Meridian: -87.0000
Scale Factor: 0.9996
Latitude Of Origin: 0.0000
Units: Meter

Date: 5/1/2018

1.50.75 0 1.5 3 4.5 6
Miles

Gratiot County Wetlands

FOREST COVER

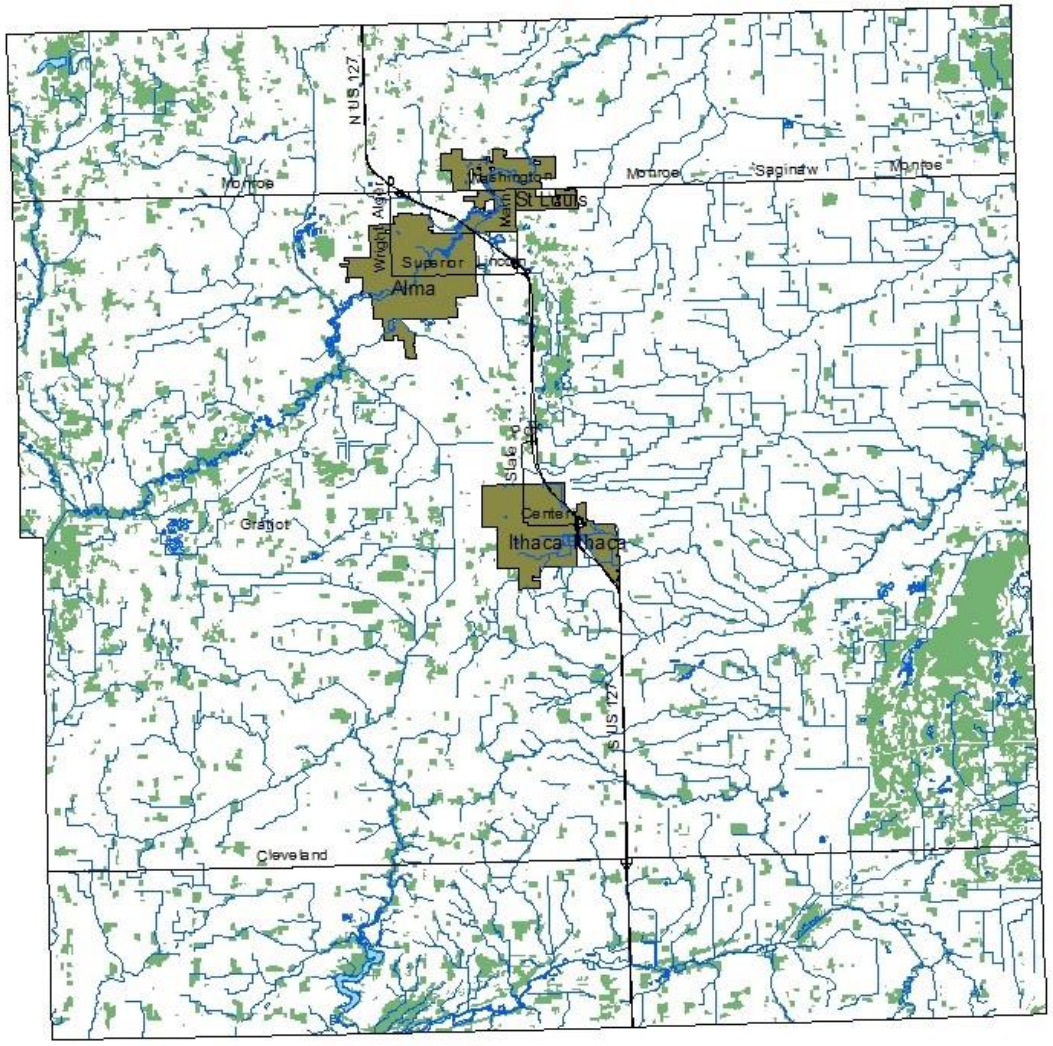
About 7.5 percent of the County is forested and an analysis of forest types will assist in defining vulnerable areas and populations. Tree species vary depending upon the soils, moisture and past activities such as logging, fires and land clearing. Aspen-Birch, central hardwoods, and pine are the most common forest types. Under dry spring conditions forest fires can occur in any forest type. However, some forest types have higher risks. Jack and red pine forests have a high risk for wildfires. Oak and white pine forests have a moderate risk for wildfires. According to the MIRIS Land Cover/Use Inventory, jack pine and red pine forest types cover approximately 2 percent of the forestland. Low fertility sandy soils, found in outwash plains and channels, supported pre-settlement pine forests that for thousands of years were perpetuated by wildfires. Today, residential development has occurred within the same wildfire prone areas. There are small pockets of pine forest in Washington Township.

Red jack and white pine forest types are included in the pine forest category. Bigtooth aspen, quaking aspen, white birch, red maple and red oak are the primary tree species found in the aspen-birch type. Red oak, white oak, black oak and northern pin oak are the primary species growing in the oak forests. Northern hardwoods include species such as sugar maple, red maple, American beech, basswood and yellow birch.

Poorly drained, lowland areas support northern white cedar, tamarack, balsam fir, black spruce, eastern hemlock, white pine, balsam poplar, trembling aspen, paper birch, black ash, speckled alder and shrub willows. Northern white cedar dominates the wetland areas where there is good lateral water movement and the soils are high in organic content. Lowland forests are typically located adjacent to water features and function as riparian forests and water quality buffers. The network of lowland forests, associated with rivers and creeks, also function as wildlife corridors and are the backbone of large regional ecological corridors. Lowland forests adjacent to rivers and streams are prone to flooding during the spring snow melt, particularly when combined with heavy spring rains.

Gratiot County Forest Cover

Map 3.6



Forested Lands

Prepared with assistance from USDA-Natural Resources Conservation Services

Coordinate System: NAD 1983 UTM Zone 16N
Projection: Transverse Mercator
Datum: North American 1983
False Easting: 500,000.0000
False Northing: 0.0000
Central Meridian: -87.0000
Scale Factor: 0.9996
Latitude Of Origin: 0.0000
Units: Meter

Date: 5/2/2018

1.50.75 0 1.5 3 4.5 6
Miles

COMMUNITY ORGANIZATION AND RESOURCES FOR HAZARD MITIGATION including County and Local Community Agencies, Departments and organizations potentially relevant for Hazard Mitigation.

Emergency Services

Emergency services are very important for the Hazard Mitigation Process. These services help serve the public in times of natural disasters and other emergency situations. It is crucial for the public to know where these services exist and how to reach them in times of need.

Gratiot County Office of Emergency Management

1375 County Farm Drive
Ithaca, MI 48847
(989) 875-5280

This office was established under the provisions of the Michigan Emergency Management Act, PA 390 of 1976, as amended, to ensure a coordinated public response in the event of a natural or man-made disaster. The Gratiot County Emergency management office assesses local capabilities to respond to emergency and disaster situations, and advocate emergency preparedness in both the public and private sectors and works to assure a comprehensive approach is used involving a range of public and private agencies including local police, fire and EMS agencies, the Michigan State Police Emergency Management and Homeland Security Division, the Michigan Department of Environmental, Great Lakes, and Energy, the Region 6 Homeland Security Board, and the National Weather Service. Other agencies coordinating with emergency management include the American Red Cross, local and state health departments, educators and amateur radio operators. This office tends to be central for all major threats and incidents within the County. This office also handles all Public Warning and Communications services, NOAA Weather alerts, Broadband, LEPC/LPT Boards, EOC Operations and Management, Training and Education programs, and all related Homeland Security matters.

Local Emergency Planning Committees (LEPC) – LPT Local Planning Team

One of the major provisions of SARA Title III is the establishment of Local Emergency Planning Committees (LEPCs) for designated planning districts. The LEPCs are responsible for developing emergency response plans for communities that have facilities in their jurisdiction subject to SARA Title III emergency planning requirements. The LEPC is the primary mechanism through which local SARA Title III planning, training and exercising activities are implemented. Michigan has 88 designated LEPCs – one for each of the 83 counties and 5 in major cities. Nearly 2,800 facilities across the state have been identified as being subject to Title III emergency planning provisions. A facility is subject to SARA Title III provisions if extremely hazardous substances (as determined by the U.S. Environmental Protection Agency) are present at the facility in quantities at or above the minimum threshold quantities established in Section 302 of the Act or at the request of the LEPC or local Fire Department.

Note: Many of the programs and initiatives designed to mitigate, prepare for, respond to, and recover from fixed- site hazardous material incidents have the dual purpose of also protecting against hazardous material transportation incidents.

Local Emergency Capability:

Procedures in the Emergency Operations Plans address the of problems associated with hazards, including specific functions such as rescue and evacuation. Communities work closely with company

officials and surrounding jurisdictions to ensure a fast, coordinated response. Mitigation possibilities include the use of community zoning regulations to provide suitable open, unoccupied "buffer" areas around pipelines, storage fields, refineries and compressor stations.

Warning Sirens or System

Gratiot County has a combination of manual and automated warning systems. The four sirens in the cities of Alma (2), St Louis (1), and Ithaca (1) sirens can be controlled from Gratiot County Central Communications and the local fire departments. The other three are activated manually by the Ashley (1), Breckenridge (1), and Perrinton (1) fire departments. Sirens typically have a working radius of approximately one (1) mile; however, this can vary based on the existing weather conditions. "There is a concern that putting the map with the location of the signs in a public document could put their safety at risk; however, a map of the sirens can be provided should one be requested."

Police

Gratiot County has three police departments within the County outside the Sheriff's Department. They are the Alma Police Department, St. Louis Police Department, and Breckenridge Police Department. The Gratiot County Sheriff's Department is located in the City of Ithaca and has an agreement to provide services to the City. In addition, the County is served by the Michigan State Police Post from Lakeview, which has a satellite office in St. Louis.

Gratiot County Sheriff's Department
226 E. Center St
Ithaca, MI 48847
Phone: 989 875-4128
Fax: 989 875-3322

Alma City Police Department
525 E. Superior St
Alma, MI 48801
Phone: 989 463-8317

Breckenridge Police Department
104 E. Saginaw St
Breckenridge, MI 48615
Phone: 989 842-5657

St. Louis Police Department
300 N. Mill St
St. Louis, MI 48880
Phone: 989 681-5285
Fax: 989 681-4620

Michigan State Police-Lakeview Post 67
10300 Howard City Edmore Rd
Lakeview, MI 48850
Phone: 989 352-8444

Fire

There are eight (8) fire departments located in or serving portions of Gratiot County. Six of the eight departments are located in the County and two are located outside the County but cover portions of the County. The departments within the County are located in the City of Alma, the City of St. Louis, the City of Ithaca, the Village of Ashley, the Village of Breckenridge, and the Village of Perrinton. The two departments located outside the County are from Carson City (Montcalm County) and Maple Rapids (Clinton County).

Gratiot County Fire Departments

Alma Fire Department
525 E. Superior St
Alma, MI 48801
Phone: 989 463-8359
Fax: 989 466-0758

Ashley Fire Department
114 W. Oak St
Ashley, MI 48806
Phone: 989 847-3050
Fax 989 847-4031

Breckenridge Fire Department
513 E. Saginaw St
Breckenridge, MI 48615
Phone: 989 842-5747
Fax: 989 842-5747

Ithaca Fire Department
129 W. Emerson St
Ithaca, MI 48847
Phone: 989 875-3200
Fax: 989 875-4064

Perrinton Fire Department
108 Robinson
Perrinton, MI 48871
Phone: 989 236-5161
Fax: 989 236-5512

St Louis Area Fire Department
220 S. Main St
St Louis, MI 48880
Phone: 989 681-3111
Fax: 989-681-4457

Maple Rapids Fire Department
118 W. Adelaide St
Maple Rapids, MI 48853
Phone: 989 682-4569
Fax: 989 682-4411

Carson City Fire Department
123 Main St
Carson City, MI 48811
Phone: 989 584-3515
Fax: 989 584-6609

Ambulance

Mobile Medical Response (MMR) is the primary response unit. There are also seven (7) rescue districts which supplement MMR. The rescue units are located in: Village of Ashley, Village of Breckenridge, Carson City, Village of Perrinton, City of St Louis, and Sumner-Seville Rescue.

Mobile Medical Response
4305 State Street
Saginaw, MI 48603
Phone: (800) 232-5216

Ashley Fire Department
114 W. Oak St
Ashley, MI 48806

Breckenridge Fire Department
513 E. Saginaw St
Breckenridge, MI 48615
Phone: 989 842-5747
Fax: 989 842-5747

Ithaca Fire Department
129 W. Emerson St
Ithaca, MI 48847
Phone: 989 875-3200
Fax: 989 875-4064

Perrinton Fire Department
108 Robinson
Perrinton, MI 48871
Phone: 989 236-5161
Fax: 989 236-5512

Mid-Michigan Community Fire Department
108 W. Saginaw St
St Louis, MI 48880
Phone: 989 681-3111
Fax: 989-681-4457

Sumner-Seville Rescue
9171 N. Warner Rd
Elwell, MI 48832
Phone: 989 436-5980

Carson City Fire Department
123 Main St
Carson City, MI 48811
Phone: 989 584-3515
Fax: 989 584-6609

Health Care

There are three facilities located in Gratiot County.

Mid-Michigan Medical Center Gratiot
300 E. Warwick Dr
Alma, MI 48801
Phone: 989 463-1101

Mid-Michigan Urgent Care
321 E. Warwick Dr
Alma, MI 48801
Phone: 989 466-3332

Mid-Michigan Health Department
151 Commerce Dr
Ithaca, MI 48847
Phone: 989 875-3681

Government Facilities

Government facilities have a large impact on how emergencies are handled. They provide services to the public such as shelter in times of natural disasters. They also serve as a way to distribute information on how to handle emergency circumstances.

Government Offices and Facilities (Main Office Locations) County

Gratiot County
Gratiot County Courthouse
214 E. Center Street
Ithaca, MI 48847
Phone: 989 875-5282
Fax: 989 875-5284
Email: tcordes@gratiotmi.com

Cities

City of Alma
525 E. Superior Street
Alma, MI 48801
Phone: 989 463-8336
Fax: 989 463-5574

City of Ithaca
129 W. Emerson Street
Ithaca, MI 48847
Phone: 989 875-3200

City of St. Louis
City Hall
300 North Mill Street
St. Louis, MI 48880
Phone: 989 681-2137

Villages

Village of Ashley
114 S. Sterling Street
P.O. Box 158
Ashley, MI 48806
Phone: 989 847-3050
Fax: 989 847-4031

Village of Breckenridge
104 E. Saginaw Street
Breckenridge, MI 48615
Phone: 989 842-3109
Fax: 989 842-3128

Village of Perrinton
108 N. Robinson
Perrinton, MI 48871
Phone: 517 236-5161
Fax: 517 236-5612

Townships

Arcada Township
W. Tyler Road
Alma, MI 48801
Phone: 989 463-6097

Bethany Township
9958 Blair Road
Breckeridge, MI 48615

Elba Township
109 Oak Street
Ashley, MI 48806
Phone: 989 847-2210

Emerson Township
2976 Baldwin Road
Ithaca, MI 48847

Fulton Township
3425 W. Cleveland Road
Perrinton, MI 48871
Phone: 989 236-5102

Hamilton Township
7853 E. Fillmore Road
Ithaca, MI 48847

Lafayette Township
2909 Barry Road
Breckenridge, MI 48615

New Haven Township
3027 S. Warner Road
Sumner, MI 48889

Newark Township
2918 W. Buchanan Road
Ithaca, MI 48847

North Shade Township
8982 Roosevelt Road
Carson City, MI 48811

North Star Township
2840 E. Buchanan Road
Ithaca, MI 48847

Pine River Township
1495 Monroe Road
St. Louis, MI 48880
Phone: 989 681-5523

Seville Township
8143 W. Madison Road
Elwell, MI 48832
Phone: 989 463-6180

Sumner Township
10820 Pine Street
Sumner, MI 48889

Washington Township
8989 S. Baldwin Road
Ashley, MI 48806

Wheeler Township
8510 Monroe Road
Wheeler, MI 48662
Phone: 989 842-3428

Schools

There are nine (9) school districts located in Gratiot County, including both public and private schools. All school districts within the County utilize "school of choice", which allows students living in one school district to attend schools in other districts. In addition, Alma College is also located within the County. Below is information on the nine public and private school districts.

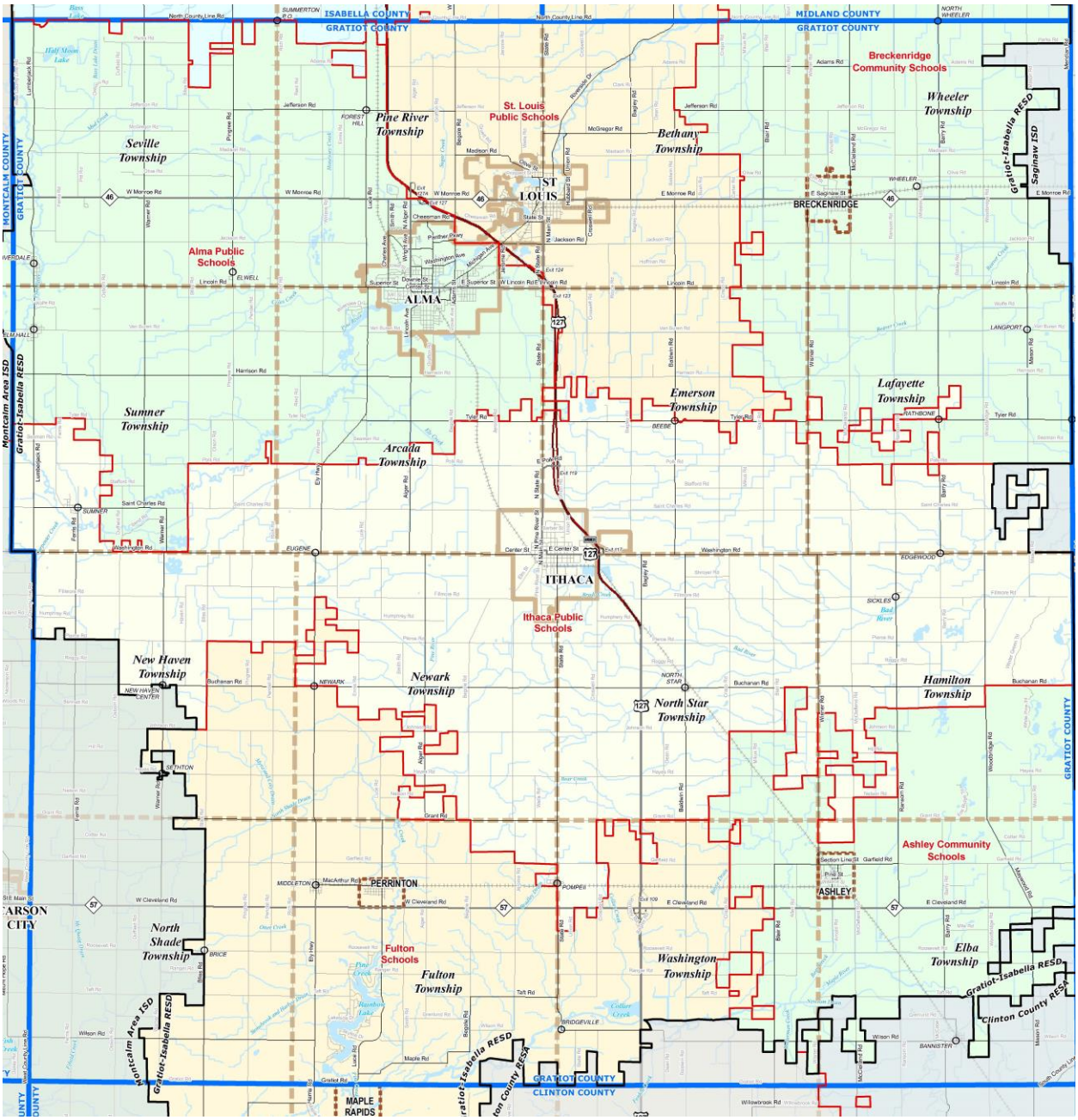
Gratiot County School Districts

Table 3.4

School District (address)	Number of Students (2016-17)	School District (address)	Number of Students (2016-17)
Alma Public Schools 1500 Pine Avenue Alma, MI 48801 Phone: 989 463-3111 Fax: 989 466-2943	2104	Ashley Community Schools 104 N. New Street P.O. Box 6 Ashley, MI 48806 Phone: 989 847-4000 Fax: 989 847-3500	262
Breckenridge Community Schools 700 Wright Street Breckenridge, MI 48615 Phone: 989 842-3182	673	Fulton Schools 8060 Ely Highway Middleton, MI 48856 Phone: 989 236-7300	776
Ithaca Public Schools 710 N. Union Street Ithaca, MI 48847 Phone: 989 875-3700 Fax: 989 875-4538	1162	St. Louis Public Schools 113 E. Saginaw St St. Louis, MI 48850 Phone: 989 681-2500 FAX: 989 681-5894	1053
Countryside Christian School 4308 S. Luce Road Ithaca, MI 48847 Phone: 989 875-2313	81	St Mary School 220 W. Downie Alma, MI 48801 Phone: 989 463-4579 Fax: 989 463-8297	120
Seventh Day Adventist School 937 Pine River Ithaca, MI 48847 Phone: 989 875-4961	8		

Gratiot County School District Map[14]

MAP 3.7



Utilities

Information on the utilities provided to communities within the County are essential to distribute information to the public in times of need. Also, certain locations that provide these services may be the source of emergency situations (transformer problems, gas leaks, etc.).

[14] Gratiot-Isabella RESD

Electricity
Consumers Energy
Homeworks Tri-County Electric Cooperative
City of St. Louis

Natural Gas
Consumers Energy
DTE

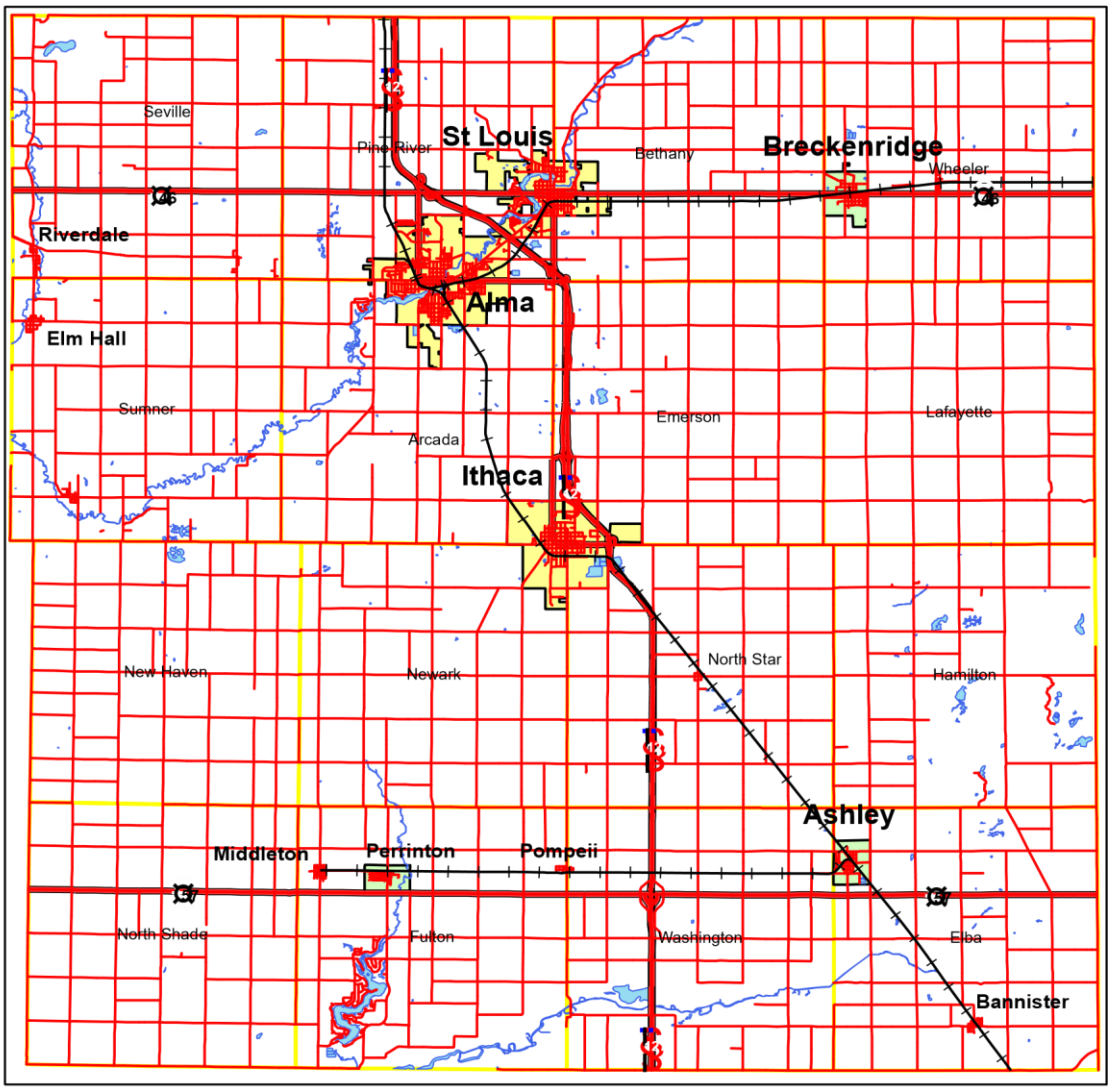
Transportation
Roads
Gratiot County has 1,466 miles of local roads, 347 miles of primary roads, and 152 miles of state trunklines. For total miles of public roads, Gratiot County ranks second in the State.

Gratiot County is served by three (3) all season State Trunkline Highways:
M-46 – East/West, northern Gratiot County
M-57 – East/West, southern Gratiot County
US-127-North/South-central Gratiot County

Gratiot County Road Commission
200 Commerce Drive
Ithaca, M I 48847
Phone: 989 875-3811
Fax: 989 875-2831
Email: gratiot@gratiotroads.org

Gratiot County Transportation Map[15]

MAP 3.8



Gratiot County
Population Centers

Legend

- RR
- Local Roads
- Highways
- Water
- Cities
- Villages
- Township Lines

[15] 2018 Gratiot County Master Plan-Greater Gratiot Development, Inc.

Airports

Gratiot Community Airport
Daryl Koch
Airport Assistant Manager
3999 W Seaman Rd
Alma MI 48801
989-463-5500.
http://threepointaviation.com/

Gratiot Community Airport is located at 3999 W. Seaman Road, between Alma and Ithaca. The Airport is governed by the Gratiot Community Airport Authority, consisting of the cities of Alma, Ithaca, and St. Louis, and Arcada and Pine River Townships, and Gratiot County. All entities contribute financially to the Airport Authority. The Authority also receives funding through hangar and land lease rentals. Persons interested in renting an aircraft hangar can contact the airport.

The Airport has a 5,000-foot east-west primary runway and a 3,200-foot north-south cross wind runway. The runways can handle commercial aircraft and small jets. It also takes private charters.

Three Point Aviation LLC is the Fixed Base Operator at the Airport and handles the day-to-day operations. Self-serve fuel for Jet A 100LL is available at the airport, twenty-four hours a day, seven days a week. Aircraft rental and a courtesy car are also available.

Mass Transportation

Gratiot County is not covered completely by any single mass transportation organization, but by several organizations. Alma Transportation covers two zones, Zone 1 – City of Alma M-F 6a-8p and Zone 2 – City of St Louis & Pine River Twp. M-F 9a-8p.

Railroads

Gratiot County is served by two rail lines: Great Lakes Central Railroad & Mid-Michigan Railroad

Great Lakes Central Railroad
Chris Bagwell
General Manager
600 Oakwood Avenue
Owosso, MI 48867
Phone: 989 425-6644
Email: chbagwell@glcrailroad.com

Great Lakes Central Railroad (GLCRR) is the largest regional railroad in Michigan, with 400 miles of track stretching through Central and Northern Michigan. GLCRR is a north/south route through Gratiot County with a spur to the west terminating in Middleton, Michigan. It travels through the communities of Ashley, Ithaca, and Alma on the main line. The spur goes through unincorporated Pompeii, Middleton, and the Village of Perrinton.

Mid-Michigan Railroad
Leila Ford
VP Marketing and Sales
Phone: 614-479-1671
Email: Leila.Ford@gwrr.com

Mid-Michigan RR operates on 33 miles of total track. It interchanges with GLCRR and Lake State Railway. MMRR travels through Breckenridge, St Louis, and terminates in Alma, connecting with GLCRR there. MMRR is a freight line focusing on agricultural commodities, lumber, and salt.

Additionally, the Michigan Steam RR Institute utilizes GLCRR track frequently in Gratiot County. The Village of Ashley is the "North Pole" stop for the internationally renowned North Pole Express which travels regularly from Owosso, Michigan to Ashley in late Fall on weekends. There are also numerous other passenger excursions the Steam Railroading Institute (SRI) conducts; Fall Color tours, Back to the Bricks, Dinner trips, etc., which either traverse Gratiot County, or make stops in Ashley, Ithaca, or Alma.
http://michigansteamtrain.com/
Contact Kimberly Springsdorf, Exec Dir SRI: 989-725-9464 ext 5 or visitshiawassee@gmail.com

GRATIOT COUNTY (2015 population estimate: 41,308)

Gratiot County Drain Commission
Bernie Barnes, Drain Commissioner
904 East Center Street
Ithaca, MI 48847
Phone: 989 875-5207
FAX: 989 875-5262
Email: drain@gratiotmi.com
The mission of this office is to provide for the health, safety and welfare of Gratiot County citizens, the protection of surface waters and the environment, and to promote the long-term environmental sustainability of Gratiot County by providing storm water management, flood control, soil erosion control and education. The office is particularly relevant for hydrological hazards.

Mid-Michigan District Health Department
Gratiot Branch
Marcus Cheatham
Health Officer
151 Commerce Dr.
Ithaca, MI 48847
Phone: 989 831-5237
email: mcheatham@mmdhd.org

The mission of the Mid-Michigan Health Department is to assure the health and well-being of our community and the environment by responding to public health needs and providing a broad spectrum of prevention and educational services.

The Mid-Michigan District Health Department was formed in 1966 and serves Clinton, Gratiot and Montcalm counties. Prior to 1966, the three counties operated as separate health department units. It moved into its current administrative building in Stanton in October of 1997. Branch offices are located in Ithaca, Stanton and St. Johns.

There are 52 townships, approximately 1,872 square miles and a combined population of over 181,200 year-round residents within the Health Department's jurisdiction.

The role of the Mid-Michigan District Health Department is in the area of preventative medicine. The activities of all program areas include a health education component which hopefully makes us more effective as educators in the field of preventative services by promoting good sanitation, personal health practices, and community screening and education.

MMDHD is governed by a six-member Board of Health, which is made up of two appointed commissioners from each of the three member counties. The Board of Health approves budgets and staffing changes and has broad oversight of program development.

The agency is funded through a mix of program grants, fees and local appropriations.

The agency has three divisions. The Community Health and Education Division and Environmental Health Division are responsible for direct service delivery. The Administrative Services Division provides support to the agency in areas such as emergency preparedness, quality improvement, performance management, public communication, finance, human resources, information technology and data support.

Michigan State University Extension-Gratiot Branch
Bill Hendrian
219 North State Street
Alma, MI 48801
Phone: 989 875-5233
FAX: 989 875-5289
Email: hendria2@anr.msu.edu
The office is involved in various educational and outreach activities involving agriculture and health. They should be valuable in events concerning such matters, such as droughts, pandemics, etc.

Greater Gratiot Development Incorporated (GGDI)
Jim Wheeler
President
136 S. Main Street
Ithaca, MI 48847
Phone: 989 875-2083
http://gratiot.org/
Greater Gratiot Development, Inc. (GGDI) is a private non-profit 501(c)(3) organization. GGDI was incorporated in 1978 to coordinate economic development and related services on behalf of the area municipalities and the County of Gratiot. GGDI acts as a countywide clearinghouse for information and assistance in the retention, expansion, and location of businesses in Gratiot County. GGDI program and administrative activities are partially funded by a countywide millage.

Gratiot Area Chamber of Commerce
Brendan Kelley
Executive Director
110 Superior St
Alma, MI 48801
Phone: (989) 463-5525
The Gratiot Area Chamber of Commerce was incorporated in 1994, combining the synergies of the Alma, Ithaca, St. Louis and Breckenridge/Wheeler Chambers. Each of the former chambers created Promotional Committees to maintain community-specific efforts, all under the umbrella of the Gratiot Area Chamber, which represents members across the entire county and beyond.

Gratiot County Planning Commission
214 East Center Street
Ithaca, MI 48847
Phone: 989 875-5201
FAX: 989 875-5260
Gratiot County administers planning and zoning for six (6) townships in the County, including Elba, Hamilton, Lafayette, Newark, North Star, and Sumner. All other townships and cities are self-zoned. The Zoning Officer for County-zoned townships is County Building Official Tony Miller. The Gratiot County Zoning Ordinance is designed to promote the public health, public safety, and general welfare, to encourage coordinated and sensible land use and to conserve the expenditure of funds to obtain the most advantageous use of our land and resources.

Gratiot County Road Commission
200 Commerce Drive
Ithaca, MI 48847
Phone: 989 875-3811
FAX: 989 875-2831
Email: gratiot@gratiotroads.org
Currently the Gratiot County Road Commission is responsible for 1183 miles of county roads and 120 county bridges. In addition to maintaining and preserving all county roads and bridges, the Gratiot County Road Commission also maintains an additional 234 lane miles of US and State Trunklines through a partnership with the Michigan Department of Transportation.

Gratiot County Sheriff's Office
226 East Center Street
Ithaca, MI 48847
Phone: 989 875-5211
The Gratiot County Sheriff's Office is the primary county law enforcement agency for Gratiot County. The Office has existed since 1855 and has grown from a one-car to respond as needed to 24-hour coverage 365 days a year. The road patrol provides law enforcement for all of Gratiot County. Their responsibilities are to enforce and investigate criminal law violations, monitor traffic violations, investigate motor vehicle crashes, and provide emergency and non-emergency assistance to persons in a variety of incidents from domestic assaults and murders to delivering death messages. They are officers of the courts (transports, bailiffs, etc). The Road Patrol has responsibility for over 41,000 residents in an area covering 572 square

miles. They also provide many special services including, TEAM, Marine Patrol, Secondary Road Patrol, Handicap Enforcement Unit, and MAGNet.

City of Alma (2010 population: 9,383)

525 E. Superior Street
Alma, MI 48801
Phone: 989 463-8336
Founded in the 19th Century, Alma is the largest city in the County. It was incorporated in 1872 and became a city in 1905. Alma provides a diverse mixture of old and new. The Public Services Department is the most relevant to emergency management and hazard mitigation considerations.

Alma Public Services
525 E. Superior Street
Alma, MI 48801
Phone: 989 463-8346
The department oversees the provision of city services such as waste disposal, fresh water supply, storm drainage systems, road maintenance, and snow removal. They have important resources to help deal with disasters or emergencies involving debris removal, water, and drainage systems.

City of Ithaca (2010 population: 2,910)
129 W. Emerson Street
Ithaca, MI 48847
Phone: 989 875-3200
Founded in the 19th Century, the City is the seat of Gratiot County. It is one of three cities within the County. Emergency management and hazard mitigation considerations are handled by the Gratiot County Emergency Management Department.

Ithaca Public Works
129 W. Emerson Street
Ithaca, MI 48847
Phone: 989 875-3200
The department oversees the provision of city services such as waste disposal, fresh water supply, storm drainage systems, road maintenance, and snow removal. They have important resources to help deal with disasters or emergencies involving debris removal, water, and drainage systems.

City of St. Louis (2010 population: 7,482)
300 N. Mill Street
St. Louis, MI 48880
Phone: 989 681-2137
Founded in the 19th Century, the City is the second largest city in the County. Emergency management and hazard mitigation considerations are handled by the Gratiot County Emergency Management Department.

St. Louis Public Services
300 N. Mill Street
St. Louis, MI 48880
Phone: 989 681-2613
The department oversees the provision of city services such as waste disposal, fresh water supply, storm drainage systems, road maintenance, and snow removal. They have important resources to help deal with disasters or emergencies involving debris removal, water, and drainage systems.

Village of Ashley (2010 population: 563)
114 S. Sterling Street
Ashley, MI 48806
Phone: 989 847-3050
Ashley was officially platted in the 1880's and is located in the southeastern portion of Gratiot County. The Village has limited resources and is reliant upon Gratiot County Emergency Management to handle emergency management and hazard mitigation matters.

Village of Ashley Department of Public Works
114 S. Sterling Street,
Ashley, MI 48806
Phone: 989 847-3050
The department oversees the provision of city services such as waste disposal, fresh water supply, storm drainage systems, road maintenance, and snow removal. They have important resources to help deal with disasters or emergencies involving debris removal, water, and drainage systems.

Village of Breckenridge (2010 population: 1,328)
104 E. Saginaw Street
Breckenridge, MI 48615
Phone: 989 842-3109
The first property owners of what is now Breckenridge were in 1860, but the Village was not incorporated until 1908. It is located east central Gratiot County. The Village has limited resources and is reliant upon Gratiot County Emergency Management to handle emergency management and hazard mitigation matters.

Village of Breckenridge Department of Public Works
104 E. Saginaw Street
Breckenridge, MI 48615
Phone: 989 842-3109
The department oversees the provision of city services such as waste disposal, fresh water supply, storm drainage systems, road maintenance, and snow removal. They have important resources to help deal with disasters or emergencies involving debris removal, water, and drainage systems.

Village of Perrinton (2010 population: 406)
118 S. Robinson
P.O. Box 397
Perrinton, MI 48871

Phone: 989 236-5161
The Village of Perrinton was founded in the late 19th Century and is located in the southwestern portion of Gratiot County. The Village has limited resources and is reliant upon Gratiot County Emergency Management to handle emergency management and hazard mitigation matters.

Village of Perrinton Department of Public Works
118 S. Robinson
P.O. Box 397
Perrinton, MI 48871
Phone: 989 236-5161
The department oversees the provision of city services such as waste disposal, fresh water supply, storm drainage systems, road maintenance, and snow removal. They have important resources to help deal with disasters or emergencies involving debris removal, water, and drainage systems.

AUTHORITIES, CENTERS, PROGRAMS, ETC. THAT ADDRESS VARIOUS HAZARDS

Sabotage/Terrorism/Weapons of Mass Destruction (WMD)
The federal Office of Homeland Security coordinates the many counter-terrorism functions scattered across numerous federal agencies and organizations and works closely with state and local police and fire agencies, emergency response teams, and emergency management agencies in formulating and carrying out the National Homeland Security Strategy.

51st (WMD)/Civil Support Team
The Michigan National Guard, 51st Western Military District (WMD)/Civil Support Team, provides additional support for the Regional Response Team Network (RRTN). Stationed at Fort Custer (Battle Creek), the 51st WMD/Civil Support Team deploys to a Weapon of Mass Destruction or suspected Weapon of Mass Destruction incident in support of the local incident commander to: assess a suspected nuclear, chemical, biological or radiological event; advise the Incident Commander on appropriate courses of action to protect the local population; and assist with appropriate requests for state additional support. They also provide informational briefings, exercises, and cross training activities with state and local first responders.

The Strategic National Stockpile (SNS) Program:
Presidential Decision Directive (PDD) 62, issued by President Clinton in May 1998 ordered federal agencies to take significantly expanded and better-coordinated steps to protect against the consequences of biological and other unconventional attacks, especially potential bioterrorism directed at civilian populations. One of the major bio- terrorism initiatives of the U.S. Department of Health and Human Services (HHS) in response to this PDD is the development of the Strategic National Stockpile – a national repository of lifesaving pharmaceuticals and medical materials that will be delivered to the site of a major medical emergency in order to reduce morbidity and mortality in civilian populations. The decision to send the SNS is a collaborative effort between local, state, and federal officials in a process whereby local health departments and emergency management officials contact the Michigan State Police Emergency Management Division, and state health officials who recommend to the Governor that a formal request for the SNS is made to the CDC.

The stockpile is activated to support a local and or state response to an emergency within the US or its territories. The two major components of the stockpile are the 12 Hour Push Pack and the Vendor Managed Inventory (VMI). Push Packs contain 50 tons of medical materiel that will treat a variety of illnesses. The VMI will re-supply the Push Pack or supplies will be sent immediately to the emergency site if the biological agent is known.

Region 1 Homeland Security Governing Board:
The United States Department of Homeland Security (DHS) has identified a number of national priorities to strengthen the preparedness of the United States to prevent and respond to threatened or actual domestic terrorist attacks, major disasters, and other emergencies, including expanded regional collaboration. Major events have a regional impact, therefore the benefit of regionalism will be most evident at the community level, when a community, as a whole, can prepare for and provide an integrated response to an incident.

The State of Michigan has been divided into eight Homeland Security Regions. Gratiot County having a recognized PA 390 program is the most northern permanent member of the Region 1 Homeland Security Planning Board. Ingham County is currently the designated fiduciary and is responsible for management and administration of the Region 1 Homeland Security Grant Program funds. The Region 1 Homeland Security Planning Board consists of voting representation from City of Lansing, Clinton County, Eaton County, Gratiot County, Hillsdale County, Ingham County, Jackson County, Lenawee County, Livingston County, and Shiawassee County. The Region 1 Planning Board also has active non-voting emergency management liaison relationships with MSP/EMHSD First District Coordinator, Michigan State University, District 1 Regional Medical Response Coalition, Delta Charter Township, Capital Region International Airport, and Delhi Charter Township. It also consists of voting representation in the area of public health from the region's Health Care Coalition.

The Region 1 Board works to achieve the following goals with funds from the Department of Homeland Security through the State Homeland Security Program and the Law Enforcement Terrorism Prevention Program.

Overarching Goals (By-Laws of the Region 1 Homeland Security Planning Board – April 2018)

- Foster, develop, facilitate and strengthen collaboration, cooperation and interoperability within and between jurisdictions in Region 1 in order to enhance both inter- and intra-regional capabilities to prevent, mitigate, protect, respond, and recover from large-scale disasters and/or catastrophic events.
- The Regional Board recognizes that catastrophic events and multi-casualty incidents often require responses that are beyond the capability of a single jurisdiction, region, or even state. Consistent with the principles of NIMS and the National Preparedness Goal, the Regional Board's primary objective is to strategically assess capabilities, identify shortfalls, and facilitate a collaborative effort on behalf of all jurisdictions within the region, and launch coordinated initiatives to address program shortfalls.

Homeland Security Presidential Directive/ HSPD-8 Subject: National Preparedness Purpose
This directive establishes policies to strengthen the preparedness of the United States to prevent and respond to threatened or actual domestic terrorist attacks, major disasters, and other emergencies by

requiring a national domestic all-hazards preparedness goal, establishing mechanisms for improved preparedness. The National Preparedness Guidelines are contained within four documents that correlate to establish a vision for national preparedness and provide a systematic approach for prioritizing preparedness efforts across the nation for local, state, and federal governments. These four documents address capabilities-based preparedness for the full range of homeland security missions, from mitigation through recovery, and include: *The National Preparedness Vision, the National Planning Scenarios, the Universal Task List,* and *Core Capabilities*.

The purposes of the *Guidelines* are to:

- Organize and synchronize national (including Federal, State, local, tribal, and territorial) efforts to strengthen national preparedness;
- Guide national investments in national preparedness;
- Incorporate lessons learned from past disasters into national preparedness priorities;
- Facilitate a capability-based and risk-based investment planning process; and
- Establish readiness metrics to measure progress and a system for assessing the Nation's overall preparedness capability to respond to major events, especially those involving acts of terrorism.

Using the Core Capabilities List, local jurisdictions measure their capabilities against the list, identifying shortfalls and making corrective actions. In addition, local exercises are designed around using the national planning scenarios which allows for local jurisdictions to determine required capabilities already identified using pre-developed scenarios.

School Safety Information Act: 102 P.A. 1999:
In response to the rash of school shootings that occurred in the late 1990s, the Michigan Legislature passed Act 102 in July 1999 – The Michigan School Safety Information Act – which requires local school districts to meet with law enforcement officials to develop emergency plans to handle violent situations. School superintendents are then required to educate local communities about the plans. The plans spell out, among other things, how to evacuate schools, bring first aid and emergency resources to the scene, and handle parents that want to pick up their children. The law also requires the development and implementation of a statewide school safety information policy, the reporting and compiling of certain school safety information, and the expulsion of pupils for certain assaults.

H.B. 4713 – Act 12 of Public Acts of 2014 February 2014:
The bill amends the Fire Prevention Code to modify school drill requirements. The bill also requires the governing body of a school to adopt and implement a school cardiac emergency response plan. The bill takes effect on July 1, 2014. Currently, a school that operates any of grades kindergarten through 12 must hold at least six fire drills and two "lockdown" drills during each school year. The bill requires a K-12 school to hold a minimum of five fire drills and three lockdown drills, according to a schedule prescribed in the bill. The Code requires a K-12 school to hold at least two tornado safety drills for each school year. Under the bill, at least one tornado safety drill would have to be held in March.

The bill would require the governing body of a K-12 school to ensure that documentation of a completed school safety drill was posted on its website (or on its intermediate school district's website) within 30 days of completing the drill and maintained for at least three years. By September 15, the chief administrator of a K-12 school would have to give a list of scheduled drill days to the county emergency

management coordinator, who would have to provide the information to the local emergency management coordinator, if any, and certain local officials. This information would be exempt from disclosure under the Freedom of Information Act. If a drill were not conducted as scheduled, it would have to be rescheduled and the chief administrator would have to notify the county emergency management coordinator of the rescheduled date. The governing body of a school that operates any of grades kindergarten through 12 would have to adopt and implement a cardiac emergency response plan for the school. The plan would have to address all of the following: use and maintenance of automated external defibrillators (AEDs), if available; activation of a cardiac emergency response team during an identified emergency; effective and efficient communication throughout the school campus; a training plan for the use of an AED and CPR techniques, in a school with grades 9 to 12; integration of the local emergency response system and emergency response agencies with the school's plan; and an annual review and evaluation of the cardiac emergency response plan.

Michigan Office of Safe Schools:

In 1998 the Michigan Legislature established the Michigan Office of Safe Schools within the Michigan Department of Education. The Office of Safe Schools began operating in October of 1999. Its mission is to collect and distribute information about school safety. The Office of Safe Schools maintains a web site that serves as a one-stop clearinghouse for information on school safety, school bus safety, food safety and current and proposed school safety legislation.

In March 2001, the Michigan Office of Safe Schools established a toll-free School Violence Hotline to provide a means for students to anonymously report specific threats of imminent school violence or other suspicious or criminal conduct. The toll-free hotline is operational 24-hours per day, 365 days a year, at 1-800-815-TIPS.

Michigan State Agencies:

Sabotage/terrorism is being addressed on a variety of other fronts within Michigan State Government. The Michigan Department of State Police oversees, and coordinates state agency actions related to homeland security and terrorism response – including the investigation of suspected or potential criminal enterprises and activities that might involve sabotage or terrorism. In addition, the State Police (in conjunction with other state agencies as well as federal and local counterparts) continuously prepares for terrorist incidents through emergency planning, training, information sharing and exercising efforts.

Weather Hazards (General)

National Weather Service Doppler Radar:

The National Weather Service (NWS) has completed a major modernization program designed to improve the quality and reliability of weather forecasting. The keystone of this improvement is Doppler Weather Surveillance Radar, which can more easily detect severe weather events that threaten life and property. The lead-time and specificity of warnings for severe weather have improved significantly. Doppler technology calculates both the speed and the direction of motion of severe storms. By providing data on the wind patterns within developing storms, the new system allows forecasters to better identify the conditions leading to severe weather such as tornadoes, severe straight-line winds, lightning and damaging hail. This means early detection of the precursors to severe storms, as well as information on the direction and speed of storms once they form.

National Weather Service Watches/Warnings:

The National Weather Service issues severe thunderstorm watches for areas when the meteorological conditions are conducive to the development of severe thunderstorms. People in the watch area are instructed to stay tuned to National Oceanic and Atmospheric Administration (NOAA) weather radio and local radio or television stations for weather updates and watch for developing storms. Once radar or a trained Skywarn spotter detects the existence of a severe thunderstorm, the National Weather Service will issue a severe thunderstorm warning. The warning will identify where the storm is located, the direction in which it is moving and the time frame during which the storm is expected to be in the area. Persons in the warning area are instructed to seek shelter immediately. The State and local government agencies are warned via the Law Enforcement Information Network (LEIN), NOAA weather radio and the Emergency Managers Weather Information Network (EMWIN), EMNET. Public warning is provided through the Emergency Alert System (EAS), (IPAWS) Integrated Public Alert Warning System. The National Weather Service stations in Michigan transmit information directly to radio and television stations, which in turn pass the warning on to the public. The National Weather Service also provides detailed warning information on the Internet through the Interactive Weather Information Network (IWIN).

National Weather Service Education:

The National Weather Service issues severe thunderstorm watches and warnings when there is a threat of severe thunderstorms. However, lightning, by itself, is not sufficient criteria for the issuance of a watch or warning (every storm would require a watch or warning). The National Weather Service has an extensive public information program aimed at educating citizens about the dangers of lightning and ways to prevent lightning-related deaths and injuries, which is facilitated by local Emergency Management Programs.

Severe Weather Awareness Week:

Each spring, the Emergency Management Division, Michigan Department of State Police, in conjunction with the Michigan Committee for Severe Weather Awareness, sponsors Severe Weather Awareness Week. This annual public information and education campaign focuses on such severe weather events as tornadoes, thunderstorms, hail, high winds, flooding and lightning. Informational materials on lightning hazards are disseminated to schools, hospitals, nursing homes, other interested community groups, facilities, and the public and internet.

Tornado National Weather Service Watches/Warnings:

The National Weather Service issues tornado watches for areas when the meteorological conditions are conducive to the development of a tornado. People in the watch area are instructed to stay tuned to NOAA weather radio and local radio or television stations for weather updates and watch for developing storms. Once a tornado has been sighted and its existence is confirmed and reported, or Doppler Radar shows strong probability of the development or occurrence of a tornado, the National Weather Service will issue a tornado warning. The warning will identify where the tornado was sighted, the direction in which it is moving and the time frame during which the tornado is expected to be in the area. Persons in the warning area are instructed to seek shelter immediately.

The State and local government agencies are warned via the Law Enforcement Information Network (LEIN), National Oceanic and Atmospheric Administration (NOAA) weather radio and the Emergency

Managers Weather Information Network (EMWIN), and EMNET. Public warning is provided through the Emergency Alert System (EAS), (IPAWS), and (CMAS) Commercial Mobile Alert System Using wireless towers. The National Weather Service stations in Michigan transmit information directly to radio and television stations, which in turn pass the warning on to the public. The National Weather Service also provides detailed warning information on the Internet, through the Interactive Weather Information Network (IWIN).

Tornado Warning Systems:
Outdoor warning siren systems warn the public about impending tornadoes and other hazards. Most of these systems were originally purchased to warn residents of a nuclear attack, but that purpose was expanded to include severe weather hazards as well. These systems can be very effective at saving lives in densely populated areas where the siren warning tone is most audible. In more sparsely populated areas where warning sirens are not as effective, communities are turning to NOAA weather alert warning systems, Integrated Public Alert & Warning System (IPAWS), and Nixle to supplement or supplant outdoor warning siren systems. Some rural areas of Gratiot County are still in poor NOAA radio reception areas and limited cellular network coverage, these areas are encouraged to supplant with monitoring of local TV and Radio Broadcasts.

Michigan Office of Fire Safety:
The Michigan Department of Licensing and Regulatory Affairs' Office of Fire Safety is responsible for conducting fire safety and prevention inspections in state-regulated facilities and certain other facilities. Specific services provided include: 1) fire safety inspections of adult foster care, correctional and health care facilities, and hotels/motels; 2) plan review and construction inspections of the regulated facilities in item (1), as well as schools, colleges, universities, and school dormitories; 3) coordination of fire inspector training programs; and 4) coordination of fire alarm and fire suppression system installation in regulated facilities. These activities are important mitigation activities designed to save lives and protect property from structural fire hazards. The State Fire Safety Board, also housed within the Michigan Department of Licensing and Regulatory Affairs, Bureau of Construction Codes and Fire Safety, promulgates rules covering the construction, operation and maintenance of schools, dormitories, health care facilities, and correctional facilities. These rules are designed to protect life and property at these facilities from fire, smoke, hazardous materials and fire-related panic.

Fire Safety Rules for Michigan Dormitories:
Even before the Seton Hall University dormitory fire in January 2000, the State Fire Safety Board took action to enhance the fire and life safety protection of Michigan's college and university dormitories. On December 21, 1999 two new sets of rules took effect governing the construction, operation, and maintenance of school, college and university instructional facilities and dormitories. These sets of rules were updated to meet the most current nationally recognized standards from the National Fire Protection Association. The new rules adopted the 1997 edition of NFPA 101, Life Safety Code. NFPA standards provide the minimum requirements necessary to establish a reasonable level of fire and life safety and property protection from hazards created by fire and explosion.

The new rules require, among other things, that fire sprinklers be installed in newly constructed dormitories or those undergoing major renovations. However, existing dormitories don't fall under the new rules and therefore do not have to be retrofitted unless they are being renovated.

Wildfires

Because the vast majority of wildfires are caused by human activity, the Michigan Department of Natural Resources established in 1981 the Michigan Interagency Wildfire Prevention Group. It was the first such group in the nation (promoting wildfire prevention and awareness) that had the full involvement of the state's fire agencies. In 1993, the Michigan Interagency Wildfire Prevention Group was expanded to form the Michigan Interagency Wildland Fire Protection Association (MIWFPA). The MIWFPA promotes interagency cooperation in fire prevention, training, fire technology, and firefighting operations. Members of the MIWFPA include the: 1) MDNR Forest Management Division; 2) USDA Forest Service - Huron Manistee, Hiawatha, and Ottawa National Forests; 3) USDI National Park Service - Pictured Rocks and Sleeping Bear Dunes National Lakeshores; 4) USDI Fish and Wildlife Service – Seney National Wildlife Refuge; 5) USDI Bureau of Indian Affairs; 6) Michigan Department of State Police – fire investigation; 7) Michigan State Firemen's Association; and the 8) Michigan Fire Chief's Association. The risk of wildfires is moderate. Gratiot County can reduce its vulnerability to wildfires by: 1) participating in multi-state and interagency mitigation efforts. Gratiot County has a (Designated Zone 4) Wildfire potential area designated by the MDNR and both State and Local Agencies have specific plans in place addressing this zone which is located in the North West section of Gratiot County.

Riverine and Urban Flooding

National Flood Insurance Program

For many years, the response to reducing flood damages followed a structural approach of building dams, levees and making channel modifications. However, this approach did not slow the rising cost of flood damage, plus individuals could not purchase insurance to protect themselves from flood damage. It became apparent that a different approach was needed. The National Flood Insurance Program (NFIP) was instituted in 1968 to make flood insurance available in those communities agreeing to regulate future floodplain development. As a participant in the NFIP, a community must adopt regulations that: 1) require any new residential construction within the 100-year floodplain to have the lowest floor, including the basement, elevated above the 100-year flood elevation; 2) allow non-residential structures to be elevated or dry flood proofed (the flood proofing must be certified by a registered professional engineer or architect); and 3) require anchoring of manufactured homes in flood prone areas. The community must also maintain a record of all lowest floor elevations or the elevations to which buildings in flood hazard areas have been flood proofed. In return for adopting floodplain management regulations, the federal government makes flood insurance available to the citizens of the community. In 1973, the NFIP was amended to mandate the purchase of flood insurance as a condition of any federally regulated, supervised or insured loan on any construction or building within the 100-year floodplain.

The following communities within Gratiot County are recognized by FEMA as participants in the National Flood Insurance Program: City of Alma. Arcada Township, Bethany Township, Fulton Township, City of Ithaca, Newark Township, City of St. Louis, and Sumner Township. These communities have all had their floodplain areas officially mapped and are in compliance with the NFIP. The remaining villages and townships have not participating in the NFIP.

Community Rating System

The Community Rating System (CRS) recognizes and encourages community floodplain management activities that exceed the minimum NFIP standards. Depending upon the level of participation, flood insurance premium rates for policyholders can be reduced up to 45%. Besides the benefit of reduced

insurance rates, CRS floodplain management activities enhance public safety, reduce damages to property and public infrastructure, avoid economic disruption and losses, reduce human suffering, and protect the environment. Technical assistance on designing and implementing some activities is available at no charge. Participating in the CRS provides an incentive to maintaining and improving a community's floodplain management program over the years. Implementing some CRS activities can help projects qualify for certain other Federal assistance programs.

Michigan Flood Hazard Regulatory Authorities:

Land Division Act, 591 P.A. 1996, as amended by 87 P.A. 1997:
The Land Division Act governs the subdivision of land in Michigan. The Act requires review at the local, county and state levels to ensure the land being subdivided is suitable for development. From a flood hazards viewpoint, a proposed subdivision is reviewed by the County Drain Commissioner for proper drainage, and for floodplain impacts by the Department of Environmental Quality, Land and Water Management Division.

Provisions of the Act and its Administrative Rules require that the floodplain limits be defined and prescribe minimum standards for developments for residential purposes and occupancy, within or affected by the floodplain. Restrictive deed covenants are filed with the final plat which stipulates that any building used, or capable of being used, for residential purposes and occupancy within or affected by the floodplain shall meet the following conditions:

- Be located on a lot having a buildable site of 3,000 square feet of area at its natural grade above the floodplain limit. (Lots with less than 3,000 square feet of buildable area may be filled to achieve that area.)

- Be served by streets within the proposed subdivision having surfaces not lower than one foot below the elevation defining the floodplain limits. Have lower floors, excluding basements, not lower than the elevation defining the floodplain limits. Have openings into the basement not lower than the elevation defining the floodplain limits.

- Have basement walls and floors below the elevation defining the floodplain limits, watertight and designed to withstand hydrostatic pressures. Be equipped with a positive means of preventing sewer backup from sewer lines and drains serving the building. Be properly anchored to prevent flotation. Floodplain Regulatory Authority, found in Water Resources, Part 31 of the Natural Resources and Environmental Act, 451 P.A. 1994, as amended.

The floodplain regulatory portion of Act 451 restricts residential occupation of high-risk flood hazard areas and ensures that other occupations do not obstruct flood flows. A permit is required from the Department of Environmental Quality for any occupation or alteration of the 100-year floodplain. In general, construction and fill may be permitted in the portions of the floodplain that are not floodway, provided local ordinances and building standards are met. (Floodways are the channel of a river or stream and those portions of the floodplain adjoining the channel which are reasonably required to carry and discharge the 100-year flood. These are areas of moving water during floods.) New residential construction is specifically prohibited in the floodway. Non-residential construction may be permitted in

the floodway, although a hydraulic analysis may be required to demonstrate that the proposed construction will not harmfully affect the stage-discharge characteristics of the watercourse. The Act does not apply to watersheds that have a drainage area of less than two square miles. Those small watersheds are considered to be local drainage systems, and do not fall under the Floodplain Regulatory Authority.

Soil Erosion and Sedimentation Control, Part 91 of the Natural Resources and Environmental Protection Act, 451 P.A. 1994, as amended:

This portion of the Act seeks to control soil erosion and protect the waters of the state from sedimentation. A permit is required for all earth changes that disturb one or more acres of land, as well as those earth changes that are within 500 feet of a lake or stream. The Act itself does not address flood hazards, per se. However, if sedimentation is not controlled, it can clog streams, block culverts, and result in continual flooding and drain maintenance problems.

Inland Lakes and Streams, Part 301 of the Natural Resources and Environmental Protection Act, 451 P.A. 1994, as amended:

This portion of the Act regulates all construction, excavation and commercial marina operations on the State's inland waters. It ensures that proposed actions do not adversely affect inland lakes, streams, connecting waters and the uses of all such waters. Structures are prohibited that interfere with the navigation and/or natural flow of an inland lake or stream. Though reduction of flooding is not a specific goal of this Act, minimizing restrictions on a stream can help to reduce flooding conditions.

Wetlands Protection, Part 303 of the Natural Resources and Environmental Protection Act, 451 P.A. 1994, as amended:

This portion of the Act requires a permit from the Department of Environmental Quality for any dredging, filling, draining or alteration of a wetland. This permitting process helps preserve, manages, and protect wetlands and the public functions they provide – including flood and storm water runoff control. The hydrologic absorption and storage capacity of the wetland allows wetlands to serve as natural floodwater and sedimentation storage areas. The Act recognizes that the elimination of wetland areas can result in increased downstream flood discharges and an increase in flood damage. Permits for wetland alterations are generally not issued unless there is no feasible alternative and the applicant can demonstrate that the proposal would not have a detrimental impact upon the wetland functions.

Natural Rivers Program, Part 305 of the Natural Resources and Environmental Protection Act, 451 P.A. 1994, as amended:

The Natural Rivers Act was originally passed in 1970 and has been incorporated as Part 305 of the Natural Resources and Environmental Protection Act. The purpose of this program is to establish and maintain a system of outstanding rivers in Michigan, and to preserve, protect, and enhance their multi-faceted values. Through the natural rivers designation process, a Natural River District is established (typically 400 feet either side of the riverbank) and a zoning ordinance is adopted. Within the Natural River District, permits are required for building construction, land alteration, platting of lots, cutting of vegetation, and bridge construction. Not all of the zoning ordinances on the natural rivers have the same requirements, but they all have building setback and vegetative strip requirements. Although the purpose is not specifically to reduce flood losses, by requiring building setbacks (in many cases prohibiting construction in the 100-year floodplain), flood hazard mitigation benefits can be realized.

Dam Safety, Part 315 of the Natural Resources and Environmental Protection Act, 451 P.A. 1994, as amended:

The Dam Safety Unit within the Land and Water Management Division, Department of Environmental Quality, has the primary responsibility to ensure dam safety within the state. Following the September 1986 flood in central Lower Michigan, the current Dam Safety Act was passed to ensure that dams are built and maintained with necessary engineering and inspections for safety of the public and the environment. The Department of Environmental Quality is required to review applications involving construction, reconstruction, enlargement, alteration, abandonment and removal for dams that impound more than five acres of water and have a height of six feet or more.

Manufactured Housing Commission Act, 96 P.A. 1987, as amended:

The Michigan Manufactured Housing Commission Act and its implementing Administrative Rules provide regulation on the placement of manufactured homes and establishes construction criteria. Manufactured homes are prohibited from being placed within a floodway, as determined by the Department of Environmental Quality. In addition, manufactured homes sited within a floodplain must install an approved anchoring system to prevent the home from being moved from the site by floodwaters (or high winds) and be elevated above the 100-year flood elevation.

Local River Management Act, 253 P.A. 1964:

Enacted in 1964, the Local River Management Act provides for the coordination of planning between local units of government in order to carry out a coordinated water management program. Implementation of the water management program occurs via the establishment of watershed councils. These councils conduct studies on watershed problems, water quality and the types of land uses occurring within the watershed. Watershed councils have the authority to develop River Management Districts for the purpose of acquisition, construction, operation and the financing of water storage and other river control facilities necessary for river management. The provision to allow acquisition of land adjacent to the river for the purpose of management aids in regulating development of land prone to flooding.

Floodplain Service Program:

The need to identify a flood hazard area before construction is essential to the goal of flood hazard mitigation. The Department of Environmental Quality regularly provides floodplain information to public and private interests as part of its Floodplain Service Program under the Land and Water Management Division. The goal of the program is to provide 100-year floodplain information to interested parties so that informed purchase or development decisions can be made. In addition to providing floodplain information, the MDEQ will provide information on land and water “interface” permit requirements and on building requirements relating to construction in flood hazard areas.

Dam Failures

Both the MDEQ and the Federal Energy Regulatory Commission (FERC) classify and regulate dams in Michigan. Under state and federal legislation, certain dam owners are required to develop a survey of the downriver area, develop flood-prone area maps and develop emergency action plans (EAPs).

Furthermore, the FERC requires the owners of such dams to exercise these plans; the MDEQ has initiated an effort to encourage owners of state-regulated dams to voluntarily perform exercises of their EAPs. In Michigan, well over 100 dams are covered by Emergency Action Plans. Dams in Michigan are regulated by Part 315 of The Natural Resources and Environmental Protection Act, 1994 PA 451, as amended. Part 315, Dam Safety provides for the inspection of dams. This statute requires the MDEQ to rate each dam as

either "high," "significant," or "low" hazard potential, according to the potential downstream impact if the dam were to fail (not according to the physical condition of the dam). The MDEQ has identified and rated over 2,400 dams. Dams over 6 feet in height that create an impoundment with a surface area of 5 acres or more are regulated by this statute. Dam owners are required to maintain an EAP for "high" and "significant" hazard potential dams. Owners are also required to coordinate with local emergency management officials to assure consistency with local emergency operations plans. Dams regulated by FERC, such as hydroelectric power dams, are generally exempt from this statute. The FERC licenses water power projects (including dams) that are developed by non-federal entities, including individuals, private firms, states and municipalities. Under provisions of the Federal Power Act and federal regulations, the licensee of the project must prepare an EAP. This plan must include a description of actions to be taken by the licensee in case of an emergency. Inundation maps showing approximate expected inundation areas must also be prepared. Licensees must conduct a functional exercise at certain projects, in cooperation with local emergency management officials. Gratiot County Emergency Management currently has (3) Identified High Hazard Dams within the county and maintains copies of specific site plans for these sites in conjunction and cooperation with the dam owners and the State of Michigan.

Shoreline Flooding and Erosion

Not Applicable to Gratiot County-No Great Lakes boundaries or lakes of significant size, with Alma Lake being the largest and having an area less than .2 square miles (117 acres).

Drought

U.S. Geological Survey:

The U.S. Geological Survey (USGS) is the primary federal agency that collects and analyzes stream flow data, another good index of the relative severity of drought. The agency provides a handy “Drought Watch” web site at http://waterwatch.usgs.gov/.

The site presents a map that is continually updated through an automated analysis of USGS stream gauging stations. Additional drought-related links can be accessed through the Michigan-specific web page: http://waterwatch.usgs.gov/new/index.php?m=dryw&r=mi) by clicking on the map (or proceeding directly to the specific web page at http://mi.water.usgs.gov/midroughtwatch.php).

Fixed Site Hazardous Material Incidents (including explosions and industrial accidents)

Resource Conservation and Recovery Act - 42 U.S.C. s/s 6901 et seq. (1976)

RCRA (pronounced "rick-rah") gave EPA the authority to control hazardous waste from the "cradle to grave”. This includes the generation, transportation, treatment, storage and disposal of hazardous waste. RCRA also set forth a framework for the management of non-hazardous wastes. The 1986 amendments to RCRA enabled EPA to address environmental problems that could result from underground tanks storing petroleum and other hazardous substances. RCRA focuses only on active and future. The Federal Hazardous and Solid Waste Amendments are the 1984 amendments to RCRA that required phasing out land disposal of hazardous waste. Some of the other mandates of this strict law include increased enforcement authority for EPA, more stringent hazardous waste management standards and a comprehensive underground storage tank program.

Within Gratiot County, efforts are ongoing to enhance general awareness and specialized training for HAZMAT emergencies.

Hazardous Material Transportation Incidents

Superfund Amendments and Reauthorization Act (SARA), Title III:
The Bhopal India tragedy initiated a chain of events aimed at enhancing preparedness activities to minimize the potential for a similar event to occur in the United States. On October 17, 1986 the Superfund Amendments and Reauthorization Act (SARA) was signed into law. A major SARA provision is Title III (the Emergency Planning and Community Right-To-Know Act, also known as SARA Title III), which establishes hazardous material emergency planning, reporting, and training requirements for federal, state and local governments, and private industry. In Michigan, the SARA Title III program is jointly administered and implemented by two state departments—the Michigan State Police and the Michigan Department of Environmental Quality.

Local Emergency Planning Committees (LEPC) – LPT Local Planning Team
One of the major provisions of SARA Title III is the establishment of Local Emergency Planning Committees (LEPCs) for designated planning districts. The LEPCs are responsible for developing emergency response plans for communities that have facilities in their jurisdiction subject to SARA Title III emergency planning requirements. The LEPC is the primary mechanism through which local SARA Title III planning, training and exercising activities are implemented. Michigan has 88 designated LEPCs – one for each of the 83 counties and 5 in major cities. Nearly 2,800 facilities across the state have been identified as being subject to Title III emergency planning provisions. A facility is subject to SARA Title III provisions if extremely hazardous substances (as determined by the U.S. Environmental Protection Agency) are present at the facility in quantities at or above the minimum threshold quantities established in Section 302 of the Act.

Note: Many of the programs and initiatives designed to mitigate, prepare for, respond to, and recover from fixed- site hazardous material incidents have the dual purpose of also protecting against hazardous material transportation incidents.

Federal Hazardous Material Transportation Regulations:
The transportation, manufacturing, storage and disposal processes for hazardous materials are highly regulated by federal and state agencies in order to reduce risk to the public. At the federal level, the U.S. Department of Transportation, Office of Hazardous Materials Safety (USDOT/OHMS), is the regulating agency for all modes of hazardous material transportation. In addition to enforcing federal hazardous material transportation regulations, the USDOT/OHMS is also involved in a number of other areas aimed at improving the safety of hazardous material shipping. Those areas include: 1) research and development of improved containment/packaging and other technological aspects of hazardous material shipping; 2) interagency coordination efforts in hazardous material transportation planning and standards setting; 3) management of data information systems pertaining to hazardous material transportation; and 4) development of hazardous material safety training policies and programs.

In Michigan, the Motor Carrier Division, Department of State Police, oversees, coordinates and implements the commercial truck safety aspects of the USDOT regulations. The Michigan Department of

Transportation oversees programs aimed at enhancing railroad safety and improving the rail infrastructure (which helps reduce the likelihood of a hazardous material rail transportation accident).

Hazardous Materials Transportation Uniform Safety Act:
The federal Hazardous Materials Transportation Uniform Safety Act (HMTUSA), enacted in 1990, provides funding for the training of emergency responders and the development of emergency response plans for both fixed site facilities and transportation-related incidents. (This funding mechanism under the HMTUSA is referred to as Hazardous Material Emergency Preparedness [HMEP] grants.) In Michigan, the HMTUSA/HMEP program is coordinated and implemented by the Emergency Management Division, Department of State Police. Since the program's inception, over $326,000 in grants have been allocated to 80 Michigan communities for hazardous material planning and training activities.

Federal/State Hazardous Material Response Resources:
There are numerous groups at the federal, state and local levels and in private industry that are trained to deal with hazardous material fixed site and transportation incidents. These groups include the National Response Team (NRT), Regional Response Teams (RRTs), and state and local hazardous material response teams. The Chemical Manufacturers Association established the Chemical Transportation Emergency Center (CHEMTREC) to provide 24-hour technical advice to emergency responders. The National Response Center (NRC), which operates much like CHEMTREC, was established to provide technical advice and coordinate federal response to a hazardous material incident.

In Michigan, a 24-hour statewide notification system called the Pollution Emergency Alerting System (PEAS) was established for reporting chemical spills to the Department of Environmental Quality. As a companion to the PEAS, the Michigan Department of Agriculture (MDA) has established a 24-hour Agriculture Pollution Emergency Hotline for use by agrichemical users to report fertilizer and pesticide spills. Callers to the MDA hotline gain immediate access to appropriate technical assistance, regulatory guidance for remediation, and common sense approaches for addressing the problem.

Oil and Natural Gas Well Accidents

Local Emergency Capability:
Communities that may be affected by oil or natural gas well accidents should have adequate procedures in their Emergency Operations Plans to address the unique types of problems associated with this hazard, including rescue and evacuation. Affected communities must work closely with company officials and surrounding jurisdictions to ensure compatibility of procedures for a fast, coordinated response. Mitigation possibilities include the use of community zoning regulations to provide suitable open, unoccupied "buffer" areas around refineries and compressor stations. Michigan Department of Environmental Quality regulations provide for buffer zones around wells and treatment and storage facilities.

Pipeline Accidents (Petroleum and Natural Gas)

MPSC Pipeline Safety Inspections:
Safety engineers from the MPSC are certified by the USDOT/OPS to conduct inspections on natural gas pipelines to ensure structural and operational integrity of the systems. If violations are found, the pipeline

company can be ordered to take corrective actions; in addition, the pipeline operator may be fined. The MPSC safety engineers also respond to accidents involving natural gas pipelines (to ensure compliance with federal and state law and to offer technical assistance to emergency responders).

Protection of Underground Facilities Act / MISS DIG/ 811 Programs:
Michigan's first line of defense against pipeline and other utility line breaks from construction excavation is The "MISS DIG" / 811 Program established with the passage of Act 53 in 1974 – The Protection of Underground Facilities. MISS DIG/ 811 System, Inc., is a 24-hour utility communications system that helps contractors comply with the state law (Act 53) which requires notification of utilities at least three working (but not more than 21 calendar) days before commencing excavation, tunneling, demolishing, drilling or boring procedures, or discharging explosives for a project. When properly administered and followed, the MISS DIG/ 811 safety system does an excellent job of minimizing pipeline and utility line accidents.

Programs and Initiatives:
Pipeline jurisdiction and oversight in Michigan is complex, determined primarily by the type and function of a pipeline and its location. Agencies involved include 1) the MPSC Gas Safety Office; 2) the USDOT/OPS in Kansas City, Missouri; and 3) the Michigan Department of Environmental Quality, Geological Survey Division (MDEQ/GSD). The table below is a breakdown of jurisdictional and inspection responsibilities for the various types of pipelines present in Michigan:

Pipeline Safety Regulation in Michigan

TABLE 3.5

Pipeline Type	Jurisdiction	Applicable Code	Inspected by
Inter-state natural gas	USDOT/OPS	49 CFR Part 192	MPSC Gas Safety Intrastate
Inter-state natural gas	State of MI/MPSC	Michigan Gas Safety Standards	MPSC Gas Safety
Liquid Petroleum	USDOT/OPS	49 CFR Parts 193/195	USDOT/OPS
Gathering Lines*	MDEQ/GSD	Oil/Gas Administrative rules under Part 165, 1994 P.A. 451	
*Note: Gathering lines are run from a production facility (i.e., well) to a pre-processing plant (i.e., dehydration facility, separator, compression station). Source: Michigan Public Service Commission, Gas Safety Office			

Nuclear Power Plant Accidents
Gratiot County is not located within the Emergency Planning Zones. The two zones are: the Plume Exposure Pathway Zone, which has a radius of approximately 10 miles, and the Ingestion Exposure Pathway Zone, which has a radius of approximately 50 miles. Mitigation of nuclear power plant hazards on the local County level is primarily limited to the detection of radiation, alerting the public, and providing directions for evacuation and/or housing – the latter three issues are addressed in other sections of this mitigation action item section of the mitigation plan.

Infrastructure Failures

Infrastructure Failures in Gratiot County

There have been no significant infrastructure failures in Gratiot County. Typically, the infrastructure failures occur when there are thunderstorms, ice storms, or windstorms and power lines are downed. In most cases, the power is restored in a matter of hours, but in some cases, power has been out for a week at a time in parts of the County.

Most of Gratiot County's infrastructure failures are secondary hazards caused by other major events such as floods, windstorms, snow and ice storms. The main infrastructure failures are power outages, which are normally restored in a matter of hours. Gratiot County EMD maintains short-term shelter agreements for multiple sites. However, if the power were out for a longer period of time, the local chapter of the American Red Cross would be called to set up temporary shelters.

Water/Electrical Infrastructure Failure

The Federal Clean Water Act regulates the discharge from community wastewater collection and treatment systems. The regulatory aspects of the Act that pertain to municipalities have been delegated to the EGLE Surface Water Quality Division for surface water discharge facilities, and the EGLE Waste Management Division for groundwater discharge facilities. Authority for the oversight of planning, facility design review, and construction permitting of sewerage systems collection, transportation and treatment facilities, is derived from Part 41 of the Michigan Natural Resources and Environmental Protection Act (451 P.A. 1994) and Administrative Rules promulgated under authority of Part 41. The two EGLE divisions assist communities with the development and maintenance of their wastewater collection and treatment systems. In addition, they monitor and regulate these systems to ensure pollution abatement and health conditions are met. Although the regulatory authority vested in the EGLE is primarily aimed at preventing pollution of waters of the state, there are requirements in place under 451 P.A. 1994 regarding the design, construction, and operational integrity and reliability of wastewater collection and treatment systems. A collaboration between Gratiot County EMD and ITC Power Transmission Corporation continues, and materials are updated annually and shared with responders.

Electrical system

Disaster-related damage to electric power facilities and systems is a concern that is being actively addressed by utility companies across the state. Detroit Edison, Consumers Energy and other major electric utility companies have active, ongoing programs to improve system reliability and protect facilities from damage by wind, snow and ice, and other hazards. Typically, these programs focus on trimming trees to prevent encroachment of overhead lines, strengthening vulnerable system components, protecting equipment from lightning strikes, and placing new distribution systems underground. The Michigan Public Service Commission (MPSC) monitors power system reliability to help minimize the scope and duration of power outages.

On August 14, 2003 a major electrical failure occurred resulting in a blackout to 50 million people in Canada and Northeast US. While Gratiot County did not lose power as a result of this blackout, the County was impacted when southeast Michigan residents fled their homes to regions of the State not experiencing the blackout. The influx of visitors resulted in food shortages throughout the County.

Telecommunications System

Like electric utility companies, telecommunications companies are concerned with the issue of protecting facilities and systems from disaster-related damage. Major telecommunications companies have programs to improve system reliability and physically protect facilities and system components from wind, snow and ice, and other hazards, utilizing many of the same techniques as the electric utility companies.

Surface Drainage Systems:

Michigan's first drain laws appeared on the books as Territorial laws – years before Michigan achieved statehood. After attaining statehood in 1837, the State passed its first drain law in 1839. Since that time, there have been 45 separate acts passed regarding drainage, up to the most recent re-codification of drain law in 1956. Since 1956, the present drain code has been amended over 200 times – an indication of how important and dynamic the issue of drainage continues to be in Michigan. The Michigan Drain Code provides for the maintenance and improvement of the vast system of intra-County (County) and intercounty drainage facilities. Each drain has a corresponding special assessment district (watershed), a defined route and course, an established length, and is conferred the status of a public corporation with powers of taxation, condemnation, ability to contract, hold, manage and dispose of property, and to sue and be sued. Drainage districts and drains are established by petition of the affected landowners and/or municipalities. County drains, with a special assessment district entirely within the County, are administered by the locally elected County Drain Commissioner. Inter-County drains, with a special assessment district in more than one County, are administered by a drainage board that consists of the drain commissioners of the affected counties and is chaired by the Director of the Michigan Department of Agriculture (MDA) or an MDA Deputy Director.

Water Distribution Systems:

Michigan's public water supplies are regulated under the Federal Safe Drinking Water Act. The Michigan Department of Environmental Quality (MDEQ), as a primary agency for the Federal government, provides supervision and control of Michigan's public water supplies (including their operation and physical improvements) under the Michigan Safe Drinking Water Act (399 P.A. 1976).

The MDEQ Drinking Water and Radiological Protection Division regulates, through a permit process, the design, construction and alteration of public water supply systems. Water supply construction must be conducted within the framework of the Michigan Safe Drinking Water Act, as well as the Architecture, Professional Engineering and Land Surveying Act (240 P.A. 1937, which requires professional engineering preparation of construction documents for water works construction costing over $15,000). Most communities in Michigan, including Gratiot have, in conjunction with the MDEQ, developed water system master plans that conform to the requirements of the Michigan Safe Drinking Water Act. From a hazard mitigation standpoint, that is important because it helps ensure that all new water system construction and alterations to existing systems will conform to the minimum standards set in the Act. While not making water infrastructure "disaster-proof", the standards provide at least a basic level of design, structural and operational integrity to new or renovated portions of a community's water supply system.

Public Health Emergencies

Michigan Department of Community Health:
The Director of the Department of Community Health, and local public health officers, have the authority (under the Michigan Public Health Code—1978 PA 368, as amended) to take those steps determined necessary and prudent to prevent epidemics and the spread of hazardous communicable diseases, or to effectively mitigate other conditions or practices that constitute a menace to public health. The Director and local public health officers can issue written orders to implement the required preventive steps and/or responses, and those orders can be enforced through the imposition of civil and criminal penalties for failure to comply. State and local health departments have detailed, written emergency operations plans that address public health emergencies.

U.S. Centers for Disease Control and Prevention:
At the national level, the U.S. Centers for Disease Control and Prevention (CDC), a branch of the Department of Health and Human Services, has the responsibility and authority to investigate public health emergencies to determine their cause, probable extent of impact, and appropriate mitigation measures. The CDC can also assist state and local public health officials in establishing health surveillance and monitoring systems/programs, and in disseminating information on prevention and treatment to the general public. The CDC announced dedicated funding for bioterrorism response, and Michigan has been strengthening its surveillance and intervention infrastructures with these funds. Since 2001, the CDC has also provided dedicated funding for public health emergency preparedness programs. In 2002, the MDCH Office of Public Health Preparedness was established to oversee these cooperative agreements. In the 2009 Influenza A (H1N1) event, CDC coordinated with numerous health departments across the country, tracked influenza cases, and provided information about outbreak trends. Tests were also performed, to verify whether flu cases were indeed of the correct type.

Michigan Pandemic Influenza Plan:
In October 2009, the Michigan Department of Community Health updated the "Michigan Pandemic Influenza Plan," to provide response guidelines for an influenza pandemic affecting Michigan. Although the plan cannot eliminate the disease, it will aid in reducing the impact by enabling state and local agencies to anticipate, prepare for, and respond efficiently and effectively to the disease. The plan, which is divided into pre-pandemic, pandemic, and post-pandemic phases, details necessary activities at the state and local level related to:

- command and management,
- crisis communications,
- surveillance,
- laboratory testing,
- community containment,
- infection control in health care facilities,
- vaccines and antivirals/medical management,
- data management,
- border/travel issues
- recovery

Transportation Accidents

Air Transportation:

The Michigan Aeronautics Commission of the MDOT administers several programs aimed at improving aviation safety and promoting airport development. The Commission's safety programs include: 1) registering aircraft dealers, aircraft, and engine manufacturers; 2) licensing airports and flight schools; 3) inspecting surfaces and markings on airport runways; and 4) assisting in removal of airspace hazards at airports. The Commission's airport development program includes providing state funds for airport development and airport capital improvements – many of which contribute to overall air transportation safety. The Federal Aviation Administration (FAA) contracts with the MDOT for the inspection of the state's 238 public- use airports on an annual basis. The FAA has regulatory jurisdiction over operational safety and aircraft worthiness. The National Transportation Safety Board (NTSB) investigates all aircraft crashes that involve a fatality and publishes reports on its findings (see the NTSB section below).

Bus Safety:

School bus safety programs and initiatives generally fall into two categories: 1) driver skill enhancement, competency training and 2) physical inspections of bus mechanical and safety equipment. The Motor Carrier Division, Michigan Department of State Police, inspects all school buses and other school transportation vehicles (21,000 units) on an annual basis. In addition, all school bus drivers in Michigan must take and pass a bus driver education and training program, and then take regular refresher courses to maintain their certification to operate a school bus. School bus drivers must also pass an annual medical examination.

CHAPTER 4: HAZARD ANALYSIS

Natural Hazards-Summer Weather

HAIL

Hail: a condition where atmospheric water particles from thunderstorms form into rounded or irregular lumps of ice that fall to the earth.

Hazard Description

Hail is a product of strong thunderstorms. Hail is formed when strong updrafts within the storm carry water droplets above the freezing level, where they remain suspended and continue to grow larger until their weight can no longer be supported by the winds. They finally fall to the ground, battering crops, denting autos, and injuring wildlife and people. As one of these thunderstorms passes over, hail usually falls near the center of the storm, along with the heaviest rain. Most hailstones range in size from a pea to a golf ball, but hailstones larger than baseballs have been reported. Large hail is a characteristic of severe thunderstorms, and it may precede the occurrence of a tornado.

Hailstorms in Gratiot County

According to the National Centers for Environmental Information (NCEI) and the 2019 Michigan Hazard Mitigation Plan, Gratiot County, Michigan had 37 events on 30 different dates from 1977-2018. There were 14 reported events that produced damages, with a total of $155,000 in property/crop damages. (The table below identifies those 14 events.) No deaths or injuries were reported as a result of these storms. However, the data from these events may be incomplete as not all damages that occurred have been reported. It should be noted that no storms predating 1997 were recorded by the NCEI.

Significant Hail Events in Gratiot County from 1977 to Present

Table 4.1

Location	Date	Time	Magnitude	Death	Injuries	Property Damage	Crop Damage
Perrinton[2]	7/14/2000	12:35 am	.75 inches	0	0	$20,000	$10,000
Ashley[1]	7/14/2000	4:00 pm	1.75 inches	0	0	$25,000	$20,000
Perrinton[2]	5/11/2003	1:00 am	.88 inches	0	0	$15,000	$10,000
Perrinton[2]	6/8/2003	2:50 pm	.75 inches	0	0	$20,000	$20,000
Ithaca[1]	8/1/2003	11:45 am	.75 inches	0	0	$5,000	$5,000
Ithaca[1]	6/9/2004	1:31 pm	.88 Inches	0	0	$5,000	$5,000
Pompeii[3]	6/14/2004	12:34 pm	.88 inches	0	0	$5,000	$5,000
Ithaca[1]	6/23/2004	7:48 pm	.88 inches	0	0	$10,000	$10,000
Breckenridge[2]	6/5/2005	1:23 pm	.88 inches	0	0	$5,000	$5,000
Alma[1]	6/5/2005	1:46 pm	1.0 inch	0	0	$10,000	$10,000
Breckenridge[2]	6/5/2005	2:23 pm	.88 inches	0	0	$10,000	$5,000
Ithaca[1]	6/5/2005	4:45 pm	1.0 inch	0	0	$10,000	$10,000

Location	Date	Time	Magnitude	Death	Injuries	Property Damage	Crop Damage
Alma[1]	5/17/2006	2:20 pm	.75 inches	0	0	$5,000	$5,000
Breckenridge[2]	10/4/2006	6:16 am	.88 inches	0	0	$10,000	$10,000

1-City
2-Village
3-Unincorporated community located in Fulton Township

Identified below are several of the more notable events.

On 7/14/2000 a large tree was downed in Sumner Township at 12:10 am. Three quarter inch hail was reported in Perrinton at 12:35 am. Damages were estimated at $30,000 to NCEI.

On 7/14/2000 local law enforcement reported 1 ¾' hail in Ashley. Damages were estimated at $45,000.

On 5/11/2003 a severe thunderstorm across the early morning hours produced seven-eighths inch hail. $25,000 in damages were reported to NCEI.

On 6/8/2003 a large tree was downed in Sumner at 12:10 am. Thee quarter inch hail was reported in Perrinton at 12:35 am. Damages were estimated at $40,000 to NCEI.

On 6/23/2004 seven-eighths inch hail was reported at three miles south of Ithaca at 7:48 pm. Damages were estimated at $20,000 to NCEI.

On 6/5/2005 a large severe weather outbreak occurred across the area resulting in numerous downed trees and power lines at 1:34 pm. Hail was reported to be three-quarters to one inch in diameter. Damages were estimated at $20,000 to NCEI.

On 6/5/2005 a large severe weather outbreak occurred across the area resulting in numerous downed trees and power lines at 3:23 pm. Hail was reported to be three-quarters to one inch in diameter. Damages were estimated at $15,000 to NCEI.

On 6/5/2005 a large severe weather outbreak occurred across the area resulting in numerous downed trees and power lines at 4:45 pm. Hail was reported to be three-quarters to one inch in diameter. Damages were estimated at $20,000 to NCEI.

On 10/4/2006 a slow-moving low-pressure system and its accompanying cold front brought an early October severe weather episode with reports of seven-eighths inch in diameter hail was reported at 6:15 am. Damages were estimated at $20,000 to NCEI.

Hail Overview

From 1977 to 2019, Gratiot County had 37 hail events or about 0.9 events per year, based on the data from NCEI and the 2019 Michigan State Hazard Mitigation Plan. This would leave an 90% probability that a hail event could occur in any given year. Of these events, only 14 of the 37 events, resulted in damages to property and/or crops totaling $285,000. NCEI did not identify any specific damages resulting from these events. Additionally, the neighboring counties of Isabella, Clinton, and Saginaw have had similar reported damages, while Montcalm ($1,170,000) and Midland ($10,127,000) Counties both have

reported damages of much greater magnitude. Gratiot County is a moderate risk county for these events to be impactful and the event is considered to be a severe weather activity which was given a high priority to address. Due to the nature of hailstorms and their minimal damages that have been reported in Gratiot County, no action has been taken by the local governments to reduce property damage vulnerability or even human vulnerability to hailstorms.

LIGHTNING

Lightning: the discharge of electricity from within a thunderstorm.

Hazard Description

Most direct impacts from lightning are relatively site-specific in scope and therefore do not have a tremendous impact on the community as a whole. With the temperature of a bolt of lightning approaching 50,000 degrees Fahrenheit in a split second, the most common direct damage from lightning is fire. The most common indirect effect of lightning is power outages. This indirect effect can have an impact on a much larger segment of the community, leaving hundreds and sometimes thousands of homes without electricity.

Globally, there are about 2,000 thunderstorms occurring at any given time and those thunderstorms cause approximately 100 lightning strikes to earth each second. In the United States, approximately 100,000 thunderstorms occur each year, and every one of those storms generates lightning. It is commonplace for a single thunderstorm to produce hundreds or even thousands of lightning strikes. However, to the majority of the public, lightning is perceived as a minor hazard. That perception lingers despite the fact that lightning damages many structures and kills and injures more people in the United States per year, on average, than tornadoes or hurricanes. Many lightning deaths and injuries could be avoided if people would have more respect for the threat lightning presents to their safety.

Statistics compiled by the NCEI and the National Lightning Safety Institute (NLSI) for the period 1959-1994 revealed the following about lightning fatalities, injuries and damage in the United States:

Location of Lightning Strikes:

- 40% are at unspecified locations
- 27% occur in open fields and recreation areas (not golf courses)
- 14% occur to someone under a tree (not on golf course)
- 8% are water-related (boating, fishing, swimming, etc.)
- 5% are golf related
- 3% are related to heavy equipment and machinery
- 2.4% are telephone-related
- 0.7% are radio, transmitter and antenna-related

The NLSI estimates that 85% of lightning victims are children and young men (ages 10-35) engaged in recreation or work-related activities. Approximately 20% of lightning strike victims die, and 70% of survivors suffer serious long-term after-effects such as memory and attention deficits, sleep disturbance, fatigue, dizziness and numbness.

Lightning Events in Gratiot County

Historically, the State of Michigan is near the top in the U. S. among states in both deaths and injuries resulting from lightning. A major reason for this is that Michigan is a destination location for outdoor activities during the summer months, the prime time for lightning strikes. Gratiot County has had few reported events in recent years, with the most recent occurring on June 1, 2019. Lightning struck a barn creating a hole in the roof and floor, resulting in a small fire. The fire was extinguished by the property owner and was investigated by the Perrinton Fire Department.

From 4/12 to 4/15/2014, severe weather events occurred throughout Gratiot County, resulting in the USDA declaring a Gratiot County a designated disaster county due to damages and losses to property owners. Included in the events were lightning strikes, which were not reported to the National Centers for Environmental information (NCEI).

Thunderstorm Hazards – Lightning Overview

There have been several lightning events reported locally in Gratiot County over the past 60 years; however, none have been recorded by the NCEI. From 1996 to 2017, neighboring Clinton County also did not have any reported lightning events. However, Saginaw, Midland, Montcalm, and Isabella Counties all had reported lightning strikes ranging from 1 event, to 7 events. Even though Gratiot County did not experience a lightning event during this reporting period, the County is still considered to be a moderate risk area for lightning events. Without any specific number of events being recorded for Gratiot County, but based on the occurrence in the neighboring counties, the probability of an event to occur annually would be minimal. Also, with most of the County being rural, the likelihood of an event occurring and being reported would even be less.

Even though there have been limited lightning strikes, many of the municipalities have installed lightning protection devices on many of the municipal facilities to protect against these strikes. Lightning strikes are considered to be a severe weather activity, which was given a high priority to address. The installation of these devices has reduced the county's vulnerability to these events somewhat, as the communication infrastructure should be protected from lightning. Residents should also be less vulnerable with many different means to notify the public of dangerous weather systems, thus allowing them to get in a safer environment during the event. However, the structures themselves are still vulnerable to lightning.

TORNADOS

Tornado: a violently whirling column of air extending downward to the ground from a cumulonimbus cloud.

Hazard Description

Tornadoes in Michigan are most frequent in spring and early summer when warm, moist air from the Gulf of Mexico collides with cold air from the Polar Regions to generate severe thunderstorms. These thunderstorms often produce tornadoes. A tornado may have winds up to 300 miles per hour and an interior air pressure that is 10 to 20 percent below that of the surrounding atmosphere. The typical length of a tornado path is approximately 16 miles but tracks up to 200 miles have been reported. Tornado path widths are generally less than one-quarter mile wide. Historically, tornadoes have resulted in tremendous loss of life, with a national average of 111 deaths per year. Property damage from tornadoes is in the hundreds of millions of dollars every year in the United States.

Tornado Intensity

Tornado intensity is measured on the Enhanced Fujita Scale, which examines the damage caused by a tornado on homes, commercial buildings, and other man-made structures. The Enhanced Fujita Scale rates the intensity of a tornado based on damage caused, not by its size. It is important to remember that the size of a tornado is not necessarily an indication of its intensity. Large tornadoes can be weak, and small tornadoes can be extremely strong. It is very difficult to judge the intensity and power of a tornado while it is occurring. Generally, that can only be done after the tornado has passed (see scale below).

The Enhanced Fujita Scale of Tornado Intensity

TABLE 4.2

EF-Scale Number	Intensity Description	Wind Speed (mph)	Type/Intensity of Damage
EF-0	Gale tornado	65-85 mph	**Light damage**. Peels surface off some roofs; some damage to gutters or siding; branches broken off trees; shallow-rooted trees pushed over.
EF-1	Moderate Tornado	86-110 mph	**Moderate damage.** The lower limit is the beginning of hurricane wind speed; roofs severely stripped; mobile homes overturned or badly damaged; loss of exterior doors; windows and other glass broken.
EF-2	Strong Tornado	111-135 mph	**Considerable damage.** Roofs torn off well-constructed houses; foundation of frame homes shifted; mobile homes completely destroyed; large trees snapped or uprooted; light-object missiles generated; cars lifted off ground.
EF-3	Severe Tornado	136-165 mph	**Severe damage.** Entire stories of well-constructed houses destroyed; severe damage to large buildings such as shopping malls; foundations blown away some distance.
EF-4	Devastating Tornado	166-200 mph	**Devastating damage.** Well-constructed houses and whole frame houses completely leveled; cars thrown, and small missiles generated.
EF-5	Incredible Tornado	200 mph+	**Incredible damage**. Strong frame houses lifted off foundations and carried considerable distances; automobile sized missiles fly through the air in excess of 100 meters; high-rise buildings have significant structural deformation; incredible phenomena will occur.

Source: Storm Prediction Center

Tornado Events in Gratiot County from 1954 to Present

Table 4.3

Location	Date	Time	Magnitude	Deaths	Injuries	Property Damage	Crop Damage
Ashley[2]	10/14/1954	3:50 pm	F2	0	0	$25,000	$0
Emerson Township[3]	05/12/1956	3:15 pm	F2	1	4	$250,000	$0
Perrinton to Ithaca[4]	06/26/1956	6:20 pm	F2	0	2	$250,000	$0
Alma[1]	04/11/1965	7:30 pm	F2	0	0	$25,000	$0
Alma[1]	04/11/1965	7:30 pm	F2	0	0	$25,000	$0
Alma[1]	04/11/1965	7:30 pm	F2	0	0	$25,000	$0
Sumner Twp to Alma[5]	04/11/1965	7:35 pm	F2	0	1	$250,000	$0
Washington Twp	06/11/1968	2:05 pm	F2	1	0	$25,000	$0
Newark Twp to North Star Twp	06/15/1982	1:50 pm	F2	0	0	$250,000	$0
Elwell[6]	05/21/2001	3:20 pm	F1	0	1	$150,000	$0
Ithaca[1]	05/21/2001	3:40 pm	F0	0	0	$25,000	$25,000
Galloway[7]	08/09/2011	2:05 pm	EF0	0	0	$500,000	$0

1-City
2-Village
3-Township(s)
4-Fulton and Emerson Townships
5-Sumner and Arcada Townships
6-Seville Township
7-Lafayette Township

Tornado Events in Gratiot County

A total of fourteen (14) tornadoes on nine days were reported in Gratiot County, Michigan between 01/01/1954 and 12/31/2018. Of these 14 tornadoes, nine tornadoes had F-2 ratings, and the remaining 5 had F1, F0, or EF0 ratings. The table above identifies those tornadoes causing injuries or deaths or having more than $10,000 in damages to property. Reported damages resulting from the 8 tornadoes totaled more than $1,800,000 with two deaths and eight injuries or deaths occurring.

On 5/12/1956 an F2 tornado touched down east of Ithaca and traveled southeast approximately 4 miles cutting a path as wide as 800 feet in certain locations. One death and four injuries resulted from this tornado. Damages were estimated to be over $250,000.

On 6/26/1956 an F2 tornado touched down near Perrinton and traveled northeast towards Ithaca for approximately 9 miles resulting in two injuries and reported damages of approximately $250,000. No additional information is available on this event.

On 4/11/1965 an F2 tornado was cited at several locations throughout the County and touched down at several locations for a total of over 11 miles. One injury was reported as well as damages approximately of $325,000. A presidential declaration for natural disaster included Gratiot County.

On 6/11/1968 an F2 tornado touched down in Washington Twp demolishing a barn and trapping a 16-year old boy. One death resulted from this tornado and damages of $25,000 were reported. No additional information is available on this event.

On 5/21/2001 an F1 tornado touched down in Elwell. A man was injured when the shed he was in collapsed. The tornado produced wind speeds up to 110 mph. Damages were reported to be $150,000. No other information is available on this event.

Tornadoes Overview

Gratiot County has experienced 14 tornadoes sightings on nine days over the past 63 years or about one every seven years. At this current rate, there is a 16% chance of a tornado causing damage to occur every year. With the changing climate, the number of tornadoes may be expected to continue if not increase at a greater rate. Tornadoes are considered to be a severe weather activity, which was given a high priority to address. Recent technological advances have provided additional warning time for these events; however, even with these advances the residents of Gratiot County remain vulnerable to tornados. The additional warning time that can be and often is provided can lessen the vulnerability of injuries and deaths as people can take shelter earlier. To lessen the impact of these events residents and businesses should also consider installing safe rooms or shelters, anchoring mobile homes, structural bracing, and the use of wind-resistant glass.

SEVERE WINDS

Severe winds: non-tornadic winds 58 miles per hour (mph) or 50.4 knots or greater.

Hazard Description

Severe winds, or straight-line winds sometimes occur during thunderstorms and other weather systems and can be very damaging to communities. Often, when straight-line winds, occur, the presence of the forceful winds, with velocities over 58 mph (50.4 knots) may be confused with a tornado occurrence. Severe winds have the potential to cause loss of life, property damage, and flying debris, but tend not to cause as many deaths as tornadoes do. However, the property damage from straight-line winds can be more widespread than a tornado, usually affecting multiple counties at a time. In addition to property damage to buildings, there is a risk for infrastructure damage from downed power lines due to falling limbs and trees. Large scale power failures are common during straight-line wind events.

Severe winds spawned by thunderstorms and other weather events can have devastating effects in terms of loss of life, injuries, and property damage. According to data compiled by the National Weather Service Michigan has experienced over 9,000 severe wind events (not including tornadoes) that resulted in 122 deaths and millions of dollars in damage since 1970. Severe wind events are characterized by wind velocities of 58 mph or greater, with gusts sometimes exceeding 74 mph (hurricane velocity), but do not include tornadoes.

Wind Events in Gratiot County

There has been a total of 92 recorded severe wind events in Gratiot County since 1955. Below is a table of the 37 significant events with more than $10,000 in property or crop damage. While storms were

identified to exist from 1955 to 1995, reports for these events did not include any deaths, injuries, or property damages of note; therefore, are not included in the table below. In the table, magnitude represents wind speed, with EST. kts being estimated knots. It should be noted that no storms predating 1995 were recorded by the NCEI.

Severe Wind Events in Gratiot County from 1995 to Present

Table 4.4

Location	Date	Time	Magnitude	Deaths	Injuries	Property Damage	Crop Damage
Gratiot County[4]	07/13/1995	4:20 pm	52 kts	0	0	$10,000	$0
St. Louis[1]	07/14/1997	6:15 pm		0	0	$10,000	$0
Ithaca[1]	05/29/1998	1:50 am		0	0	$20,000	$0
Gratiot County[4]	05/31/1998	5:00 am		0	0	$610,000	$0
Alma[1]	02/11/1999	10:40 pm		0	0	$10,000	$0
Gratiot County[4]	05/17/1999	4:45 pm		0	0	$50,000	$0
Sumner Township[3]	06/13/1999	2:10 pm		0	0	$10,000	$0
Ithaca[1]	07/23/1999	1:15 am	53 kts	0	0	$10,000	$0
Perrinton[2]	07/24/1999	2:55 pm		0	0	$10,000	$0
Bannister[5]	06/01/2000	10:26 pm	53 Est. kts	0	0	$25,000	$0
Alma[1]	06/14/2000	4:50 pm	53 Est. kts	0	0	$25,000	$0
Sumner Township[3]	07/14/2000	12:10 am	53 Est. kts	0	0	$20,000	$0
Sumner Township[3]	08/02/2000	4:25 am	53 Est. kts	0	0	$20,000	$0
Gratiot Cunty[4]	08/22/2000	10:25 pm	53 Est. kts	0	0	$20,000	$0
Riverdale[6]	07/29/2001	4:50 pm	53 Est. kts	0	0	$50,000	$10,000
Bannister[5]	07/29/2001	5:30 pm	53 Est. kts	0	0	$25,000	$0
Alma[1]	09/07/2001	4:50 pm	60 Est. kts	0	0	$15,000	$0
Ashley[2]	10/24/2001	7:00 pm	53 Est. kts	0	0	$25,000	$0
Gratiot County[4]	03/09/2002	4:00 pm	52 Est. kts	0	0	$20,000	$0
Ashley[2]	06/09/2004	3:02 pm	53 Est. kts	0	0	$10,000	$0
Ithaca[1]	08/25/2004	6:20 pm	53 Est. kts	0	0	$15,000	$0
Gratiot County[4]	10/30/2004	11:00 am	50 Est. kts	0	0	$50,000	$0
Ithaca[1]	06/05/2005	2:55 pm	52 Est. kts	0	0	$10,000	$0
Ithaca[1]	06/05/2005	5:40 pm	52 Est. kts	0	0	$20,000	$0
St. Louis[1]	06/28/2005	5:25 pm	52 Est. kts	0	0	$40,000	$0
St. Louis[1]	07/17/2006	5:08 pm	56 Est. kts	0	0	$20,000	$0
Breckenridge[2]	07/09/2007	3:30 pm	52 Est. kts	0	0	$20,000	$0
Forest Hill[7]	07/18/2007	4:25 pm	65 Est. kts	0	0	$75,000	$0
Perrinton[2]	08/22/2007	9:00 pm	50 Est. kts	0	0	$20,000	$0
Bannister[5]	08/29/2007	2:45 pm	50 Est. kts	0	0	$20,000	$0
Alma[1]	05/20/2013	3:50 pm	63 Est. kts	0	0	$10,000	$0
Gratiot County[4]	11/17/2013	10:00 pm	61 Est. kts	0	0	$100,000	$0
Alma[1]	04/12/2014	9:15 pm	61 Est. kts	0	0	$20,000	$0

Location	Date	Time	Magnitude	Deaths	Injuries	Property Damage	Crop Damage
Gratiot County[4]	03/08/2017	8:00 am	52 Est. kts	0	0	$10 M	$0
Bannister[5]	06/17/2017	3:40 pm	61 Est. kts	0	0	$40,000	$0
New Haven Township[3]	09/05/2018	5:40 pm	52 Est. kts	0	0	$10,000	$0
Gratiot County[4]	02/24/2019	7:00 am	52 Est. kts	0	0	$3 M	$0

1-City
2-Village
3-Township
4-Located throughout Gratiot County
5-Unincorporated community in Elba Township
6-Unincorporated community in Seville Township
7-Unincoporated community in Pine River Township

A total of 92 severe wind events on 80 days were reported by the NCEI for Gratiot County, Michigan between 01/01/1995 and 12/31/2018, which is approximately 4 events per year. While many of these events occurred during thunderstorms, they were not limited to thunderstorm activity. There were no deaths or injuries reported resulting from the winds; however, estimated damages were over $14.5 million, with nearly 70 percent of those damages as a consequence of the storm on 3/8/2017. Below are some of the more significant events within Gratiot County in the past 60+ years.

On 5/31/98 a Derecho (a long-lived line of intense, fast moving thunderstorms producing widespread destructive winds) with 60-130 mph thunderstorm winds tore through Central Michigan, including Gratiot County. No local deaths or injuries were reported; however, there were four (4) deaths and 146 injuries statewide. Public damages were estimated to be $610,000, with private damages not estimated. Thirteen counties, including Gratiot County, were declared a federal disaster area by the President.

From 4/12 to 4/15/2014, severe weather events occurred throughout Gratiot County, resulting in the USDA declaring a Gratiot County a designated disaster county due to damages and losses to property owners. Included in the events were lightning strikes, high winds, and flooding, which were not reported to the National Centers for Environmental information (NCEI).

On 12/23 thru 12/29/2015 High Winds of 60MPH+ accompanied by heavy sleet, rain and snowfall caused numerous trees and subsequent utility failures throughout Gratiot County. Power outages lasted for up to 5 days in some areas and local public safety agencies were inundated with calls for assistance. Gratiot County Emergency Management assisted several shut-ins and specific needs requests. Several roads were blocked for short periods of time and utility crews from multiple states assisted. Although Gratiot County did not have to declare a disaster, many agencies had their budgets impacted by additional overtime and resources used. Additionally, many businesses were forced to close, and a significant economic loss resulted. Damage estimates are $150,000.

On 3/8/2017 high winds gusting up to 70 miles per hour caused hundreds of thousands of residents in the Lower Peninsula to lose power, including the residents of Gratiot County. Trees and tree limbs fell as a result of the wind downing power lines throughout the region, as well as causing significant damage to homes and businesses. Damages were estimated to be $10 million in Gratiot County alone.

On 02/25/2019 high winds throughout central Michigan resulted in downed power lines and widespread power outages. Losses were estimated at $3 million for Gratiot County.

Severe Winds Overview

Gratiot County has experienced 92 severe wind events in approximately 24 years, which is about four events per year, or a 100% chance that an event would occur on an annual basis. Figures from the National Weather Service indicate that severe winds occur more frequently in the southern half of the Lower Peninsula than any other area in the State. On an average, severe wind events can be expected 3-4 times per year in the northern Lower Peninsula. These figures refer to winds from thunderstorms and other forms of severe weather, not tornadoes. Severe winds are considered to be a severe weather activity, which was given a high priority to address. With the additional means to warn residents of Gratiot County prior to these events, the County should be less vulnerable to injuries and deaths. However, due to the destructive nature of these events, physical damages from these events will still occur, leaving the County vulnerable to the severe winds in the immediate future.

FOG

Fog: condensed water vapor in cloudlike masses lying close to the ground and limiting visibility.

Hazard Description

Fog forms near the ground when water vapor condenses into tiny liquid water droplets that remain suspended in the air. Many different processes can lead to the formation of fog, but the main factor is saturated air. Two ways that air can become saturated are by cooling it to its dew point temperature or by evaporating moisture into it to increase its water vapor content. Although most fog, by itself, is not a hazard because it does not actually apply destructive forces, the interaction between humans and fog can be a dangerous situation, sometimes resulting in disastrous consequences.

Hazard Analysis

In considering severe and high-impact meteorological events, attention can easily become focused on the more dramatic storms. Tornadoes and hurricanes for example, are readily recognized by the general public and the meteorological community alike for their devastating consequences. Fog, on the other hand does not lend itself as readily to this categorization.

Fog can be dangerous because it reduces visibility. Although some forms of transport can penetrate fog using radar, road vehicles have to travel slowly and use more lights. Localized fog is especially dangerous, as drivers can be caught by surprise. Fog is particularly hazardous at airports, where some attempts have been made to develop methods (such as using heating or spraying salt particles) to aid fog dispersal. These methods have seen some success at temperatures below freezing.

Fog Events in Gratiot County

No major events occurring in Gratiot County were reported by the NCEI for Gratiot County, Michigan between 1/1/1950 and 12/31/2017.

Fog Overview

No major events have occurred in Gratiot County in recent years; however, one major fog event is estimated to occur in Michigan every two years. Property damage can be significant for vehicles due to the number of crashes resulting from fog, although real property and structures are usually unaffected. Thus, while fog has not impacted the residents of Gratiot County in recent years, it is not unforeseeable that fog could impact Gratiot County in the future. However, fog is not considered to be a severe weather event and was not given a high priority to address. Additionally, while fog has occurred in Gratiot County, they have not resulted in deaths, injuries, or property damages. Thus, the County is less vulnerable to the impacts of fog.

EXTREME TEMPERATURES (HEAT)

Extreme warm temperatures: prolonged periods of very high temperatures often accompanied by exacerbating conditions such as high humidity and lack of rain.

Hazard Description

Extreme temperatures – whether it be extreme heat or extreme cold – share a commonality in that they both primarily affect the most vulnerable segments of society such as the elderly, children, impoverished individuals, and people in poor health. The major threats of extreme heat are heatstroke (a major medical emergency), and heat exhaustion. Extreme heat is a more serious problem in urban areas, where the combined effects of high temperature and high humidity are more intense.

Gratiot County is susceptible to extreme heat. The temperate climate of southern Michigan, combined with the unsettling effect of Lake Huron, make for extreme deviations in temperature. 50-degree swings in the temperature in a 24-hour period are not uncommon. These events occur regularly depending on the year. Prolonged periods of extreme heat can pose severe and often life-threatening problems for Gratiot County's citizens. Extreme summer weather is characterized by a combination of very high temperatures and humid conditions. When persisting over a long period of time, this phenomenon is commonly called a heat wave. The major threats of extreme summer heat are heatstroke (a major medical emergency), and heat exhaustion. Heatstroke often results in high body temperatures, and the victim may be delirious, stuporous, or comatose. Rapid cooling is critical to preventing permanent neurological damage or death. Heat exhaustion is a less severe condition than heatstroke, although it can still cause problems involving dizziness, weakness and fatigue. Heat exhaustion is often the result of fluid imbalance due to increased perspiration in response to the intense heat. Treatment generally consists of restoring fluids and staying indoors in a cooler environment until the body returns to normal. Other, less serious risks associated with extreme heat are often exercise-related and include heat syncope (a loss of consciousness by persons not acclimated to hot weather), and heat cramps (an imbalance of fluids that occurs when people unaccustomed to heat exercise outdoors).

Extreme Heat Events in Gratiot County

Two extreme heat events were reported by the NCEI for Gratiot County, Michigan with both of them being in the past two years.

On 6/30/2018 hot and humid weather occurred in lower Michigan. Temperatures at Gratiot County Airport reached 91 degrees, with a dew point of 77 degrees, resulting in a heat index of 105 degrees. No deaths or injuries occurred as a result of this event. No damages were reported.

From 7/18 to 7/20/2019 Central Michigan experienced record high temperatures. Heat advisories and heat warnings were issued in the Central Michigan area. Gratiot County Emergency Management coordinated the opening of several cooling centers throughout the County. Heat indexes were reported to be as high as 110 degrees. No deaths were reported, but several heat-related illnesses were documented.

Extreme Heat Overview

There have been two recorded events in the past two years. These are also the only events of this type since 1997. However, the probability that an extreme heat event is not based on the last two years, but over a greater period of time. With many severe weather events occurring in recent years, climate change can be identified as a possible reason for these events to occur. Should the trend continue, more frequent severe weather events, and extreme heat events are anticipated to occur. While there have been minimal excessive heat conditions, high heat events occur annually in Gratiot County and are a risk to the residents and visitors. Air conditioning is probably the most effective measure for mitigating the effects of extreme summer heat on people. Unfortunately, many of those most vulnerable to this hazard (children, elderly, homeless individuals, and the critically ill) do not have access to air-conditioned environments. Excessive heat is considered to be a severe weather event which was given a high priority to address.

Natural Hazards-Winter Weather

ICE/SLEET STORMS

Ice/sleet storm: a storm that generates sufficient quantities of ice or sleet to result in hazardous conditions and/or property damage.

Hazard Description

Ice storms are sometimes incorrectly referred to as sleet storms. Sleet is similar to hail only smaller and can be easily identified as frozen rain drops (ice pellets) which bounce when hitting the ground or other objects. Sleet does not stick to trees and wires, but sleet in sufficient depth does cause hazardous driving conditions. Ice storms are the result of cold rain that freezes on contact with the surface, coating the ground, trees, buildings, overhead wires and other exposed objects with ice, sometimes causing extensive damage. When electric lines are downed, households may be without power for several days resulting in significant economic loss and disruption of essential services in affected communities.

Ice and Sleet Storms in Gratiot County

A total of four ice/sleet storms were reported by the NCEI for Gratiot County, Michigan between 1/1/2003 and 12/31/2018. Damages were estimated to be over $1 million as a result of these storms; however, the data from these events is incomplete as not all damages that may have occurred have been reported. (Damages are estimated, based on reports from insurance companies. If damages are not reported to

insurance companies, this information becomes incomplete.) No deaths or injuries were reported as a result of these storms. It should be noted that no storms predating 1997 were recorded by the NCEI.

Ice/Sleet Storms in Gratiot County from 2000 to Present

Table 4.5

Location	Date	Time	Death	Injuries	Property Damage	Crop Damage
Gratiot County (Ice Storm)	04/03/2003	10:00 am	0	0	$200,000	$0
Gratiot County (Ice Storm)	02/13/2005	10:00 pm	0	0	$50,000	$5,000
Gratiot County (Ice Storm)	02/16/2006	12:00 am	0	0	$1 million	$10,000
Gratiot County (Sleet)	12/23-29/2015	1:00 pm	0	0	$0	$0

On 04/03/2003 a major ice storm hit much of lower Michigan causing power outages throughout the region. The loss of power resulted in large damages. The storm hit in three separate stages of freezing rain. Reports of ice forming as a result were as high as one inch in the Lansing area.

On 2/16/2006 a major ice storm developed over much of central lower Michigan producing as much as a half an inch of ice. Numerous homes in the region lost power for 3-5 days. Downed trees and power lines were reported throughout the region.

On 12/23 thru 12/29/2015 High Winds of 60MPH+ accompanied by heavy sleet, rain and snowfall caused numerous trees and subsequent utility failures throughout Gratiot County. Power outages lasted for up to 5 days in some areas and local public safety agencies were inundated with calls for assistance. Gratiot County Emergency Management assisted several shut-ins and specific needs requests. Several roads were blocked for short periods of time and utility crews from multiple states assisted. Although Gratiot County did not have to declare a disaster many agencies had their budgets impacted by additional overtime and resources used. Additionally, many businesses were forced to close, and a significant economic loss resulted.

Ice and Sleet Storms Overview

There have been four reported ice storms over the past 15 years, or about one every 3.75 years. These events were not restricted to a community, but extended through much of Gratiot County, if not beyond. The probability of an event to occur annually is about 27%. One of the biggest problems resulting from ice and sleet storms is loss of power. The weight of the ice causes power lines to snap and break. Sometimes it can take days to restore power. If this happens temporary shelters may need to be set up. The local chapter of the American Red Cross would be called. Also, with the power loss would come loss of heat, which could cause death from hypothermia especially with the elderly population. Another problem caused by ice and sleet storms would be debris cleanup. The weight of the ice could cause tree limbs to snap and break. Historically, approximately 87% of ice storms occur during the months of January, February, March and April, when conditions are most conducive for the development of ice and sleet. Ice/sleet storms are considered to be severe weather events, which were given a high priority to address.

SNOWSTORMS

Snowstorms: a period of rapid accumulation of snow often accompanied by high winds, cold temperatures, and low visibility.

Hazard Description

As a result of being surrounded by the Great Lakes, Michigan experiences large differences in snowfall in relatively short distances. The annual mean accumulation ranges from 30 to 170 inches of snow. The highest accumulations are in the northern and western parts of the Upper Peninsula. In Lower Michigan, the highest snowfall accumulations occur near Lake Michigan and in the higher elevations of northern Lower Michigan.

Blizzards are the most dramatic and perilous of all snowstorms, characterized by low temperatures and strong winds (35+ miles per hour) bearing enormous amounts of snow. Most of the snow accompanying a blizzard is in the form of fine, powdery particles that are wind-blown in such great quantities that, at times, visibility is reduced to only a few feet. Blizzards have the potential to result in property damage and loss of life. Just the cost of clearing the snow can be enormous.

The western Upper Peninsula experiences the most snowstorms in Michigan each year. The western half of the Lower Peninsula also experiences a relatively large number of snowstorms. One reason for this is the "lake effect", a process by which cold winter air moving across Lakes Michigan and Superior picks up moisture from the warmer lake waters, resulting in significant snowfall amounts in the western part of the state.

Snowstorms in Gratiot County

There has been a total of 55 events in the snowstorm category (blizzards, heavy snows, winter storms, and winter weather) from 1/1/1997 to 12/31/2018. Storms of this nature are wide reaching and are not restricted to a specific municipality. In fact, many of the events identified below extend beyond the borders of Gratiot County. No injuries or deaths were reported as a result of these storms; however, the estimated damages from these events was $175,000. It should be noted that data from these events is incomplete as not all damages that may have occurred were reported. Below is a table that identifies all the events noted by the NCEI. It should be noted that no storms predating 1997 were recorded by the NCEI.

Snowstorms in Gratiot County from 1997 to Present

Table 4.6

Location	Date	Time	Death	Injuries	Property Damage	Crop Damage
Gratiot County	10/26/1997	4:00 pm	0	0	$0	$0
Gratiot County	12/24/1997	4:00 pm	0	0	$0	$0
Gratiot County	01/07/1998	5:00 pm	0	0	$0	$0
Gratiot County	01/22/1998	7:00 pm	0	0	$0	$0
Gratiot County	01/29/1998	6:00 am	0	0	$0	$0

Location	Date	Time	Death	Injuries	Property Damage	Crop Damage
Gratiot County	03/09/1998	7;00 am	0	0	$0	$0
Gratiot County	03/13/1998	3:00 pm	0	0	$0	$0
Gratiot County	01/02/1999	7:00 am	0	0	$0	$0
Gratiot County	01/04/1999	12:00 am	0	0	$0	$0
Gratiot County	03/04 to 03/06/1999	10:00 pm	0	0	$0	$0
Gratiot County	03/08 to 03/10/1999	10:00 pm	0	0	$0	$0
Gratiot County	01/03/2000	3:00 pm	0	0	$0	$0
Gratiot County	01/12/2000	12:00 pm	0	0	$0	$0
Gratiot County	12/11/2000	6:00 am	0	0	$0	$0
Gratiot County	12/16/2000	10:00 pm	0	0	$0	$0
Gratiot County	01/30/2002	4:00 am	0	0	$0	$0
Gratiot County	03/02/2002	1:00 am	0	0	$0	$0
Gratiot County	03/04/2003	6:00 pm	0	0	$0	$0
Gratiot County	01/14/2004	4:00 am	0	0	$0	$0
Gratiot County	01/27/2004	7:00 am	0	0	$0	$0
Gratiot County	11/24/2004	12:00 pm	0	0	$0	$0
Gratiot County	02/20/2005	5:00 am	0	0	$0	$0
Gratiot County	02/27/2005	7:00 am	0	0	$0	$0
Gratiot County	12/08/2005	4:00 pm	0	0	$0	$0
Gratiot County	01/20/2006	7:00 pm	0	0	$0	$0
Gratiot County	12/01/2006	4:00 am	0	0	$0	$0
Gratiot County	03/01/2007	6:00 am	0	0	$25,000	$0
Gratiot County	12/01/2007	6:00 pm	0	0	$0	$0
Gratiot County	12/15/2007	7:00 pm	0	0	$0	$0
Gratiot County	01/21/2008	10:00 pm	0	0	$0	$0
Gratiot County	02/01/2008	3:36 am	0	0	$0	$0
Gratiot County	02/06/2008	1:30 pm	0	0	$0	$0
Gratiot County	11/30 to 12/01/2008	1:00 pm	0	0	$0	$0
Gratiot County	12/08/2008	5:00 pm	0	0	$0	$0
Gratiot County	12/19/2008	4:30 am	0	0	$0	$0
Gratiot County	02/09/2010	8:00 am	0	0	$0	$0
Gratiot County	02/01/2011	10:00 pm	0	0	$0	$0
Gratiot County	02/20/2011	2:00 pm	0	0	$0	$0
Gratiot County	02/20/2011	10:00 pm	0	0	$0	$0
Gratiot County	02/07/2013	8:00 am	0	0	$0	$0
Gratiot County	01/04/2014	7:00 pm	0	0	$0	$0
Gratiot County	02/24/2016	10:00 am	0	0	$0	$0
Gratiot County	03/01/2016	9:00 am	0	0	$0	$0
Gratiot County	03/23/2016	8:00 am	0	0	$50,000	$0
Gratiot County	12/11/2016	12:00 am	0	0	$0	$0

Location	Date	Time	Death	Injuries	Property Damage	Crop Damage
Gratiot County	04/14/2018	12:00 pm	0	0	$100,000	$0
Gratiot County	01/28/2019	1:00 am	0	0	$0	$0

Following are examples of the different types of snowstorms in this category that have affected the County.

Blizzard-From 1/26/1978 to 1/27/1978 one of the most severe blizzards in Michigan history covered the entire lower peninsula. Snowfalls ranged from 30 inches in Muskegon to 8+ inches in Detroit (for the first several hours of the storm, Detroit was getting rainfall). About 20 people died throughout the state, mostly due to heart attacks or traffic accidents. Approximately 100,000 cars were abandoned on Michigan highways, many of them in the southeast part of the state.

Blizzard-On 1/2/1999 blizzard-like conditions developed across Lower Michigan on and continued through the afternoon. Wind gusts of 45 to 60 mph were common throughout the region with a snow accumulation of 6 to 12 inches. No deaths, injuries, or property damages were reported due to the storm.

Winter Weather-From 3/4 to 3/8/1999 two low pressure systems moved into Michigan resulting in multiple days of snow. Gratiot County reported having 12-15 inches of snow as a result of these systems. No deaths, injuries, or property damages were reported due to the storm.

Winter Storm-On 3/1/2007 a strong low-pressure system brought a combination of snow and ice. The ice accumulation was approximately one-half inch and snow was 8 to 9 inches. No deaths, injuries, or damages were reported as a result of this storm.

Winter Weather-From 2/1 to 2/2/2011 a combination of lake-effect snow and previously fallen snow, along with high winds resulted in blizzard-like conditions across the western lower Michigan peninsula. Freshly fallen snow of 12 inches was reported throughout the region.

Heavy Snow-On 2/7/2013 a low pressure system brought 8 to10 inches of snow across northern Gratiot County, with snowfall rates of up to two inches an hour at times during the storm. No deaths, injuries, or property damages were reported due to the storm.

Winter Weather-On 12/23 thru 12/29/2015 High Winds of 60MPH+ accompanied by heavy sleet, rain and snowfall caused numerous trees and subsequent utility failures throughout Gratiot County. Power outages lasted for up to 5 days in some areas and local public safety agencies were inundated with calls for assistance. Gratiot County Emergency Management assisted several shut-ins and specific needs requests. Several roads were blocked for short periods of time and utility crews from multiple states assisted. Although Gratiot County did not have to declare a disaster, many agencies had their budgets impacted by additional overtime and resources used. Additionally, many businesses were forced to close, and a significant economic loss resulted. Damage estimates were $150,000.

Snowstorms Overview

Of the reported 55 snowstorms in Gratiot County, all of them have occurred in past 22 years, averaging approximately 2.5 storms per year, leaving a 100% chance of a storm occurring each and every year. With the changing weather patterns that include more frequent heavy storms (rain and snow), this trend of multiple annual events is expected to continue. Severe snowstorms affect every Michigan community. While the number of events has not resulted in a large number of deaths/injuries in Gratiot County, due to the nature of these events snowstorms are considered to be severe weather events, which were given a high priority to address. Also, while the means to notify the public of these events has improved in recent years, thereby allowing residents to remain in a warm, safe environment, the nature of these events still put the residents in a vulnerable position with respect to travel conditions and power outages resulting from these events.

EXTREME TEMPERATURES (COLD)

Extreme cold temperatures: prolonged periods of very low temperatures often accompanied by exacerbating conditions such as heavy snowfall and high winds.

Hazard Description

Extreme temperatures, whether it be extreme heat or extreme cold, share a commonality in that they both primarily affect the most vulnerable segments of society such as the elderly, children, impoverished individuals, and people in poor health. The major threats of extreme cold are hypothermia (also a major medical emergency) and frostbite.

Gratiot County is susceptible to extreme cold. The temperate climate of southern Michigan, combined with the unsettling effect of Lake Huron, make for extreme deviations in temperature. 50-degree swings in the temperature in a 24-hour period are not uncommon. These events occur regularly depending on the year.

Prolonged periods of extreme cold can pose severe and often life-threatening problems for Gratiot County's citizens. Like heat waves, periods of prolonged, unusually cold weather can result in a significant number of temperature-related deaths. Each year in the United States, approximately 700 people die as a result of severe cold temperature-related causes. This is substantially higher than the average of 170 heat related deaths each year. It should be noted that a significant number of cold-related deaths are not the direct result of "freezing" conditions. Rather, many deaths are the result of illnesses and diseases that are negatively impacted by severe cold weather, such as stroke, heart disease and pneumonia. It could be convincingly argued that, were it not for the extreme cold temperatures, death in many cases would not have occurred at the time it did from the illness or disease alone.

Hypothermia (the unintentional lowering of core body temperature), and frostbite (damage from tissue being frozen) are probably the two conditions most closely associated with cold temperature-related injury and death. Hypothermia is usually the result of over-exposure to the cold and is generally thought to be clinically significant when core body temperature reaches 95 degrees or less. As body temperature drops, the victim may slip in and out of consciousness, and appear confused or disoriented. Treatment normally involves re-warming the victim, although there is some controversy in the medical community

as to exactly how that should be done. Frostbite rarely results in death, but in extreme cases it can result in amputation of the affected body tissue.

Extreme Cold Events in Gratiot County

No extreme cold events were reported by the NCEI for Gratiot County, Michigan between 1/1/1997 and 12/31/2018. However, several events have been identified recently that were not found in that data base.

From 12/2013 to 2/2014 portions of the upper Midwest and Northeast United States experienced a prolonged cold spell (polar vortex). Wind chills approaching -40 degrees were recorded throughout the region. NOAA's records from 1895 to present show that this was the 34th coldest stretch for the contiguous 48 states.

January 2019-Central Michigan was gripped by 10 or more days with daily high temperatures not exceeding 20 degrees.

Extreme Cold Overview

Even though no extreme cold events were identified by the NCEI or in the State of Michigan's Hazard Mitigation Plan, these two events were identified by Gratiot County representatives. As they were both within the last 10 years, this may suggest that the events could occur more frequently in the future. Twice is the past 8 years could suggest a 25 percent probability of an event occurring an any given year. During these events, many of those most vulnerable to this hazard (children, elderly, homeless individuals, and the critically ill) may not have access to sufficiently heated environments. Excessive cold is considered to be a severe weather event, which was given a high priority to address. With multiple means to notify the general public of these cold events, the public does have ample time to seek shelter, thus reducing their vulnerability to these events.

Hydrological Hazards

DAM FAILURES

Dam failure: the collapse or failure of an impoundment (water held back by a dam) resulting in downstream flooding.

Hazard Description

A dam failure can result in loss of life and extensive property or natural resource damage for miles downstream from the dam. Dam failures occur not only during flood events, which may cause overtopping of a dam, but also as a result of misoperation, lack of maintenance and repair, or vandalism. A common form of dam failure occurs when tree roots disrupt the integrity of an earthen dam. Water can pass through the dam where the soil has been broken apart by the roots. Such failures can be catastrophic because they occur unexpectedly with no time for evacuation.

In Michigan, all dams over 6 feet high that create an impoundment with a surface area of more than 5 acres are regulated by Part 315, Dam Safety, of the Natural Resources and Environmental Protection Act

(451 P.A. 1994), as amended. This statute requires the Michigan Department of Environment, Great Lakes, and Energy (EGLE) (formerly known as the Department of Environmental Quality (DEQ)) to rate each dam as either a low, significant, or high hazard potential. This rating system is based solely on the potential downstream impact if the dam were to fail and is not according to the physical condition of the dam.

The National Inventory of Dams lists seven (7) dams within Gratiot County with three dams having a significant hazard potential classification and the remaining four dams having a low hazard potential classification. The definitions for these ratings by Michigan Law (Part 315, Dam Safety, of the Natural Resources and Environmental Protection Act) are as follows:

Significant hazard potential classification: Failure or mis-operation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or impact other concerns. [16]

Low hazard potential classification: failure or misoperation results in no probable loss of human life and low economic and/or environmental losses.[17]

The three significant dams are as follows.
City of St. Louis Dam
State Street Dam in the City of Alma
Rainbow Lake Dam located in Fulton Township

The four low risk dams are as follows.
Gratiot-Saginaw SGA in Elba Township
Salidek Dam in Fulton Township
Little Rainbow Lake Dam in Fulton Township
Mill Andy Pond Dam in Washington Township

<u>Dam Failures in Gratiot County</u>
There has been one dam failure in Gratiot County in recent memory.

On 9/12/1986 Rainbow Lake Homeowners Association earthen dam failed due to fast-rising floodwaters. This failure impacted both the Rainbow Lake Community located on Rainbow Lake and the Village of Maple Rapids in Clinton County. In addition to the local flooding on Rainbow Lake, 20 homeowners in Maple Rapids in Clinton County had to evacuate their homes.

<u>Dam Failure Flooding Overview</u>
According to the National Inventory of Dams Gratiot County has three dams that are rated as Significant Hazard Potential Dams. The Federal Emergency Response Commission (FERC) has emergency planning

[16] Federal Guidelines for Dam Safety: Hazard Potential Classification for Dams, US. Department of Homeland Security Federal Emergency Management Agency, January 2004
[17] ibid

oversight of the dams. Dam owners are required to maintain an Emergency Action Plan (EAP) for significant and high hazard potential dams. Owners are also required to coordinate with local Emergency Management officials to assure consistency with local Emergency Operations Plans. Dam failures have been given a medium priority to address.

RIVERINE FLUVIAL AND SURFACE FLOODING

Riverine (fluvial) Flooding: the overflow of rivers, streams, drains and lakes due to excessive rainfall, rapid snowmelt or ice jams and dam failures.

Surface (pluvial) Flooding: is caused when heavy rainfall creates a flood event independent of an overflowing water body.

Hazard Description

Flooding of land adjoining the normal course of a stream or river has been a natural occurrence since the beginning of time. If these floodplain areas were left in their natural state, floods would not cause significant damage. Development has increased the potential for serious flooding because rainfall that used to soak into the ground or take several days to reach a river or stream via a natural drainage basin now quickly runs off streets, parking lots, and rooftops, and through man-made channels and pipes.

Floods can damage or destroy public and private property, disable utilities, make roads and bridges impassable, destroy crops and agricultural lands, cause disruption to emergency services, and result in fatalities. People may be stranded in their homes for several days without power or heat, or they may be unable to reach their homes at all. Long-term collateral dangers include the outbreak of disease, widespread animal death, broken sewer lines causing water supply pollution, downed power lines, broken gas lines, fires, and the release of hazardous materials.

Most riverine flooding occurs in early spring and is the result of excessive rainfall and/or the combination of rainfall and snowmelt. Ice jams also cause flooding in winter and early spring. Severe thunderstorms may cause flooding during the summer or fall, although these are normally localized and have more impact on watercourses with smaller drainage areas. Oftentimes, flooding may not necessarily be directly attributable to a river, stream or lake overflowing its banks. Rather, it may simply be the combination of excessive rainfall and/or snowmelt, saturated ground, and inadequate drainage. With no place to go, the water will find the lowest elevations – areas that are often not in a floodplain. That type of flooding is becoming increasingly prevalent in Michigan as development outstrips the ability of the drainage infrastructure to properly carry and disburse the water flow. Flooding also occurs due to combined storm and sanitary sewers that cannot handle the tremendous flow of water that often accompanies storm events. Typically, the result is water backing into basements which damages mechanical systems and can create serious public health and safety concerns.

Ice Jams

Cold winters like those experienced in Gratiot County can produce thick river ice and the potential for ice jams. An ice jam develops when pieces of snow and ice buildup along a river. As the ice buildup increases, water passes slowly, and flooding develops behind the dam of ice. Water levels can also rise rapidly when

temperatures rise and result in snowmelt runoff or rain, thus adding more water to the river behind an ice jam.

In the spring, or when temperatures rise, the ice buildup will thaw and break up, and may unleash all of the dammed-up water in a short period of time. When this occurs, flooding can rapidly result downstream from the ice jam. The combination of ice, debris, and water released from the ice jam can cause tremendous physical damage to homes, docks, and other structures.

Monthly Mean Precipitation (liquid equivalent in inches) in Gratiot County, 1929-2015

TABLE 4.7

Month	Gratiot County	
	1929-2000	2001-2015
January	1.86	1.88
February	1.33	1.64
March	2.21	1.82
April	2.76	3.82
May	3.00	3.98
June	3.38	3.58
July	2.95	3.12
August	3.38	3.06
September	3.53	2.80
October	2.88	3.18
November	2.67	2.46
December	1.97	2.21
Annual Average	31.90	33.55

Source: National Weather Service

Citing the information above, there is a slight increase in annual precipitation (5.2%) from the last fifteen years over the previous 70 years. However, there are seven months with increased monthly rainfall including the months of April and May, where there is more than a two-inch increase. The increase at this time of the year is critical, as they are the rainiest months of the year and any increase could result in greater spring floods or possibly even jeopardize the planting of the crops (as occurred in 2019).

Riverine Flooding in Gratiot County

According to the 2019 Michigan State Hazard Mitigation Plan, from Jan 1996 to April 2017 Gratiot County experienced 12 flood events on 11 separate days. (A review of the NCEI records identified a total of 11 flood events between 1/1/1950 and 12/30/2018.) It should be noted that those floods that have been identified as being located in Gratiot County are floods that included both riverine and surface flooding, based on heavy rains that preceded the floods.

Flood Event in Gratiot County from 1997 to Present

Table 4.8

Location	Date	Time	Death	Injuries	Property Damage	Crop Damage
Ithaca	02/21/1997	8:00 am	0	0	$0	$0
Gratiot County	12/24/1997	4:00 pm	0	0	$0	$0
Gratiot County	05/18/2000	7:00 am	0	0	$100,000	$50,000
Gratiot County	02/09/2001	7:00 pm	0	0	$0	$0
Gratiot County	02/24/2001	6:00 am	0	0	$0	$0
Gratiot County	05/15/2001	4:45 pm	0	0	$50,000	$50,000
Gratiot County	05/15/2001	11:45 pm	0	0	$50,000	$50,000
Gratiot County	05/16/2001	3:00 am	0	0	$25,000	$25,000
Gratiot County	05/23/2004	12:00 am	0	0	$0	$0
Gratiot County	07/28/2011	2:00 am	0	0	$0	$0
Gratiot County	04/17/2013	10:00 pm	0	0	$0	$0

From 9/09/1986 to 9/12/1986 a slow moving, low pressure system moved into the Lower Peninsula. During this time, an intense storm produced rainfall ranging from 8 inches to 20+ inches. In Central Michigan, there was an estimated $500 million in damages, with 6 deaths and 89 injuries resulting from the storm. In Alma, 10.75 inches fell during this timeframe. The Pine River in Alma rose 11 feet as a result of this storm. Farmers in Gratiot County had nearly $6.8 million in losses from their four major crops (corn, soybeans, dry beans, and sugar beets).

On 4/18/2013 Gratiot County and the City of Alma declared a state of emergency due to riverine flooding. The State St. bridge crossing over the Pine River was closed, and sandbags were ordered from the Army Corps of Engineers to protect city infrastructure.

Overnight on 7/22/2017 locally heavy rain in excess of 7 inches fell, resulting in flooding in the north half of Gratiot County as well as to the north of Gratiot County. As a result, the bridge in Alma was closed, along with multiple roads due to culvert washouts. Sumner Township was nearly inaccessible by road, due to the roads covered by moving water.

Riverine and Surface Flooding Overview

There have been 11 events in the past 22 years, which is about one event every two years or a 50% chance of a flood occurring annually. With the changing weather patterns, more floods may be anticipated due

to the stronger more potent rains. Currently there are eight municipalities, including three cities and five townships in Gratiot County, participating in the National Flood Insurance Program (NFIP). In order to maintain their participation in the NFIP, ordinances have been adopted that prohibit new construction within floodplains. Modifications to existing buildings within floodplains have to be approved by a certified floodplain manager within the County. To further reduce their vulnerability, municipalities must maintain culverts and drainage ditches throughout the county as well as keep them clear of all debris. While this will not eliminate flooding, it will reduce the flooding from the less powerful storms. There are no properties officially designated by the NFIP as "repetitive loss properties".

DROUGHTS

Droughts; a water shortage caused by a deficiency of rainfall, generally lasting for an extended period of time.

Hazard Description

Drought is the consequence of a reduction in the amount of precipitation that was expected over an extended period of time, usually a season or more in length. The severity of a drought depends not only on its location, duration, and geographical extent, but also on the water supply demands made by human activities and vegetation. This is considered a regional event impacting the entire county and beyond rather than an event impacting a community or communities within the county.

A drought can cause many severe hardships for communities and regions. Probably one of the most common and severe impacts to a community like Gratiot County would be the threat of wildfires as sixty-three percent of the County is forests. Also, there would be a drop in the quantity and quality of agricultural crops. Other negative impacts that can be attributed to a drought include water shortages for human consumption, industrial, business and agricultural uses, recreation and navigation, declines in water quality in lakes, streams and other natural bodies of water, malnourishment of wildlife and livestock, increases in fires and wildfire related losses to timber, homes, and other property, increases in wind erosion, and declines in tourism in areas dependent on water-related activities.

These direct impacts can further result in indirect impacts to a community, such as reduced revenue due to income losses in agriculture, retail, tourism and other economic sectors; declines in land values due to physical damage from the drought conditions and decreased functional use of the property, and possible loss of human life due to extreme heat, fire, and other heat-related problems.

Two common measurement tools of dry weather conditions are the Palmer Drought Indices (including the Palmer Drought Severity Index and the Palmer Hydrological Drought Index) and the Crop Moisture Index. The Palmer Drought Severity Index is a good long-term drought monitoring tool. It is a monthly index that indicates the severity of a wet or dry spell. This index is based on average temperature and rainfall information for a particular location in a formula to determine dryness. The Crop Moisture Index (CMI) evaluates short-term moisture conditions across crop producing regions. The CMI measures how much moisture is in the plant root zone of the soil. This index is based on the mean temperature and total precipitation that occurs each week, as well as the CMI from the previous week. The CMI changes as quickly as the weather changes. A heavy rainstorm can dramatically change the CMI for a region. Since

this index changes so quickly and in response to a single weather event, the CMI is not considered a good long-term drought measurement tool.

The Palmer Drought Severity Index uses a value of 0 for the normal amount of rainfall in a particular location and drought is shown in terms of negative numbers. For example, minus 2 is moderate drought, minus 3 is severe drought, and minus 4 is extreme drought. Any value above 0 demonstrates that there have been above normal amounts of precipitation. This index can be used for indicating lake levels and surface water supply abnormalities but is not all that good for monitoring climatic impacts on vegetation, especially crops.

Droughts/Drought Related Events in Gratiot County

The State of Michigan has been divided into ten (10) climate divisions for drought monitoring and analyses. Gratiot County is located in Division 6, which is located is the center of the Lower Peninsula and consists of an eight-county region. According to the State of Michigan 2019 Hazard Analysis (an appendix to the 2016 State of Michigan Hazard Mitigation Plan), division 6 experienced seven droughts ranging from nine months to 18 months in duration.[18]

1910-1911 The longest drought in duration, the drought lasted 18 months, with January of 1911 having an index of value of -4.67.

1930-1931 Considered the most severe drought in the division, if not the State of Michigan, the Palmer Drought Severity Index reached an all-time low index value of -6.06.

Drought Overview

As previously stated, Gratiot County is located in Division 6, of Michigan's 10 drought climate divisions. From the period of 124 years (1895-2018) Gratiot County (Division 6), 47% of the years experienced a moderate drought or worse, 20% of these years experienced a severe drought, and 10% of the years experienced severe droughts.

Transportation Hazards

TRANSPORTATION ACCIDENTS: AIR, LAND, AND WATER

Transportation accident: a crash or accident involving an air, land or water-based commercial passenger carrier resulting in death or serious injury.

Hazard Description-Air Transportation Accidents

There are four circumstances that can result in an air transportation accident:

1. An airliner colliding with another aircraft in the air.
2. An airliner crashing while in the cruise phase of a flight due to mechanical problems, sabotage, or other cause.

[18] Michigan Hazard Analysis April 2019, Michigan Department of State Police

3. An airliner crashing while in the takeoff or landing phases of a flight.
4. Two or more airliners colliding with one another on the ground during staging or taxi operations.

The Michigan Aeronautics Commission of the Michigan Department of Transportation administers several programs aimed at improving aviation safety and promoting airport development. The Commission's safety programs include:

1. Registering aircraft dealers, aircraft, and engine manufacturers.
2. Licensing airports and flight schools.
3. Inspecting surfaces and markings on airport runways.
4. Assisting in removal of airspace hazards at airports.

The Commission's airport development program includes providing state funds for airport development and airport capital improvements – many of which contribute to overall air transportation safety.

The Federal Aviation Administration (FAA) contracts with the Michigan Department of Transportation for the inspection of the state's 238 public-use airports on an annual basis. The FAA has regulatory jurisdiction over operational safety and aircraft worthiness. The National Transportation Safety Board (NTSB) investigates all aircraft crashes that involve a fatality and publishes reports on its findings. (See the NTSB section below).

When responding to any of these types of air transportation accidents, emergency personnel may be confronted with a number of problems, including:

1. Suppressing fires.
2. Rescuing and providing emergency first aid for survivors.
3. Establishing mortuary facilities for victims.
4. Detecting the presence of explosive or radioactive materials.
5. Providing crash site security, crowd and traffic control, and protection of evidence.

<u>Hazard Description-Land Transportation Accidents</u>

A land transportation accident in Michigan could involve a commercial intercity passenger bus, a local public transit bus, a school bus, passenger vehicles, or an intercity passenger train. Although these modes of land transportation have a good safety record, accidents do occur. Typically, the bus slipping off a roadway in inclement weather, or colliding with another vehicle causes bus accidents. Intercity passenger train accidents usually involve a collision with a vehicle attempting to cross the railroad tracks before the train arrives at the crossing. Unless the train accident results in a major derailment, serious injuries are usually kept to a minimum. Bus accidents, on the other hand, can be quite serious – especially if the bus has tipped over. Numerous injuries are a very real possibility in those types of situations.

School bus safety programs and initiatives generally fall into two categories:

1. Driver skill enhancement and competency training.
2. Physical inspections of bus mechanical and safety equipment.

The Motor Carrier Division, Michigan Department of State Police, inspects all school buses and other school transportation vehicles (21,000 units) on an annual basis. In addition, all school bus drivers in Michigan must take and pass a bus driver education and training program, and then take regular refresher courses to maintain their certification to operate a school bus. School bus drivers must also pass an annual medical examination.

Local transit and intercity bus safety falls under the purview of the Michigan Department of Transportation's Bureau of Urban and Public Transportation. Generally, the issue of intercity and transit bus safety is handled on a partnership basis with the service providers, with MDOT providing oversight of the initiatives undertaken by the providers to ensure mechanical and operational safety.

The Michigan Department of Transportation is the state regulatory agency for railroad-highway grade crossing safety issues. In this role, MDOT conducts biennial, on-site crossing reviews for Michigan's 5,535 public crossings, and reports observed crossing maintenance deficiencies to the responsible railroad or roadway authority. In addition, MDOT conducts diagnostic study team reviews at selected crossings to determine whether the current level of warning device requires enhancement. At the present time, 42% of Michigan's public crossings have at least automatic side-of-street flashing light signals, and 16% have automatic gates.

In January 2001 an amendment (367 P.A. 2000) to the Michigan Vehicle Code went into effect allowing the MSP, MDOT, or specified local officials to install video cameras at railroad crossings to serve as a deterrent to motorists who might attempt to go around or through activated railroad crossing lights and gates. Although the ultimate purpose of this law is to reduce pedestrian and vehicular deaths and injuries at railroad crossings, the law will also likely reduce passenger train accidents caused by collisions with vehicles on the tracks – a major cause of many passenger train derailments.

Michigan's "Operation Lifesaver" Coalition – part of a national, non-profit education and awareness program dedicated to ending tragic collisions, fatalities and injuries at highway-rail grade crossings and on railroad rights of way- has helped reduce the number of serious crashes at railroad crossing in the state. The Operation Lifesaver coalition in Michigan is spearheaded by the MSP and MDOT and is comprised of state and local government officials, law enforcement, and employees of the railroad companies operating in Michigan. The Operation Lifesaver program emphasizes education and enforcement and its efforts appear to be working. Since 1996, the number of crashes, injuries, and fatalities at railroad crossing in Michigan has shown a steady decline. Any reduction in vehicle-train crashes at railroad crossings helps reduce the likelihood of a passenger transportation accident involving a train, school bus, local transit bus, or commercial intercity passenger bus.

Another MDOT program that can help improve rail safety is the Michigan Rail Loan Assistance Program. Established under Act 117, P.A. 1997, this program was initiated to help finance capital improvements on Michigan's rail infrastructure. Although the program is designed primarily to help preserve and improve rail freight service, any improvements made to the rail infrastructure that serves passenger rail service can only help improve passenger rail safety. Track rehabilitation is one of the eligible projects that can be funded under this program, and the safety value of a project is one of the primary selection criteria. (The Gratiot County transportation map is included in Chapter 3.)

Transportation Accidents in Gratiot County

There have been no major commercial transportation accidents in recent years. However, there have been numerous multi-vehicle accidents due to weather conditions that have resulted in the closing of US-127.

Transportation Accidents Overview

Gratiot County has two railroad lines, the Mid-Michigan Railroad and the Great Lakes Central Railroad, an Interstate Highway US-127, and two Michigan Highways, M-46 and M-57. Even with limited commercial accidents in recent years, transportation has been identified has a high priority due to the amount of rail, federal highway, and state highway miles located within Gratiot County.

Hazardous Material Incidents

HAZARDOUS MATERIAL INCIDENTS - TRANSPORTATION

Hazardous material incident: an uncontrolled release of hazardous materials during transport, capable of posing a risk to health, safety, property or the environment.

Hazard Description

As a result of the extensive use of chemicals in our society, all modes of transportation – highway, rail, air, marine, and pipeline – are carrying thousands of hazardous materials shipments on a daily basis through local communities. A transportation accident involving any one of those hazardous material shipments could cause a local emergency affecting many people.

Michigan has had numerous hazardous material transportation incidents that affected the immediate vicinity of an accident site or a small portion of the surrounding community. Those types of incidents, while problematic for the affected community, are fairly commonplace. They are effectively dealt with by local and state emergency responders and hazardous material response teams. Larger incidents, however, pose a whole new set of problems and concerns for the affected community. Large-scale or serious hazardous material transportation incidents that involve a widespread release of harmful material (or have the potential for such a release) can adversely impact the life safety and/or health and well-being of those in the immediate vicinity of the accident site, as well as those who come in contact with the spill or airborne plume. In addition, damage to property and the environment can be severe as well. Statistics show almost all hazardous material transportation incidents are the result of an accident or other human error. Rarely are they caused simply by mechanical failure of the carrying vessel.

Hazardous Material Incidents: Transportation Overview

Although there have not been any significant hazardous materials transportation incidents, there have been minor petroleum and hazardous materials spills throughout the years. Major transportation corridors are primarily two lanes. These routes are heavily congested in the summer months and often icy or impassible in the winter. It is certainly only a matter of time before a serious hazardous materials incident occurs on a county roadway, railway, or waterway.

OIL/GAS WELL INCIDENT

Oil/gas well incident: an uncontrolled release of oil or gas, or the poisonous by-product hydrogen sulfide, from wells.

Hazard Description

Oil and natural gas are produced from fields scattered across 63 counties in the Lower Peninsula. Since 1925 over 44,000 oil and natural gas wells have been drilled in Michigan, of which roughly half have produced oil and gas. To date, Michigan wells have produced approximately 1.4 billion barrels of crude oil and 4 trillion cubic feet of gas.

The petroleum and natural gas industry are highly regulated and has a fine safety record, but the threat of accidental releases, fires and explosions still exists. In addition to these hazards, many of Michigan's oil and gas wells contain extremely poisonous hydrogen sulfide (H2S) gas. Hydrogen sulfide is a naturally occurring gas mixed with natural gas or dissolved in the oil or brine and released upon exposure to atmospheric conditions. Over 1,300 wells in Michigan have been identified as having H2S levels exceeding 300 parts per million (ppm).

As the table below indicates, at concentrations of 700 ppm, as little as one breath of hydrogen sulfide can kill. Although hydrogen sulfide can be detected by a "rotten egg" odor in concentrations from .03 ppm to 150 ppm, larger concentrations paralyze a person's olfactory nerves so that odor is no longer an indicator of the hazard. Within humans, small concentrations can cause coughing, nausea, severe headaches, irritation of mucous membranes, vertigo, and loss of consciousness. Hydrogen sulfide forms explosive mixtures with air at temperatures of 500 degrees Fahrenheit or above and is dangerously reactive with powerful oxidizing materials. Hydrogen sulfide can also cause the failure of high-strength steels and other metals. This requires that all company and government responders be familiar not only with emergency procedures for the well site, but also with the kinds of materials that are safe for use in sour gas well response.

Physiological Response to H_2S

TABLE 4.9

Particles	Response
10ppm	Beginning eye irritation
50-100 ppm	Slight conjunctivitis and respiratory tract irritation after 1-hour exposure
100 ppm	Coughing, eye irritation, loss of sense of smell after 2-15 minutes. Altered respiration, pain in the eyes and drowsiness after 15-30 minutes followed by throat irritation after 1 hour. Several hours of exposure results in gradual increase in severity of these symptoms and death may occur within the next 48 hours.

200-300 ppm	Marked conjunctivitis and respiratory tract irritation after 1 hour of exposure.
500-700 ppm	Loss of consciousness and possibly death in 30 minutes to 1 hour.
700-1000 ppm	Rapid unconsciousness, cessation of respiration and death.
1000-2000 ppm	Unconsciousness at once, with early cessation of respiration and death in a few minutes. Death may occur even if the individual is removed to fresh air at once.

Oil and Gas Well Accidents Overview

There are 443 oil and natural gas wells in Gratiot County along with 35.2 miles of gas pipeline. This is a relatively small quantity when compared with state leader, Otsego County, with over 5700 wells. Of almost as great a concern is the fact that a combination of multiple organizations and individuals own the wells. As a general rule, most gas companies prefer to respond to incidents involving their wells themselves – and in the vast majority of cases that is what happens. Because gas companies often have controlled burns, and deal with wells on a daily basis, it is impossible to ascertain how many incidents have actually occurred in the county. However, there is still the possibility that an emergency response agency could find themselves in the situation of responding to an incident at a gas well. Responders must understand the dangers associated with HS2 and must have a working knowledge of these wells that are in their areas of responsibility.

PETROLEUM AND NATURAL GAS PIPELINE ACCIDENTS

Petroleum and natural gas pipeline accident: an uncontrolled release of petroleum or natural gas, or the poisonous by-product hydrogen sulfide, from a pipeline.

Hazard Description

Though often overlooked, petroleum and natural gas pipelines pose a real threat in many Michigan communities. Petroleum and natural gas pipelines can leak or fracture and cause property damage, environmental, contamination, injuries, and even loss of life. The vast majority of pipeline accidents that occur in Michigan are caused by third party damage to the pipeline, often due to construction or some other activity that involves trenching or digging operations.

Michigan is both a major consumer and producer of natural gas and petroleum products. According to the Michigan Public Service Commission (MPSC), approximately 25% of the natural gas consumed in Michigan is produced within the state. The remaining 75% is imported by five interstate pipeline companies that have access to the major natural gas producing regions in North America. Michigan cycles more natural gas through its storage system than any other state. Michigan ranks 11th in the nation in production of natural gas and ranks 6th in consumption at 937.2 billion cubic feet. Michigan's petroleum product consumption in 1997 was 189 million barrels, ranking it 10th nationally. These figures underscore the fact that vast quantities of petroleum and natural gas are extracted from, transported through, and stored in the state, making many areas vulnerable to petroleum and natural gas emergencies. Michigan's gas and petroleum networks are highly developed and extensive, representing every sector of the two industries – from wells and production facilities, to cross-country transmission pipelines that bring the products to market, to storage facilities, and finally to local distribution systems.

While it is true that the petroleum and natural gas industries have historically had a fine safety record, and that pipelines are by far the safest form of transportation for these products, the threat of fires, explosions, ruptures, and spills nevertheless exists. In addition to these hazards, there is the danger of hydrogen sulfide (H_2S) release. These dangers (fully explained in the Oil and Natural Gas Well Accidents section) can be found around oil and gas wells, pipeline terminals, storage facilities, and transportation facilities 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.

Petroleum and Natural Gas Pipeline Accidents in Gratiot County

On 2/17/2010 an oil and saltwater spill of 1680 gallons took place in northern Gratiot County from a Dart Oil line. The spill was contained in a 250-yard area. Clean-up was completed by 2/19/2010.

Petroleum and Natural Gas Pipeline Accidents Overview

There are several petroleum and natural gas pipelines running throughout the County. Gratiot County has several compressor stations and storage fields in the area. In the Emergency Operations Center are plans and emergency contact numbers for these locations. One point that is stressed in most of these plans is for local emergency crews not to do anything on scene until a representative from the company arrives.

Because petroleum and natural gas pipeline accidents are an inevitable occurrence, affected local communities must be prepared to respond to the accident, institute necessary protective actions, and coordinate with federal and state officials and the pipeline company emergency crews to effectively manage and recover from the accident. That can best be accomplished through collaborative planning, training, and exercising of emergency procedures with all potentially involved parties.

HAZARDOUS MATERIAL INCIDENTS - FIXED SITE AND PROPANE STORAGE SITES

Hazardous Material Incident: an uncontrolled release of hazardous materials from a fixed site, capable of posing a risk to health, safety, property, and the environment.

Industrial Accidents-A fire, explosion, or other severe accident (especially if it involves hazardous materials) at an industrial facility that results in serious property damage, injury, or loss of life.

Hazard Description (Hazardous Material Incidents)

Hazardous materials are present in quantities of concern in business and industry, agriculture, universities, hospitals, utilities, and other community facilities. Hazardous materials are materials or substances which, because of their chemical, physical, or biological nature, pose a potential threat to life, health, property and the environment if they are released. Examples of hazardous materials include corrosives, explosives, flammable materials, radioactive materials, poisons, oxidizers, and dangerous gases.

Hazardous materials are highly regulated by the government to reduce risk to the general public, property and the environment. Despite precautions taken to ensure careful handling during the manufacture,

transport, storage, use and disposal of these materials, accidental releases are bound to occur. Areas at most risk are within a 1-to-5-mile radius of identified hazardous material sites. Many communities have detailed plans and procedures in place for responding to incidents at these sites, but release can still cause severe harm to people, property, and the environment if proper mitigative action is not taken in a timely manner.

Hazard Description-Industrial Accidents

Industrial accidents differ from hazardous material incidents in the scope and magnitude of offsite impacts. Whereas, hazardous material incidents typically involve an uncontrolled release of material into the surrounding community and environment that may require evacuations or in-place sheltering of the affected population. The impacts from industrial accidents are often confined to the site or facility itself, with minimal physical outside impacts. Nonetheless, industrial accidents, such as fires, explosions, and excessive exposure to hazardous materials, may cause injury or loss of life to workers at the facility, and significant property damage. In addition, industrial accidents can cause severe economic disruption to the facility and surrounding community, as well as significant long-term impacts on the families of the workers injured or killed.

Superfund Amendments and Reauthorization Act (SARA), Title II

There are currently 5 Sites in Gratiot County designated SARA Title III, Section "302 Sites". These sites are required to have an emergency plan on file with the Local Emergency Planning Commission, Fire Department, and their facility. All 5 "302 Sites" in Gratiot County have an emergency plan on file with the Local Emergency Planning Committee and their individual Fire Departments.

At the meetings held in the county, attendees and the Emergency Management Coordinator expressed some concern for the safety and security of propane storage sites. The county would like to improve security and inventory the sites for the future safety of the residents. (Buffer Zones for 302 Sites are half-mile radius.)

Hazardous Material Incidents/Industrial Accidents in Gratiot County

There have not been any hazardous material/industrial accidents in Gratiot County to report in recent years.

Hazardous Material Incidents/Industrial Accidents Overview

Like all heavily industrialized states, Michigan will always be concerned with the risk of accidental hazardous material releases. However, the threat of accidental hazardous material releases that can affect life, health, property or the environment can be greatly reduced by: 1) developing and maintaining adequate community hazardous material response plans and procedures; 2) adequately training hazardous material workers and off-site emergency responders; 3) educating the public about hazardous materials safety; 4) enforcing basic hazardous material safety regulations; and 5) mitigating, wherever possible, the threat of accidental hazardous material releases. Fortunately, many Michigan communities are making great strides in these important areas.

NOTE: Nuclear research facilities can produce/use radioactive materials, as well as other hazardous substances, and therefore need to be dealt with by specially trained personnel. Caution should be exercised at these facilities, and proper radiological survey equipment should be used during a response.

As a major manufacturing and industrial center, Michigan has had its share of industrial explosions and/or fires that resulted in deaths or injuries. Fortunately, industrial and fire safety regulations enacted over the years have kept these types of accidents to a minimum. Although industrial accidents occur with regularity in Michigan, major incidents with mass casualties, such as the four deadly explosions that occurred in 1998 and 1999, are relatively rare.

Nuclear Power Plant Accidents

Nuclear Power Plant Accident: an actual or potential release of radioactive material at a commercial nuclear power plant or other nuclear facility in sufficient quantity to constitute a threat to the health and safety of the off-site population.

Hazard Description

Such an occurrence, though not probable, could affect the short and long-term health and safety of the public living near the nuclear power plant and cause long-term environmental contamination around the plant. As a result, the construction and operation of nuclear power plants are closely monitored and regulated by the Federal government.

Nuclear Power Plant Failures Overview

Communities with a nuclear power plant must develop detailed plans for responding to and recovering from such an incident, focusing on the 10-mile Emergency Planning Zone (EPZ) around the plant, and a 50-mile Secondary EPZ that exists to prevent the introduction of radioactive contamination into the food chain. Michigan has 3 active and 1 inactive commercial nuclear power plants, in addition to 4 small nuclear testing/research facilities located at 3 state universities and within the City of Midland. Gratiot County does not have a nuclear power plant.

Gratiot County does not have a nuclear power plant located within 50 miles and is not within the Secondary EPZ or ingestion pathway zone. Thus, they are not required to have a plan in place for that zone. The closest active Nuclear Power Plant located within the US is approximately 90 miles away from Gratiot County, which is the Palisades Nuclear Generating Station, located in South Haven. Should an accident occur in the Midwest that could impact the County any measures would be addressed by an outside agency.

Technological Failures

INFRASTRUCTURE FAILURES

Infrastructure failure: a failure of critical public or private utility infrastructure resulting in a temporary loss of essential functions and/or services.

Hazard Description

Michigan's citizens are dependent on the public and private utility infrastructure to provide essential life supporting services such as electric power, heating and air conditioning, water, sewage disposal and treatment, storm drainage, communications, and transportation. When one or more of these

independent, yet interrelated systems fail due to disaster or other cause – even for a short period of time – it can have devastating consequences. For example, when power is lost during periods of extreme heat or cold, people can literally die in their homes if immediate mitigative action is not taken. When the water or waste treatment systems in a community are inoperable, serious public health problems arise that must be addressed immediately to prevent outbreaks of disease. When storm drainage systems fail due to damage or an overload of capacity, serious flooding can occur.

These are just some examples of the types of infrastructure failures that can occur, and all of these situations can lead to disastrous public health and safety consequences if immediate mitigative actions are not taken. Typically, it is the most vulnerable members of society (i.e., the elderly, children, impoverished individuals, and people in poor health) that are the most heavily impacted by an infrastructure failure. If the failure involves more than one system, or is large enough in scope and magnitude, whole communities and possibly even regions can be severely impacted.

Communication loss can be catastrophic in emergency situations in the county. Power outages or direct damage to communication equipment could mean life or death in certain situations. The population is dependent on emergency services getting to the incident site in a timely manner, and if there is damage to the equipment, the services may not reach their destination at all. The elderly population in the county is especially vulnerable to power outages and times of extreme weather and these times are the most important to get services to them. In that case, there needs to be an alternative way of communication for the emergency services to reach their destination.

The county has come up with a few ideas to help solve this problem. They suggested that Mutual aid assistance for failures in utility and communications systems (including 9-1-1) could help alleviate the problem. Alternative 9-1-1 access could be done through radio operators whose homes are identified through special markings. Also, they could use generators for backup power at critical facilities. Finally, the replacement or renovation of aging structures and equipment (to make as hazard resistant as economically possible).

Infrastructure Failures in Gratiot County

On June 26, 2001 there was a disruption of telephone service in Gratiot County. Each individual phone exchange was isolated unto itself. No community was able to make telephone calls outside of their local exchange. It was discovered that a construction project in the Saginaw area had caused damage to a fiber optic communication line.

This problem also affected the 911 and LEIN lines for the Gratiot County Dispatch. Communications to the areas outside of Gratiot County were done via radio. Local Fire Departments manned their stations to take emergency calls from their communities. The Amateur Radio Operators Group (RACES) was activated. They provided communications between the hospitals, nursing homes, and on-call doctors in the area. This event lasted approximately 5 ½ hours.

On 8/14/03 portions of the northeastern U.S. covering eight states suffered a power outage. This included metro Detroit. While the outage did not affect Gratiot County directly, there was a major exodus from metro Detroit resulting in a large influx of visitors to the northern counties, including Gratiot County.

Infrastructure Failures Overview

Most of Gratiot County's infrastructure failures are secondary hazards caused by other major events such as floods, windstorms, snow and ice storms. The main infrastructure failures are power outages, which are normally restored in a matter of hours. Gratiot County EMD maintains short term shelter agreements with multiple agencies. However, if the power were out for a longer period of time, the local chapter of the American Red Cross would be called to set up temporary shelters.

Cyber attack

Cyber attack: cyber attack is a malicious and deliberate attempt by an individual or organization to breach the information system of another individual or organization. Usually, the attacker seeks some type of benefit from disrupting the victim's network.[19]

Hazard Description

Cyber attacks threaten businesses daily and have incrementally increased in recent years. According to Cisco, the total number of cyber attacks have increased nearly fourfold over a 20-month period from January 2016 to October 2017.[20] These attacks can range from the installation of malware (malicious software) to intentionally cause damage to computers or computer networks to calls to the public and defraud them from the money in their bank accounts.

Cyber attack Overview

While some forms of cyber attack occur every day, the main focus of cyber attacks is two-fold. The first concern is at the county level and is a large-scale event or events that can be inflicted on local banking or other financial/economic institution causing widespread hardship in our population. The second concern are telephone calls that use misrepresentation and prey upon the general public, specifically the elderly or lower income households as Gratiot County's demographic includes a large population of lower income and retired households. A disruption in monthly payment or replenishment would have severe financial hardships and could result in civil disobedience that could quickly overwhelm local resources. With most banking and financial transactions done electronically and are web-based, this is a threat that we have identified as a known hazard.

Recent examples that have occurred have been IRS Tax Fraud Schemes via email and telephone, Gas Credit Card and ATM Skimmer operations that have resulted in theft of credit card number causing misuse of credit cards and lost funds and customer confidence issues that have resulted in lost revenue to local businesses. Gratiot County Law Enforcement, and Emergency Management and Homeland Security Division continue to monitor critical infrastructure sites and Government facilities for cyber intrusions. Gratiot County Emergency Management and Homeland Security continue to educate businesses, community leaders, and general populations to all aspects of cyber related activities. This also includes a recent grant awarded to further educate the senior population.

[19] Cisco Technology
[20] Cicso Technology

Ecological Hazards

WILDFIRES

Wildfire: an uncontrolled fire in grass or brushlands, or forested areas.

Hazard Description

Contrary to popular belief, lightning strikes are not a leading cause of wildfires in Michigan. According to 2017 Michigan Department of Natural Resources (MDNR) information, the leading cause of wildfires in Michigan was debris burnings, lightning caused only 4 percent of all wildfires and was seventh highest cause on the list. Debris burning was responsible for 32 percent of the wildfires.

Upon examination of the causes of fire, it becomes apparent that most Michigan wildfires occur close to where people live and recreate, which puts both people and property at risk. The immediate danger from uncontrolled wildfires is the destruction of timber, structures, other property, wildlife, and injury or loss of life to people who live in the affected area or who are using recreational facilities in the area.

Wildfires in Gratiot County

Although there have been no significant wildfires in Gratiot County in recent years, each year there are a number of small fires, most of which are so minor in nature the Michigan Department of Natural Resources (MDNR) is not called to assist in addressing the fire. (Please refer to the Wildfires Overview section for more information on the annual number of wildfires in Gratiot County.) Given the appropriate weather, fuels (dry and dead grasses, tree debris, etc.) and topography, any fire can develop into a significant wildfire.

Wildfire Overview

The MDNR reports that since 1980 there have only been two (2) forest fires reported to their office, or one fire every 20 years. Having such an evert would be a 5 percent probability. With neither fire resulting in any deaths, injuries, or physical damage to buildings or crops. These events are diminishing in the County with the reduced amount of forest/wooded areas. Also, with the improved training now be available to local fire departments, wildfires were given a moderate priority to address.

INVASIVE SPECIES

Invasive Species: a species that has been introduced by human action to a location where it did not previously occur naturally, becomes capable of establishing a breeding population in the new location without further intervention by humans, and becomes a pest by threatening local biodiversity and causing human health impacts, significant economic costs, and/or harmful ecological effects.

Hazard Description

Invasive species can be transported in many ways, such as on animals, vehicles, ships, commercial goods, produce, and clothing. Although non-native species are the foundation of U.S. agriculture, and also are used to prevent erosion, to provide fishing and hunting opportunities, and as ornamental plants and pets,

occasionally a non-native organism flourishes too well and causes unwanted economic, ecological, or human health impacts. The terms "invasive" or "nuisance" are used to describe such species.

Hazard Analysis

Hundreds of new species from other countries are introduced intentionally or accidentally into the United States each year. These invasive species may arrive on our shores in a variety of ways. Transportation efficiencies that make it possible to travel around the globe in hours rather than weeks make it possible for organisms to survive transportation from one continent to another. As more adaptable and generalized species are introduced to environments already impacted adversely by human activities, native species are often at a disadvantage to survive in what was previously a balanced ecosystem.

Invasive Species in Gratiot County

The LPT has identified the following invasive species as concerns due to their impact or potential impact to the residents, livestock, vegetation located in Gratiot County. Insects: Asian Long-Horned Beetle, Emerald Ash Borer, Gypsy Moth, and Khapra Beetle. Microbes: Dutch Elm Disease. Water Species: Asian Carp, Sea Lamprey, and Dreissenid Mussels. Terrestrial Animals: Boar. Livestock Diseases: foot and Mouth Disease. Wildlife Diseases: Chronic Wasting Disease. Plant Species: Autumn Olive, Baby's Breath, Black Alder, Black Locust, Common Buckthorn, Dame's Rocket, Flowering Rush, Garlic Mustard, Glossy Buckthorn, Hogweed, Honeysuckle, Common Privet, Japanese Barberry, Lyme Grass, Multiflora Rose, Ornamental Grasses, Narrow-leaved Cattail, Oriental Bittersweet, Phragmites, Purple Loosestrife, Reed Canary Grass, Spotted Knapweed, Swallow-wort, Teasel, Thistles, Wild Parsnip.

Invasive Species Overview

Gratiot County continues to address several invasive species such as phragmites, emerald ash borer, and Dutch elm disease on a limited basis. Due to the exorbitant costs to eliminate any single one species, they can only address these species in limited fashion. In addition, there is a concern that any or all of these species could be out of control at any given time, such as the case with the emerald ash borer, whose effects are still being felt.

Fires

STRUCTURAL FIRES

Structural fire: a fire, of any origin that ignites one or more structures, causing loss of life and/or property.

Hazard Description

In terms of average annual loss of life and property, structural fires – often referred to as the "universal hazard" because they occur in virtually every community – are by far the biggest hazard facing most communities in Michigan and across the country. Each year in the United States, fires result in approximately 5,000 deaths and 25,000 injuries requiring medical treatment. Direct property losses due to fire exceed $9 billion per year – and much of that figure is the result of structural fire.

According to the Federal Emergency Management Agency's National Fire Data Center, residential fires represent 74% of all structural fires and cause 80% of all fire fatalities. Approximately 85% of those

fatalities occur in single- family homes and duplexes. Perhaps the most tragic statistic of all is that over 40% of residential fires and 60% of residential fatalities occur in homes with no smoke alarms.[21] This is especially critical in Gratiot County as the County is considered to be a rural county and most of the structures are residential.

According to statistics compiled by the Fire Marshal Division, Michigan Department of State Police for 2003 (the last year for which statewide statistics are available), nearly 19,000 structural fires occurred in Michigan, resulting in 161 deaths and 624 injuries. Dollar losses for structural fires were estimated at nearly $230 million. The Fire Marshal Division estimated that a structural fire occurred in Michigan every 28 minutes in 2003. Nationally, Michigan's fire death rates in 2007 of 15.4 persons per million (population) puts it in the upper third of all states in the nation.

There are several major challenges to firefighting in Michigan and Gratiot County. The first major challenge is regarding the Michigan fire service and the lack of a state-mandated fire safety code and code enforcement program for all occupancies. A second major challenge is the firefighting capacity within Gratiot County. There is not a full-time firefighting staff in Gratiot County. Communities without full-time firefighters are reliant upon paid-on-call firefighters or are without a fire service at all.

Due to the smaller size of the fire departments, when there is a multiple alarm fire within the County, other municipal fire departments are called out to assist in putting out the fire. This is not only a strain on the communities, should another fire occur.

Structural Fires in Gratiot County

There are numerous fires annually in Gratiot County that are handled by local fire departments. While a large majority of them are residential in nature, several commercial fires have occurred in recent years.

On 3/10/1969 one of Alma College's first academic and administrative buildings, "Old Main" caught fire and burned down in about an hour. Students and faculty initially evacuated the building but returned to carry out equipment and records until they were stopped by firemen. The fire destroyed classrooms, faculty offices, manuscripts, research documents and other records. An historic marker has been placed on campus.

On 02/11/1987 in the City of Ithaca, a fire destroyed a portion of a downtown block when Beebe Furniture Store caught fire. Fire also destroyed a video store, sporting goods shop, and a shoe store. In addition, an attorney's office, TV repair shop, and bridal shop suffered smoke and water damage. Two firefighters suffered smoke inhalation. Fire departments from Ithaca, Alma, St. Louis, Ashley, and Shepherd assisted in putting out the fire.

On 10/14/2010 the historic Alma Opera House in the City of Alma burned down along with several other downtown buildings.

[21] FEMA's National Fire Data Center

On 03/02/2016 two buildings were destroyed, and a third building was damaged in a downtown fire in the city of Alma. No persons died or were injured as a result of the fire. It was determined that the owner of one of the buildings was convicted of arson. Fire departments from Alma, St. Louis, Ithaca, Breckenridge, Perrinton, Shepherd, Mt. Pleasant, and Vestaburg assisted in battling the fire.

07/16/2018 a residential fire in the City of Alma claimed the life of the resident of the apartment. In addition, several fire fighters from Alma were treated for smoke inhalation. These individuals were treated and were back to work within the week.

On 11/03/2018 the St Louis Chrysler dealership in the City of St. Louis was partially destroyed when a fire broke out in the service area of the dealership. Damage was limited to the structure; however, one fire fighter was treated for over-exertion from the fire. No other deaths or injuries were reported.

On 10/19/2019 in the unincorporated community of Pompeii, a residential fire broke out with no local water supply. Local fire departments from Perrinton, Ashley, Ithaca, St. Louis, Elsie, Maple Rapids, and Carson City all assisted in putting out the fire.

Structural Fires Overview

Structural fires occur in every community annually. Older, more historic neighborhoods are more prone to fire as the homes are not as fireproofed as the more recently constructed homes. Because fires are a major concern in every municipality, most cities/villages have some form of fire department. As the municipalities in Gratiot County are all smaller, rural communities, all departments have volunteer fire departments, with a fire chief that is either full-time or part-time. With smaller fire departments any multiple alarm fire, residential or commercial, will require the assistance of other departments.

SCRAP TIRE FIRES

Scrap tire fire: a large fire that burns scrap tires being stored for recycling/re-use.

Hazard Description

Michigan generates some 7.5 to 9 million scrap tires each year. Although responsible means of disposal have become more common, tire dumps of the last forty years present environmental and safety hazards that will last into the foreseeable future. By 2001, the State of Michigan had identified a total in excess of 24 million scrap tires in disposal sites scattered around the state. By 2010, these were all reported as removed from the county.

The Scrap Tire Regulatory Program is implemented by the Waste Management Division of the Michigan Department of Environment, Great Lakes, and Energy (EGLE), under the authority of Part 169 of the Natural Resources and Environmental Protection Act (451 P.A. 1994), as amended. Policies and regulations established under this law provide the basis for the EGLE to implement and administer an effective scrap tire management program per the following initiatives: 1) a compliance and enforcement program was implemented; 2) a scrap tire policy recycling hierarchy was established; 3) special uses of scrap tires were approved; and 4) a grant program was established to address abandoned tires.

In 1997, Part 169 was amended to require that a statewide emergency response plan be put into place to address response to fires at collection sites.

Scrap Tire Fires in Gratiot County

Gratiot County has not had a significant scrap tire fire in recent memory.

Scrap Tire Overview

With the elimination of scrap tire sites within Gratiot County, this hazard has been greatly reduced. As there are old tires located at car dealerships and other sites, this hazard has not been completely eliminated.

Seasonal Population Increase

SEASONAL POPULATION INCREASE

Seasonal population increase: A population, in the county, beyond the normal level of people to which resources are allocated.

Hazard Description

As more and more people vacation to the northern portions of Michigan, local communities in northern Michigan are going to find it harder to maintain levels of safety and resources to keep the population in the jurisdictions comfortable and safe. The trend of people buying summer homes or cottages is growing, and with the advent of Baby-Boomers reaching retirement age, the seasonal and permanent populations of the northern counties will continue to slowly grow.

Many stresses are put on local governmental agencies such as fire departments, police departments, as well as hospitals, the road commission, and ambulance services to maintain the status quo of service for their county. With more people relocating to the northern counties for extended periods of time, the level of staff and resources may not suffice to the needs of the population.

Gratiot County is no exception to seasonal population spikes in the summer, deer season, and to a lesser extent, the winter months.

Seasonal Population Increases in Gratiot County

With the power outages across the country in the summer of 2003, Gratiot County experienced a high influx of people from the Detroit area going to their seasonal homes. The emergency management office reported that there were low supplies of food and stresses on emergency services in Gratiot County.

Seasonal Population Increase Overview

Seasonal population increase will continue to be a problem in Gratiot County, located in the center of the Lower Peninsula, as well as many of the counties in the northern portion of the State of Michigan unless there are preventative measures taken to solve it. This summer population is based on numerous visitors of the four campgrounds located throughout the County. Many of the visitors stay throughout the summer, while others have varied “residence” times.

The population of Gratiot County is projected to steadily increase and with budget cuts, Gratiot County is finding it hard to maintain the status quo for emergency services. The seasonal population influx will only make the situation harder to manage. Also, infrastructure problems in southern Michigan can be a factor that directly affects Gratiot County. During the summer months many Gratiot County local communities have festivals, concerts and special events. This brings in many hundreds and sometimes thousands of visitors into confined areas. Due to the lack of overall resources it strains the local emergency services. More comprehensive planning including the use of Michigan State Police Large Venue Planning is administered by the MSP/EMHSD Local Emergency Management and Homeland Security Division. This planning process encompasses both local and external threat matrices, local emergency services, weather related and evacuation planning.

Population Increases Due to Large Venue Planned Event

Gratiot County communities experience large population increases during summer seasonal months due to "Snowbirds" that winter in warmer climates. However, the County also has large population influxes due to holidays and large venue events.

All of these events draw large crowds of people into smaller community venues, taxing local resources and making them vulnerable to unexpected occurrences such as Severe Weather, Civil Disturbance, or Acts of Terrorism.

Civil Disturbances

CIVIL DISTURBANCES

Civil disturbances: collective behavior that results in a significant level of law-breaking, perceived threat to public order, or disruption of essential functions and quality of life.

Hazard Description

Civil disturbances can be classified within the following four types: (1) acts or demonstrations of protest, (2) hooliganism, (3) riots, or (4) insurrection. Since most of these types of disturbance share similarities with each other, and the classifications presented here are not absolute and mutually exclusive, it is recommended that this entire section be studied as a whole. The descriptions that follow, while roughly organized by type of disturbance, provide information of interest in evaluating and understanding all types of civil disturbance, and therefore should not be treated as independent subsections or read in isolation from each other.

The first type, demonstrations of protest, usually contains some level of formal organization or shared discontent that allows goal-oriented activities to be collectively pursued. This first category includes political protests and labor disputes. Many protest actions and demonstrations are orderly, lawful, and peaceful, but some may become threatening, disruptive, and even deliberately malicious (on the part of at least some of those involved either in the protest itself or in reaction to the protest). It is only the latter type of event that should properly be classified as a civil disturbance. The destruction of property, interruption of services, interference with lawful behaviors of ordinary citizens and/or emergency responders, the use of intimidation or civil rights violations, and threats or actual acts of physical violence

may all occur during civil disturbance events. Actual Michigan events have included the willful destruction of property and impeded property access during labor strikes, and heated conflicts between opposing participants at political rallies or issue-driven demonstrations. Different risks and forms of disturbance are connected with the nature and perceived importance of the cause, the degree of organization among those who are active in the protest, and the amount of group cohesion among those who are involved.

The second category of civil disturbance, hooliganism, is relatively unorganized and involves individual or collective acts of deviance inspired by the presence of crowds, in which the means (and responsibility) for ordinary levels of social control are perceived to have slackened or broken down. Certain types of events, such as sporting events, "block parties," or concerts, become widely publicized and, in addition to normal citizens who merely seek entertainment, tend to also attract certain types of persons who seek situations in which anonymity, confusion, and a degree of social disorder may allow them to behave in unlawful, victimizing, or unusually expressive ways that would normally be considered unacceptable by most ordinary people. An Example includes the disorder that has followed various championship sporting events. Although the majority of persons present are ordinary citizens (although many may have some level of intoxication), a minority of persons begin making itself known through unlawful or extreme acts of deviance, and it is from this part of the crowd that the hazard primarily stems.

Common problems include the widespread destruction of property, numerous types of assault and disorderly conduct, and criminal victimization. It should also be noted that many persons who are normally law-abiding may temporarily behave in unusually aggressive ways during these events, often prompted by an understandably defensive anxiety about the disorder and behavior exhibited by the deviant minority, but also possibly exacerbated by a level of alcoholic intoxication as well as the temptation by some to engage in appealing deviant behaviors that under normal circumstances of social control would not be selected. Many citizens remain law-abiding but may remain in the area of a civil disturbance either because they live in the area, have activities (including social and recreational ones) that they wish to continue engaging in, have legitimate business to conduct, or because they are curious or concerned and wish to observe or witness the situation as it occurs. The majority of such law-abiding citizens will leave the area in an orderly way when given clear instructions by a legally recognized authority to do so. There are cases in which hooliganism may become combined with protest, and thus complicate the situation for law enforcement personnel. In some circumstances, elements of protest are added only by a small minority of participants after the disturbances have already begun, but in other circumstances, protest activity may arise out of concerns regarding the extent and nature of pre-emptive law enforcement activities that were intended to prevent a civil disturbance.

The third type, riots, may stem from motivations of protest, but lacks the organization that formal protests include. Although legitimate and peaceful protests may spontaneously form when people gather publicly with the perception that they already share certain values and beliefs, riots tend to involve violent gatherings of persons whose level of shared values and goals is not sufficiently similar to allow their collective concerns or efforts to coalesce in a relatively organized manner. Instead, there tends to be a diffuse sense of shared discontent, but relatively few norms to shape these strivings into clearly coherent action. For example, widespread discontent within a community that is sufficiently cohesive may quickly take on a set of shared leaders and clear organization, such as a march or chant that is clearly in the form of a protest or demonstration, but in an area that doesn't have the same cohesiveness and shared norms and values, a relatively chaotic form of expression may take place instead, involving assaults, intimidation,

and unlawfully destructive expressions of discontent, possibly including the victimization of innocent citizens or businesses who have been selected by part of the crowd to function as scapegoats during their expression of discontent. In addition to the sentiments of discontent that may have sparked the initial activities, however, elements of hooliganism may emerge and even come to predominate, as certain persons may attempt to exploit the social disorder for their own individual ends. In other cases, elements of legitimate protest may also form within this type of civil disturbance, and pockets of organized protest may help to channel and contain the negative elements of hooliganism, looting, etc. that might otherwise threaten all area residents. The complexity of these events for law enforcement can be very great, demanding carefully calculated efforts to analyze the nature of the disturbance, and difficult decisions about how to approach and possibly involve the numerous types of persons, gatherings, groups, and behaviors that may have the potential to either mitigate or exacerbate the situation.

The fourth type of civil disturbance, insurrection, involves a deliberate collective effort to disrupt or replace the established authority of a government or its representatives, by persons within a society or under its authority. Some prison uprisings may fall into this category, although others may more properly be classified as riots or protests, depending upon the presence and extent of specific goals and organization, and the type of action used in achieving such goals. An insurrection has the deliberate goal of either replacing established authorities with a new distribution of power, or with the destruction of established power structures in favor of (usually temporary) anarchy or a smaller-scale set of recognized criminal (gang), ethnic, or other group networks and power structures. The latter circumstances tend to involve disturbances that exist on a relatively small scale, such as in a single local area or involving a prison network or "cult compound" (or any other similarly self-aware group or subculture with identified collective interests and a network that allows rapid communication). However, larger-scale insurrections are also possible, involving issues of class conflict or other widespread social inequalities, highly divisive political issues, or other important large-scale events that disrupt the social equilibrium because they illuminate areas in which cultural values are not sufficiently shared throughout the society or region that is experiencing the conflict, disruption, or strain. In many cases, this kind of large-scale social strain has developed gradually over time, and involves an entire series of compromises, concessions, and migrations that may temporarily relieve the disruptive social and value conflicts, only to reemerge after another period of changes and population growth has caused a breakdown in previous arrangements. This description of the causes of social discontent applies to many protests and riots, as well as insurrection. In cases involving the formation or emergence of significant subcultures or counterculture, such as during the Vietnam era, or when dominant values break down or fail to be established on important key issues or mores, there is the potential for insurrection on a larger scale. The Civil War of 1861-1865 was one such instance, in which the authority of the federal government was either accepted or rejected by various states which then aligned themselves in opposition to each other. Between these two extremes (of a purely localized civil disturbance and a national civil war) are numerous other possibilities for regional, political, class, or ethnic conflicts that may involve one or more categories of citizen in conflict with others. Examples could include prisoners versus law enforcement personnel, a countercultural group versus the establishment, or a violent political activist group in conflict with selected representatives of a contrary viewpoint. (Some such actions may overlap with those of terrorism, q.v.)

Civil Disturbance in Gratiot County Overview

Civil disturbances occur rarely in Gratiot County. However, with the ever-increasing threats throughout society, this is a growing problem that should a civil disturbance of a large magnitude occur, the Michigan

State Police, and possibly other law enforcement details will have to be called in to assist the local public safety personnel.

NUCLEAR ATTACK

Nuclear attack: a hostile action taken against the United States which involves nuclear weapons and results in destruction of property and/or loss of life.

Hazard Description

Any hostile attack against the United States, using nuclear weapons, which results in destruction of military and/or civilian targets. All areas of the United States are conceivably subject to the threat of nuclear attack. However, the strategic importance of military bases, population centers and certain types of industries place these areas at greater risk than others. The nature of the nuclear attack threat against the U.S. has changed dramatically with the end of the "Cold War" and the conversion of previous adversaries to more democratic forms of government. Even so, the threat still exists for a nuclear attack against this country. Despite the dismantling of thousands of nuclear warheads aimed at U.S. targets, there still exists in the world a large number of nuclear weapons capable of destroying multiple locations simultaneously. In addition, the number of countries capable of developing nuclear weapons continues to grow despite the ratification of an international nuclear non-proliferation treaty. It seems highly plausible that the threat of nuclear attack will continue to be a hazard in this country for some time in the future.

At this point, attack-planning guidance prepared by the Federal government in the late 1980s still provides the best basis for a population protection strategy for Michigan. That guidance has identified 25 potential target areas in Michigan, and 4 in Ohio and Indiana that would impact Michigan communities, classified as follows: 1) commercial power plants; 2) chemical facilities; 3) counterforce military installations; 4) other military bases; 5) military support industries; 6) refineries; and 7) political targets. For each of these target areas, detailed plans have been developed for evacuating and sheltering the impacted population, protecting critical resources, and resuming vital governmental functions in the post-attack environment. Even though Iosco County has an airbase; the threat of a nuclear attack has been lowered due to the end of the "Cold War" and the closure of the base. There still may be a small threat to the former base because it could still be reused for B-52 MStratfortress bomber operations in case the current Stratfortress base is destroyed. The airfield could also have the potential for terrorism/sabotage and is being looked at under that category.

Nuclear weapons are explosive devices that manipulate atoms to release enormous amounts of energy. Compared to normal chemical explosives such as TNT or gunpowder, nuclear weapons are far more powerful and create harmful effects not seen with conventional bombs. A single nuclear weapon is able to devastate an area several miles across and inflict thousands of casualties. Although nuclear attack is an unlikely threat, the severe damage that would be caused by even one weapon requires the danger to be taken seriously.

The threat of nuclear attack has primarily been associated with the Cold War between the United States and the Soviet Union in the last half of the 20th Century. Although the Cold War is over, there remains a

threat of nuclear attack. More nations have developed nuclear weapons and there is also the possibility that terrorists could use a nuclear weapon against the United States.

Hazard Analysis/Understanding Nuclear Weapons

The following information about nuclear weapons is important for understanding the threat of nuclear attack: (1) types of nuclear weapons, (2) measures of weapon power, (3) forms of attack, and (4) types of delivery systems.

Nuclear weapons have been built in a wide variety of types for several different purposes. The first weapons relied on nuclear fission, or the splitting of heavy atoms to release energy and create an explosion. Later, new weapons were invented that used a combination of fission and fusion, which involves the creation of heavier atoms from lighter ones. Fusion bombs are also referred to as hydrogen bombs or H-bombs. For emergency planning purposes, the important differences are that (1) fusion bombs are more difficult to build and (2) that they can be much more powerful. Otherwise, all types of nuclear weapons create the same types of effects.

The power of nuclear weapons is measured by comparing the energy released by the weapon to the energy released by large amounts of conventional high explosive. The strengths of smaller weapons are measured in kilotons (or thousands of tons) of TNT explosive. A twenty-kiloton bomb produces as much energy as twenty thousand tons of TNT exploded all at once. The strength of larger weapons is measured in megatons, or millions of tons of TNT. A two-megaton bomb produces as much energy as two million tons of high explosive.

Smaller nuclear weapons are generally designed to be used against military targets on the battlefield. These are called tactical nuclear weapons. Larger devices designed to attack cities, infrastructure, and military bases are called strategic nuclear weapons.

Bombs can be set off at varying heights above the target. If the bomb is set off high in the air, its effects are spread out over a wider area and generally more damage is done. This is called an air burst. A bomb that is set off at or near the Earth's surface level wastes much of its energy against the ground. This is called a ground burst. Ground bursts have some specific military uses and terrorists may use ground bursts because they are unable to lift their weapons high enough to create an air burst.

Like any weapon, a nuclear device must be carried to its target by a delivery system. The first nuclear weapons were bombs dropped out of aircraft. Later, tactical weapons were made small enough to fire out of cannons or carry in large backpacks. Intercontinental ballistic missiles (ICBMs) are rockets that can carry one or more nuclear weapons across thousands of miles in less than an hour. Terrorists may lack sophisticated missiles, but they could create effective delivery systems by transporting a nuclear weapon in the back of a truck, aboard a cargo plane, or within a shipping container.

Effects of Nuclear Weapons

The effects of nuclear weapons are more complicated than those of conventional explosives. Nuclear devices cause damage through six major effects: (1) thermal pulse, (2) blast, (3) prompt radiation, (4) electromagnetic effects, (5) mass fire, and (6) residual radiation.

THERMAL PULSE is an intense flash of light and heat released within the first few seconds of a nuclear explosion. The damage from thermal pulse is almost instantaneous and covers a wide area. People and animals exposed to the pulse can be badly burned. Flammable objects such as buildings, vehicles, and trees may be set on fire. The flash is strongest close to the bomb and becomes weaker with distance. Even people located far away from the explosion may still be blinded by the intense light of the pulse.

BLAST is a powerful wave of force that moves out from the center of the explosion through the air and the ground. The farther the blast travels, the weaker it becomes. Very close to the bomb, the blast will destroy even the most strongly built buildings and will kill everyone not hidden deep underground. Farther away, buildings may survive, but with severe damage, and people will be injured by being picked up and smashed against objects. At still greater ranges, buildings will be less damaged, and injuries will largely result from shattered glass and thrown debris. At all distances, a powerful wind follows the initial blast wave and adds to the destruction. The blast from a ground burst will dig a large crater into the ground, but this cratering will not occur with an air burst.

PROMPT RADIATION is the harmful blast of high energy radiation given off at the same time as the thermal pulse. Prompt radiation includes gamma rays and neutron radiation. This radiation is capable of killing or injuring living beings by damaging tissues and organs. Prompt radiation is quickly absorbed by the atmosphere and does not impact as wide an area as other nuclear weapons effects. In most instances, a person close enough to receive a harmful dose of prompt radiation is also close enough to be immediately killed by the explosion's thermal pulse or blast. However, in unusual cases, some people who survive the immediate effects of the bomb may sicken or die days later, from radiation poisoning.

ELECTROMAGNETIC EFFECTS occur immediately after a nuclear explosion and may damage communications equipment, computers, and electronics. Radios, cell phones, and power lines are especially vulnerable. In most cases, the effects are limited to an area near to the explosion. Some equipment may recover after a period of time, while other devices will need to be replaced. One special type of nuclear attack might cause more widespread electromagnetic effects: a very large nuclear weapon carried high into the atmosphere by a missile is capable of damaging communications and electronics over a very large area.

MASS FIRE results from the ignition of thousands of individual fires by a bomb's thermal pulse, combined with widespread destruction from its blast. Over a period of hours, small fires merge and feed on damaged buildings and debris. Controlling these fires would be very difficult, due to damaged water mains, destroyed fire-fighting equipment, and blocked roads. The result is an extremely intense fire that can spread quickly and reach very high temperatures. Mass fire may significantly expand the area devastated by a bomb, destroying areas that might otherwise be only lightly damaged by other types of effects.

RESIDUAL RADIATION is unlike prompt radiation in that it lasts well after the nuclear explosion has ended. The ground immediately underneath the center of the explosion will be dangerously radioactive for several days due to "induced radiation." There will also be some radioactive dust and debris that will drift downwind of the explosion. This radioactive dust is called "fallout." Fallout will be a minor problem in the case of an air burst explosion but will be very intense in the case of a ground burst attack. Regardless of the type of attack, the danger from fallout will tend to be greatest close to the site of the attack. The cloud of fallout will weaken the longer it lasts and the farther it travels.

Note that the effects of a nuclear attack will depend on the size of the weapon. A larger bomb will cause damage over a wider area. The importance of different types of damage will also vary with the weapon. Large strategic nuclear weapons will create most of their damage though thermal pulse and mass fires, while with small tactical bombs the blast effect and prompt radiation will be relatively more important.

Nuclear Attack Overview

Nuclear attack is an unlikely hazard, but even a single weapon could cause death and destruction on a massive scale. Nuclear weapons inflict damage over a wide area and through a variety of effects, including thermal pulse, blast, fire, and radiation. Despite the end of the Cold War, nuclear attack by foreign nations remains a real possibility, and this danger has been joined by the threat of terrorist nuclear attack. It makes sense to continue to prepare for the nuclear attack hazard as part of an overall emergency management strategy.

Hazard Mitigation Alternatives for Nuclear Attack

- Designated fallout shelters and public warning systems.
- Construction of concrete safe rooms (or shelters) in houses, trailer parks, community facilities, and business districts.
- Using laminated glass, metal shutters, structural bracing, and other hazard-resistant, durable construction techniques in public buildings and critical facilities.
- Increased coverage and use of NOAA Weather Radio (which can provide notification to the **c**ommunity during any period of emergency, including enemy attack).

SABOTAGE (TERRORISM)

Sabotage (terrorism): an intentional, unlawful use of force or violence against persons or property to intimidate or coerce a government, the civilian population, or any segment thereof, in furtherance of political, social, or religious objectives.

Hazard Description

Sabotage/terrorism can take many forms or have many vehicles for delivery, including: 1) bombings; 2) assassinations; 3) organized extortion; 4) use of nuclear, chemical, radiological, and biological weapons; 5) information warfare; 6) ethnic/religious/gender intimidation (hate crimes); 7) state and local militia groups that advocate overthrowing the U.S. Government; 8) eco-extremism, designed to destroy or disrupt specific research or resource-related activities; and 9) widespread and organized narcotics smuggling and distribution organizations. Because sabotage/terrorism objectives are so widely varied, so too are the potential targets of such actions. Virtually any public facility or infrastructure, or place of public assembly, can be considered a potential target. In addition, certain types of businesses engaged in controversial activities are also potential targets, as are large computer systems operated by government agencies, banks, financial institutions, large businesses, health care facilities, and colleges/universities.

One of the first acts of domestic sabotage/terrorism ever carried out occurred in Michigan on May 18, 1927, in Bath. A disgruntled taxpayer and farmer detonated 1,000 pounds of explosives under the newly constructed Bath Consolidated School killing 38 students and 3 teachers and injuring 58 others. The

perpetrator then blew himself up, along with the school superintendent. As tragic as that event was, it could have been worse were it not for the fact that half of the explosives failed to detonate as planned, which certainly would have killed many more students and teachers. Concentrated activities to prevent terrorist activities have become even more vital with the passage of time and in the wake of the 9/11 events of destruction in New York City and Washington D.C. Many more resources may anticipate being mobilized to prevent terrorist activities in the near future.

Although at first it might appear Gratiot County is an unlikely target for terrorism, it cannot be totally discounted. Potential targets include the dams, the water treatment plant, the runways at the airports, and all industrial sites in the area. Furthermore, any government building, school, or individual can become a target of domestic terrorism.

Sabotage and Terrorism include a broad range of potential hazards that affect a community from a variety of perspectives. This hazard is defined as an intentional, unlawful use of force or violence against persons or property to intimidate or coerce a government, the civilian population, or any segment thereof, in furtherance of political, social, or religious objectives. Sabotage/terrorism can take many forms or have many vehicles for delivery, including: 1) bombings; 2) assassinations; 3) organized extortion; 4) use of nuclear, chemical, radiological, and biological weapons; 5) information warfare; 6) ethnic/religious/ gender intimidation (hate crimes); 7) state and local militia groups that advocate overthrowing the U.S. Government; 8) eco-extremism, designed to destroy or disrupt specific research or resource-related activities; and 9) widespread and organized narcotics smuggling and distribution organizations.

Sabotage Overview

Even though there have not been any recently recorded sabotage/terrorism events occurring in Gratiot County, the Emergency Management staff has regularly scheduled training events to address these circumstances. With the ever-growing threat of local acts, the County is working to prepare their personnel should an event occur.

Public Health Emergencies

PUBLIC HEALTH EMERGENCIES

Public health emergency: a widespread and/or severe epidemic, incident of contamination, or other situation that presents a danger to or otherwise negatively impacts the general health and well-being of the public.

Hazard Description

Public health emergencies can take many forms: 1) disease epidemics; 2) large-scale incidents of food or water contamination; 3) extended periods without adequate water and sewer services; 4) harmful exposure to chemical, radiological, or biological agents; 5) large scale infestations of disease-carrying insects or rodents. Public health emergencies can occur as primary events by themselves, or they may be secondary events another disaster or emergency, such as flood, tornado, or hazardous material incident. The common characteristic of most public health emergencies is that they adversely impact, or have the

potential to adversely impact, a large number of people. Public health emergencies can be statewide, regional, or localized in scope and magnitude.

Perhaps the greatest emerging public health threat would be the intentional release of a radiological, chemical, or biological agent with the potential to adversely impact a large number of people. Such a release would most likely be an act of sabotage aimed at the government or at a specific organization or segment of the population. Fortunately, Michigan has not yet experienced such a release aimed at mass destruction.

Public Health Emergencies in Gratiot County

The most common type of public health emergency involves influenza that spreads through educational institutions, the workplace and other entities that experience a large volume of public traffic. Influenza typically kills between 200 and 500 individuals in Michigan alone and has the potential to change its structure and rapidly affect large populations.

In 1974 just outside of St Louis Michigan, in the heart of Gratiot County, a local farmer fed polybrominated biphenyl (PBB) contaminated feed to his dairy herd. Michigan Chemical Corporation (Velsicol) which was located in the city limits of St Louis had supplied the Michigan Farm Bureau Services with sacks of fire-proofing chemical PBB (which is known to cause cancer, genetic mutation, and birth defects), instead of the intended magnesium oxide feed supplement (commonly used in antacid tablets used for human consumption) as part of a custom dairy feed #402. During the crucial eight-month period between the farmer's first observations and the discovery of the accident, serious statewide contamination had already occurred. By 1975 the state had quarantined more than 500 farms. Condemned for slaughter were more than 17,000 cattle; 3,415 hogs; 1.5 million chickens and 4.8 million eggs. Still today, 6 in 10 people tested for PBB in Michigan have levels above the national average, including some born after the disaster. For further detail of the disaster and subsequent disaster management refer to: United States Environmental Protection Agency website:
https://cumulis.epa.gov/supercpad/cursites/csitinfo.cfm?id=0502194 or the book ""Tombstone Town: Left for dead, marked with a tombstone, a toxic town fights back" - published in 2015 which is a memoir of a local resident and community activist, Jane Keon.

In 2009 the County experienced an outbreak of the Swine Flu (H1N1 Flu Virus). While there were no reported deaths as a result of the Flu, there were over 2250 vaccinations administered to combat the flu.

Public Health Emergency Overview

In the 1980s, the state health department confirmed that 95 percent of Michigan's population had PBB in their bodies from eating beef, drinking milk or consuming other products from contaminated farms. A cancer epidemic was feared. Although one has not occurred, so far anyway, studies do show the most exposed families have increased breast and digestive cancer, and lymphoma. Among the effects observed in the exposed populations the daughters of the most highly exposed women began menstruation, on average, before they reached their twelfth birthdays.

In 2001, Michigan health officials were introduced to the emerging health threats posed by foot-and-mouth disease and the West Nile encephalitis virus. Although foot-and-mouth disease is a highly

contagious disease that only affects animals, a widespread outbreak such as that which occurred in parts of the United Kingdom in the spring of 2001 could have significant public health implications for humans as well, due to the potentially large numbers of dead animal carcasses that would have to be disposed of to prevent disease outbreaks. The Michigan Department of Agriculture and Rural Development, in conjunction with numerous other federal, state and local agencies and the agriculture industry, continues to monitor the foot-and-mouth disease situation and take the necessary steps to prevent the introduction and spread of the disease in the United States.

Geological Hazards

EARTHQUAKES

Earthquake: a shaking or trembling of the crust of the earth caused by the breaking and shifting of rock beneath the surface.

Hazard Description

Earthquakes range in intensity from slight tremors to great shocks. They may last from a few seconds to several minutes or come as a series of tremors over a period of several days. The energy of an earthquake is released in seismic waves. Earthquakes usually occur without warning. In some instances, advance warnings of unusual geophysical events may be issued. However, scientists cannot yet predict exactly when or where an earthquake will occur. Earthquakes tend to strike repeatedly along fault lines, which are formed where large plates of the earth's crust below the surface constantly push and move against one another. Risk maps have been produced which show areas where an earthquake is more likely to occur. Earthquake monitoring is conducted by the U.S. Geological Survey, the National Oceanic and Atmospheric Administration, and universities throughout the country.

The actual movement of the ground in an earthquake is seldom the direct cause of injury or death. Most casualties result from falling objects and debris. Disruption of communications systems, electric power lines, gas, sewer and water mains can be expected. Water supplies can become contaminated by seepage around water mains. Damage to roadways and other transportation systems may create food and other resource shortages if transportation is interrupted. In addition, earthquakes may trigger other emergencies such as fires and hazardous material spills, thereby compounding the situation.

Earthquake Overview

No severely destructive earthquake has ever been documented in Michigan. However, several mildly damaging earthquakes have been felt since the early 1800s. The exact number is difficult to determine, as scientific opinion on the matter varies. With most of these earthquakes, damage (if any) was limited to cracked plaster, broken dishes, damaged chimneys, and broken windows. (Biggest Michigan threats would be to pipelines, buildings that are poorly designed and constructed, and shelving, furniture, mirrors, gas cylinders, etc. within structures that could fall and cause injury or personal property damage)

The greatest impact on Gratiot County would probably come from damage to natural gas and petroleum pipelines. If the earthquake occurs in the winter, areas of the state could be severely impacted by fuel

shortages - which could translate into shortages in Gratiot County. Being on the I-127 corridor, the Cities of Alma, Ithaca, and St. Louis are positioned to receive shipments from major suppliers from the South.

Damage would probably be negligible in well-designed and constructed buildings. However, poorly designed and constructed buildings could suffer considerable damage under the right circumstances.

In January 1990, Executive Order (EO) 12699, Seismic Safety of Federal and Federally Assisted or Regulated New Building Construction, was signed into law. This EO requires that appropriate seismic design and construction standards and practices be adopted for any new construction or replacement of a federal building or federally building during or after an earthquake.

Gratiot County is not in an area designated as being high risk from ground movement; yet by encouraging awareness of the hazards of poor construction practices and/or routine evaluations of existing structures for deficiencies, vulnerabilities can be identified and repaired before loss is sustained.

There is some chance of a moderate earthquake over the next few decades, which might be strong enough to damage some property and underground infrastructure.

SUBSIDENCE

Subsidence: the lowering or collapse of the land surface caused by natural or human-induced activities that erode or remove subsurface support.

Hazard Description

Subsidence is the lowering or collapse of the land surface due to loss of subsurface support. It can be caused by a variety of natural or human-induced activities. Natural subsidence occurs when the ground collapses into underground cavities produced by the solution of limestone or other soluble materials by groundwater. Human- induced subsidence is caused principally by groundwater withdrawal, drainage of organic soils, and underground mining. In the United States, these activities have caused nearly 17,000 square miles of surface subsidence, with groundwater withdrawal (10,000 square miles of subsidence) being the primary culprit. In addition, approximately 18% of the United States land surface is underlain by cavernous limestone, gypsum, salt, or marble, making the surface of these areas susceptible to collapse into sinkholes.

Generally, subsidence poses a greater risk to property than to life. Nationally, the average annual damage from all types of subsidence is conservatively estimated to be at least $125 million.

Mine Subsidence

In Michigan, the primary cause of subsidence is underground mining. Although mine subsidence is not as significant a hazard in Michigan as in other parts of the country, many areas in Michigan are potentially vulnerable to mine subsidence hazards. Mine subsidence is a geologic hazard that can strike with little or no warning and can result in very costly damage. Mine subsidence occurs when the ground surface collapses into underground mined areas. In addition, the collapse of improperly stabilized mine openings is also a form of subsidence. About the only good thing about mine subsidence is that it generally affects very few people, unlike other natural hazards that may impact a large number of people. Mine subsidence

can cause damage to buildings, disrupt underground utilities, and be a potential threat to human life. In extreme cases, mine subsidence can literally swallow whole buildings or sections of ground into sinkholes, endangering anyone that may be present at that site. Mine subsidence may take years to manifest. Examples of collapses occurring decades after mines were abandoned have been documented in several areas of the country.

Michigan's Mining Experience

Michigan's rich mining heritage has played a significant role in the State's development into a world economic power. Due to its diverse geology, Michigan has a wide variety of mineral resources, most notable of which are copper ore, iron ore, coal, sand, gravel, gypsum, salt, oil and gas. It is not surprising then that underground mining has occurred on a significant scale throughout Michigan's history. The principal types of underground mining that occurs, or has occurred in Michigan, include coal mining, metallic mineral mining, salt mining, gypsum mining, and solution mining.

Copper Mining

Copper mining, in particular, put Michigan on the map as a major mining area. Although native copper ore occurs in other parts of the world, at one time the quantity of Michigan's native ore was unsurpassed. From the mid to late 1800s, Michigan's Keweenaw Peninsula mines produced more native copper ore than any other mining area in North America. As those resources became depleted, copper mining began near White Pine in Ontonagon County. The target strata in the White Pine mining operations were on an anticline that was mined both at depths as shallow as 100 feet and as deep as 2900 feet. Over-mining of pillars in shallow parts of the mine caused collapse and subsidence at the surface, on mine property, during the 1980s. The "Copper County" area generally crosses Ontonagon, Houghton, and Keweenaw Counties.

Salt/Solution Mining

Michigan also has one of the world's largest underground salt accumulations. The thickest salt beds lie under most of the Lower Peninsula. These formations are, in some places, over 3,000 feet thick and composed of layers of salt and other minerals. Michigan ranked first or second in national salt production from 1880 to the late 1920s. The bulk of the salt production was from natural brines pumped from six salt formations. Salt was also produced from artificial brines that were derived by injecting freshwater into salt formations and retrieving the resulting brines (called solution mining). The old Detroit salt mine produced rock salt using the "room and pillar" method until 1983. (The room and pillar method involved creating large underground expanses [rooms] in which to mine, supported by pillars [natural or artificial structural members] that held in place the roofs of these rooms.) The Detroit salt mine was approximately 1,100 feet below ground and encompassed approximately 1,100 acres of subsurface land. The room and pillar method are being used only in the single salt mine that is still operating in Michigan, by the Detroit Salt Company, which has an excellent safety record. Salt is also being produced from brines extracted at various locations within the state.

Gypsum Mining

Gypsum has been mined in Michigan since 1841. In the Grand Rapids area, gypsum is mined by the "room and pillar" method. Open pit mining is used in the Alabaster region (Iosco County). In both of these areas, gypsum beds directly underlie thin layers of glacial drift. Closed topographic lows observed in both areas

are believed to be due to groundwater solution of the gypsum and subsequent collapse of the overlying material.

Coal Mining

Michigan also once supported a thriving coal mining industry. Records indicate that over 165 different coal mines operated in Michigan's coal-bearing region, which includes 31 counties in the south-central portion of the lower Peninsula. Over 100 of the 165 known coal mines in the state were located in the Saginaw Bay area. Coal was first discovered in Michigan in 1835 in Jackson County. From that discovery, several small underground and surface coal mines were opened in that area of the state. In 1861, coal was discovered near Bay City, and in 1897 commercial coal mining began in Bay County. That led to the establishment of numerous additional mines in Saginaw, Tuscola and Genesee counties, which tended to be larger, deeper and more extensive mines. That was the start of Michigan's coal mining industry.

The state's underground coal mines were an average of 110 feet deep and were worked by the "room and pillar" method. Michigan had continuous coal mining from 1897 to 1952, when the last underground coal mine near St. Charles, Saginaw County, closed. From 1860 (the year mine records were first kept) until 1975 (the year the last surface coal mine closed), the 165 commercial coal mines produced a total output of over 46 million tons of coal. The maximum coal output was achieved in 1907, when Michigan's 37 operating coal mines produced two million tons per year - enough to supply 16% of Michigan's total demand for coal.

Mine Subsidence Problem in Michigan

The legacy of underground mining can be felt in numerous locations across the state. Many of the underground mining areas, whether active or abandoned, are vulnerable to subsidence in some form. The map on the previous page indicates the areas in the state that are potentially vulnerable to mine subsidence. Unfortunately, records of abandoned mines are often sketchy and sometimes non-existent. Therefore, it is often difficult to determine exactly where the mines were located. Many areas of Michigan may have developed over abandoned mines and may not even be aware of it. Oftentimes, the only way a community or home / business owner becomes aware of a potential hazard is when subsidence actually occurs and damage or destruction results.

Groundwater

According to local geologists teaching at Alma College, the local water table (aquifer) is very high. With a high-water table, the likelihood of subsidence occurring due to porous failing soil is unlikely.

Subsidence Overview

Gratiot County has not experienced any cases of subsidence on record. However, with the low number of mines that exist and have been abandoned, it may be possible for a future occurrence(s) of subsidence to occur in the County. This was identified as a low priority.

VULNERABILITY SUMMARY

The Gratiot County Local Planning Team (GCLPT) reviewed the hazards as identified in the 2010 Gratiot County Hazard Mitigation Plan as well as the hazards identified in the 2014 Michigan Hazard Mitigation Plan. (This process was completed in 2018, before the 2019 Michigan Hazard Mitigation Plan was completed.) After completing risk and vulnerability assessments, the GCLPT then completed an overall prioritization of the hazards. This prioritization is found in the table below.

PRIORITY ASSESSMENT

Table 4.10

Event	Risk Assessment Ranking	Vulnerability Assessment	Ability to Mitigate Actions	Overall Priority
Energy Emergencies	1	High	60%	High
Infrastructure Failures	5	High	50%	High
Cyber Crimes	6	High	50%	High
Structural Fires	7	Medium	70%	High
Transportation Accidents	8	High	70%	High
Public Health Emergency	9	High	40%	High
Riverine Flooding	10	High	100%	High
Extreme Temperatures	2	Medium	70%	Medium
Hazardous Materials Incidents	12	Medium	50%	Medium
Invasive Species	13	Medium	40%	Medium
Dam Failures	17	High	60%	Medium
Civil Disturbance	18	Low	60%	Medium
Severe Summer Weather	3	Medium	20%	Moderate
Severe Winter Weather	4	Medium	20%	Moderate
Tornadoes	14	High	20%	Moderate
Pipeline/Well Incidents	15	Medium	20%	Moderate
Drought	16	Medium	70%	Moderate
Terrorism/Sabotage	20	High	30%	Moderate
Scrap Tire Fires	21	Low	90%	Moderate
Wildfires	22	Low	70%	Moderate
Windfarm Incidents	23	Medium	80%	Moderate
Fog	11	Low	20%	Low
Subsidence	19	Low	0%	Low
Earthquakes	24	Low	20%	Low
Nuclear Attack	25	High	0%	Low
Nuclear Power Plant Incidents	26	Low	10%	Low

To better establish the impacts of the hazards by communities, following is another table that identifies the high, medium, and moderate hazards, as identified by each community.

HAZARDS BY VULNERABILTY
FOR EACH COMMUNITY

Table 4.11

Community	High Impact Hazards	Medium Impact Hazards	Moderate Impact Hazards
Gratiot County	A B F H J	C G I M N Q R	D E K L O P S T U
City of Alma	A B F G H K R	C I M N O P	D E J L Q S T U
City of Ithaca	A B F H R	C G I M N O P	D E J K L Q S T U
City of St Louis	A B F G H K R	C I M N O P	D E J L Q S T U
Village of Ashley	A B F H R	C G I M N O P	D E J K L Q S T U
Village of Breckenridge	A B F H R	C G I M N O P	D E J K L Q S T U
Village of Perrinton	A B F H R	C G I M N O P	D E J K L Q S T U
Arcada Twp.	A B F G H J	C E M N Q R	D I K L O P S T U
Bethany Twp.	A B F G H J	C M N Q U	D E I K L O P R S T
Elba Twp.	A B F G H J	C E M N Q	D I K L O P R S T U
Emerson Twp.	A B F G H J	C M N Q U	D E I K L O P R S T
Fulton Twp.	A B F G H J	C E M N Q	D I K L O P R S T U
Hamilton Twp.	A B F G H J	C M N Q U	D E I K L O P R S T
Lafayette Twp.	A B F G H J	C M N Q U	D E I K L O P R S T
New Haven Twp.	A B F G H J	C M N Q U	D E I K L O P R S T
Newark Twp.	A B F G H J	C M N Q	D E I K L O P R S T U
North Shade Twp.	A B F G H J	C M N Q U	D E I K L O P R S T
North Star Twp.	A B F G H J	C E M N Q U	D I K L O P R S T
Pine River Twp.	A B F G H J	C E K M N Q U	D I L O P R S T
Seville Twp.	A B F G H J	C E M N Q U	D I K L O P R S T
Sumner Twp.	A B F G H J	C M N Q U	D E I K L O P R S T
Washington Twp.	A B F G H J	C E M N Q U	D I K L O P R S T
Wheeler Twp.	A B F G H J	C M N Q U	D E I K L O P R S T

A: Energy Emergencies, B:Infrastructure Failures, C: Cyber Crimes, D : Structural Fires, E : Transportation Accidents, F : Public Health Emergency, G: Riverine Flooding, H: Extreme Temperatures, I: Hazardous Materials Incidents, J: Invasive Species, K: Dam Failures, L: Civil Disturbance, M: Severe Summer Weather, N: Severe Winter Weather, O: Tornadoes, P: Pipeline/Well Incidents, Q: Drought, R: Terrorism/Sabotage, S: Scrap Tire Fires, T: Wildfires, U: Windfarm Incidents

CHAPTER 5:
ANALYSIS OF ALTERNATIVE ACTIONS (2010 PLAN)

Prior to the development of the mitigation strategies, Gratiot County Hazard Mitigation Advisory Committee (GCHMAC) developed goals and objectives. Below are the goals and objectives and the mitigation action categories as determined for the 2010 Hazard Mitigation Plan. Revised goals and objectives for the 2019 Plan, as determined by the GCHMAC members, will appear in Chapter 6: Action Plan.

Goals were general guidelines that explain what a community wants to accomplish. Goals are often long-term and represent broad visions. **Objectives** were identified as strategies or implementation steps to attain the identified goals. They were specific, measurable and may have had completion dates. An overview of the results for these objectives are found on the following pages.

GOAL 1: Minimize the harmful effects of severe weather hazards

OBJECTIVES

- Increase coverage and use of NOAA weather radios
- Enhance public early warning systems and networks
- Enforcement of Building and Property Maintenance Codes
- Establish heating centers/shelters for vulnerable populations
- Improve infrastructure to lessen impact of severe weather
- Reduce flood losses

GOAL 2: Improve the efficiency of all local emergency responders

OBJECTIVES

- Increase communications interoperability with all first responders
- Use GIS to assist in identifying hazards

GOAL 3: Reduce the frequency of utility loss

OBJECTIVES

- Promote aggressive tree management for all utilities

The next steps in the 2010 hazard mitigation planning process were to identify mitigation actions suitable to the community, evaluate the effect the action will have on the specified mitigation objective and prioritize actions to decide in what sequence or order these actions should be pursued. This step will also be utilized in the 2019 Plan and will be located in Chapter 6: Action Plan.

GRATIOT COUNTY IMPLEMENTATION STRATEGY TABLE: 2010-2017

Table 5.1

Objective	Mitigation	Priority	Status	Lead Agency	Outcomes
Goal 1-Minimize the harmful effects of severe weather hazards.					
1.1.1	Seek funding for NOAA weather radios for facilities caring for special needs populations and special needs populations living independently.	High	Complete	Gratiot County Emergency Management	Radios distributed, but not used by recipients.
1.1.2	Promote the use of NOAA weather radios through the distribution of brochures at community events.	High	Complete	Gratiot County Emergency Management	Brochures distributed.
1.1.3	Encourage the construction of shelters at City and County Parks.	Medium	Not Started	Local Government Parks and Recreation Departments	Grant funds not received for this item, and there were Insufficient funds to fund without the grants.
1.2.1	Upgrade the warning sirens in Breckenridge, Ashley, and Perrinton to be remotely operated by Gratiot County Emergency Management.	Medium	Not Started	Gratiot County Emergency Management	Grant funds not received for this item, and there were Insufficient funds to fund without the grants.

GRATIOT COUNTY IMPLEMENTATION STRATEGY TABLE: 2010-2017

Table 5.1

Objective	Mitigation	Priority	Status	Lead Agency	Outcomes
1.3.1	Encourage each municipality to adopt building codes and property maintenance codes. Proper construction, anchoring, and maintenance will reduce the amount of damage caused by heavy snows, high winds, heavy rain, and fire.	High	Complete	Local Government Planning Boards	Municipalities have adopted State codes to address building and property maintenance.
1.3.2	Increase education regarding the importance of securing all structures as well as taking care of clutter to help eliminate flying debris.	Medium	Ongoing	Local Fire/Code Enforcement Departments	Not all townships have participated due to lack of personnel to complete the task.
1.4.1	Work with Red Cross, Commission on Aging, and District Health Department to identify vulnerable populations. Using GIS, plot relationship of vulnerable populations with shelters identified by Red Cross.	High	Started	Emergency Operations Center	Shelters identified, vulnerable population not identified and confirmed with ever evolving population. GIS is outsourced and was not available to assist in the process.

GRATIOT COUNTY IMPLEMENTATION STRATEGY TABLE: 2010-2017

Table 5.1

Objective	Mitigation	Priority	Status	Lead Agency	Outcomes
1.5.1	Separate the City of Alma's sanitary and storm sewer system to prevent overflow during severe weather events, which can cause local flooding and public health issues.	High	Ongoing	City of Alma Public Works Department	Portions of the City have started but project is not complete.
1.5.2	Expand the county drain capacity along US 127 in Ithaca to help protect existing and future businesses in a potential commercial and industrial development area.	Medium	Ongoing	City of Ithaca/Gratiot County Road Commission	Several drains have been replaced.
1.6.1	Encourage all municipalities to participate in the NFIP and to adopt FEMA Floodplain Maps.	Top	Ongoing	Local Governments	Several municipalities are participating.
1.6.2	Identify better data to produce more accurate floodplain maps.	Top	Ongoing	Gratiot County Information Management	Drain Commission is working on this project.
1.6.3	Encourage adoption of zoning ordinances that enhance floodplain management.	High	Not Started	Local Governments	No zoning changes have occurred.

GRATIOT COUNTY IMPLEMENTATION STRATEGY TABLE: 2010-2017

Table 5.1

Objective	Mitigation	Priority	Status	Lead Agency	Outcomes
1.6.4	Reconstruct bridges and culverts to eliminate obstructions to the floodway.	Top	Ongoing	City of Alma	Numerous culverts have been replaced and bridges have been updated.
Goal 2-Improve the efficiency of all local emergency responders.					
2.1.1	Work with local public works departments to assure interoperability with other first responders (police, fire, EMS).	High	Ongoing	Gratiot County Emergency Management	Project has started but is slow moving due to the costs of changing communication systems (both initial and maintenance costs).
2.1.2	Develop county-wide communication plan for emergency responders.	High	Ongoing	Gratiot County Central Communications	Participation has started but is limited to those agencies that have been able to pay.
2.2.1	Develop map layers identifying areas where hazardous materials are stored, critical infrastructure exists, and previous hazard situations have existed.	Top	Not Started	Gratiot County Information Management	GIS is outsourced and was not available to assist in the process.

GRATIOT COUNTY IMPLEMENTATION STRATEGY TABLE: 2010-2017

Table 5.1

Objective	Mitigation	Priority	Status	Lead Agency	Outcomes
Goal 3- Reduce the frequency of utility loss					
3.1.1	Create a liaison for all utilities to discuss trimming matters as well as partnering for these tasks.	High	Ongoing	Local Public Works Departments	No liaison position was created; however, the utilities were more aggressive in trimming trees in recent years.

CHAPTER 6: ACTION PLAN

Through a systematic process that included the review of the action items identified in the Gratiot County 2010 Hazard Mitigation Plan (2010 Plan) and the possible mitigation strategies as identified in the 2003 Local Hazard Mitigation Planning Workbook (Workbook), the Gratiot County Local Planning Team (GCLPT) was able to identify the following actions to be the most effective strategies for hazard mitigation in the 2019 Hazard Mitigation Plan for Gratiot County. The actions include mitigation actions identified in the 2010 Plan that are ongoing or have not been completed and are still considered to be relevant, as well as new strategies that have been identified by the GCLPT.

The GCLPT initiated the selection process with a review of the goals and objectives as identified in the 2010 Plan and modified them to fit the needs of Gratiot County in 2020 and beyond. These goals and objectives are identified on the following page.

The action plan items from the 2010 Plan were then evaluated and those items that were deemed complete or no longer applicable were eliminated from this plan (see review of all 2010 items in Chapter 5). The GCLPT then began review of the possible mitigation strategies as identified in the Workbook. After reviewing over 250 possible mitigation strategies (many of them duplicate strategies for multiple hazards) the GCLPT was able to eliminate multiple strategies to reduce the number of possible strategies to 87. The final list of 87 strategies is found in Appendix C. The list of original strategies is found in Appendix D.

The GCLPT was then asked to identify hazard mitigation projects/processes that address the hazards items on the list. The projects/processes that address hazards that can be identified as FEMA-eligible projects were given a high priority. Project/process items that were readily achievable with a reasonable cost/benefit ratio were identified as a medium priority. Projects/processes that were less achievable or had an unreasonable cost/benefit ratio were identified as moderate priorities. It should be noted those projects that met the high or medium priority criteria, but were identified as not being as cost effective as other projects, were given a lower priority.

Gratiot County municipalities were asked to identify those high priority projects (FEMA-eligible) they would participate in should the project be funded, and local funds be available. A table following the list has been included that identifies those projects.

As there were 18 projects that were identified as high priorities, these projects have been included as the action list items. However, due to the total number of projects identified, the entire list is not included in the following list. The complete list of potential projects is listed in Appendix E. These projects may be reevaluated annually and modified appropriately. Projects not identified in the 2010 Plan have been labeled as “NEW” in their descriptions.

GOALS AND OBJECTIVES

GOAL 1: Protect Public Health and Safety

OBJECTIVES

a. Provide community wide hazard warning systems (natural, health and terrorism)
b. Provide information and resources to increase hazard awareness and education
c. Maintain existing resources and provide necessary training
d. Identify and obtain necessary resources and equipment to prevent or minimize hazard effects

GOAL 2: Minimize damage to public and private property

OBJECTIVES

a. Adopt policies to make property less vulnerable
b. Apply proactive mitigation measures to prevent hazard damage
c. Obtain necessary equipment, resources and training to protect property if hazard occurs
d. Conduct training sessions and exercises to prepare for possible hazards

GOAL 3: Maintain essential services

OBJECTIVES

a. Identify, inspect and maintain all critical infrastructure and facilities
b. Repair or replace critical infrastructure and facilities that are damaged or degraded
c. Protect critical infrastructure and facilities from hazard damage
d. Obtain necessary resources and equipment to ensure essential services are maintained in the event of a hazard
e. Identify/maintain a database of available (life-safety) equipment and trained personnel

GOAL 4: Manage growth/development

OBJECTIVES

a. Develop hazard resistant growth policies
b. Discourage development in high hazard areas
c. Integrate hazard mitigation planning into land use planning
d. Encourage sustainable development
e. Protect and conserve natural resources

HIGH PRIORITY HAZARD MITIGATION ACTIONS

Item 1

Upgrade the warning systems, including sirens, throughout County to be able to inform public for all hazards

Action: Upgrade the warning systems throughout the County, encourage the residents to enroll in the County's wireless emergency alert system

- Location: County-wide
- Lead Agency: Emergency 9-1-1
- Participating Agencies: OEM, Fire Chiefs Association
- Hazards Addressed: All hazards
- Potential Funding Source(s): 9-1-1 funds, FEMA
- Project Cost: TBD
- Schedule: 2020
- Priority: High
- Goal/Objective Achieved: Goal 1, Objective a
- Benefit(s): Improved public notification of hazardous events.

Item 2

Expand the county drain capacity to help protect existing businesses and future business development

Action: Identify inadequate drain systems, and improve accordingly

- Location: County-wide
- Lead Agency: Drain Commission
- Participating Agencies: Road Commissions, Farm Bureau
- Hazards Addressed: Flooding, infrastructure failure
- Potential Funding Source(s): Drain Commission, Road Commission, FEMA
- Project Cost: TBD
- Schedule: Ongoing
- Priority: High
- Goal/Objective Achieved: Goal 2, Objective b; Goal 3, Objective c
- Benefit(s): Improved infrastructure thereby reducing local flooding.

Item 3

Reconstruct bridges and culverts and remove debris to eliminate obstructions to the floodway

Action: Identify and improve bridges and culverts and identify potential logjam areas to eliminate obstructions in floodway

- Location: County-wide
- Lead Agency: Road Commission
- Participating Agencies: Drain Commission, MDOT
- Hazards Addressed: Infrastructure failure, flooding
- Potential Funding Source(s): Road Commission, MDOT, Drain Commission, FEMA
- Project Cost: TBD
- Schedule: Ongoing
- Priority: High
- Goal/Objective Achieved: Goal 2, Objective b; Goal 3, Objective c
- Benefit(s): Improved infrastructure and reduced flooding.

Item 4 (NEW)

Increase investment for first responders

Action: Seek additional funds for equipment/training.

- Location: County-wide
- Lead Agency: OEM
- Participating Agencies: Local Municipalities
- Hazards Addressed: All hazards
- Potential Funding Source(s): Grants
- Project Cost: TBD
- Schedule: Ongoing
- Priority: High
- Goal/Objective Achieved: Goal 1, Objective d
- Benefit(s): First responders better informed/prepared for hazardous events.

Item 5 (NEW)

Initiate automated hydrological monitoring at the Pine River Gauge in Alma.

Action: Acquire and install automated United States Geological Survey (USGS) approved river gauge monitoring equipment.

- Location: Existing manually read River Gauge on Pine River at Alma 43°22'47.1"N 84°39'20.3"W
- Lead Agency: OEM
- Participating Agencies: Drain Commission, City of Alma, City of St Louis
- Hazards Addressed: Riverine Flooding
- Potential Funding Source(s): FEMA, local match for upkeep
- Project Cost: TBD
- Schedule: 2021
- Priority: High
- Goal/Objective Achieved: Goal 2, Objective b
- Benefit(s): Improved flood monitoring with automated regular reporting of real-time data to USGS and National Weather Service (NWS).

Item 6 (NEW)

Acquire and install three networked weather monitoring stations to collect real-time weather data for Gratiot county Central Dispatch

Action: Acquire and install networked capable weather monitoring stations (wind/temperature/air pressure/precipitation gauge etc) at critical locations in the County and network feed data to Gratiot County Central Dispatch and National Weather Service (NWS).

- Location: City of St Louis Fire Department, Gratiot County Central Dispatch, and Village of Perrinton Fire Department
- Lead Agency: OEM
- Participating Agencies: NWS, Central Dispatch, Fire Chiefs Association, City of St Louis Fire Department, and Village of Perrinton Fire Department
- Hazards Addressed: All weather hazards, fires, hazardous material events
- Potential Funding Source(s): FEMA
- Project Cost: TBD
- Schedule: 2022
- Priority: High

- Goal/Objective Achieved: Goal 1, Objective b; Goal 2, Objective c
- Benefit(s): Improved data for first responders enabling better decision-making based upon hazard information.

Item 7

Separate sanitary and storm sewers to prevent overflow during severe weather events, which can cause local flooding, public health issues, and sewer backups

Action: Identify local sewer systems that need to be separated, separate accordingly.

- Location: County-wide
- Lead Agency: Mid-Michigan Health Department
- Participating Agencies: City of Alma, City of Ithaca, City of St Louis, Village of Ashley, Village of Breckinridge, Village of Perrinton
- Hazards Addressed: Public health emergencies, flooding
- Potential Funding Source(s): FEMA
- Project Cost: TBD
- Schedule: Ongoing
- Priority: High
- Goal/Objective Achieved: Goal 3, Objective b
- Benefit(s): Improved public health, reduced flooding due to overloaded sewer systems.

Item 8

Encourage all municipalities to participate in National Flood Insurance Program (NFIP) and to adopt FEMA Floodplain maps

Action: Contact local municipalities to encourage joining NFIP and adopting FEMA floodplain maps

- Location: County-wide
- Lead Agency: OEM
- Participating Agencies: Alma, Ithaca, St. Louis, Bethany Township, Fulton Township, Newark Township, and Sumner Township
- Hazards Addressed: flooding
- Potential Funding Source(s): FEMA
- Project Cost: NA
- Schedule: Ongoing
- Priority: High
- Goal/Objective Achieved: Goal 4, Objectives a, b, d, and e
- Benefit(s): Improved insurance coverage for residents/businesses in floodplains.

Item 9 (NEW)

Install lightning protection devices at municipal facilities and schools

Action: Identify facilities requiring protection from lightning strikes, purchase/install protection devices

- Location: County-wide
- Lead Agency: OEM
- Participating Agencies:
- Hazards Addressed: Lightning, local infrastructure
- Potential Funding Source(s): Local funds, FEMA
- Project Cost: TBD
- Schedule: 2021

- Priority: High
- Goal/Objective Achieved: Goal 2, Objective c; Goal 3, Objective c
- Benefit(s): Municipal infrastructure protected from damaged by lightning.

Item 10 (NEW)

Identify and plan to eliminate/reduce invasive species negatively impacting the County

Action: Working with county and local officials, identify invasive species that negatively impact the County and work on a plan to mitigate their impact.

- Location: County-wide
- Lead Agency: EGLE
- Participating Agencies: DNR, Parks & Recreation Departments, MDARD
- Hazards Addressed: Invasive Species
- Potential Funding Source(s): State funds, FEMA
- Project Cost: TBD
- Schedule: Ongoing
- Priority: High
- Goal/Objective Achieved: Goal 2, Objective a
- Benefit(s): Reduction/elimination of invasive species improving environment for native species.

Item 11 (NEW)

Maintain water quality for potable and recreational purposes.

Action: Collaborate with local, state, and federal agencies to ensure safe groundwater and surface water for potable and recreational purposes.

- Location: County-wide
- Lead Agency: Michigan Department of Environment, Great Lakes, & Energy (EGLE)
- Participating Agencies: Park & Recreation Departments, Mid-Michigan District Health Department
- Hazards Addressed: Flooding, Public Health Issues
- Potential Funding Source(s): State funds, FEMA
- Project Cost: TBD
- Schedule: Ongoing
- Priority: High
- Goal/Objective Achieved: Goal 1, Objective c; Goal 3, Objective a
- Benefit(s): Water that is safe for consumption and recreational purposes.

Item 12 (NEW)

Develop a plan to reduce/eliminate hazardous road conditions

Action: Plant living snow fences along designated roadways.

- Location: County-wide
- Lead Agency: Road Commission
- Participating Agencies: MDOT
- Hazards Addressed: Severe winter weather conditions
- Potential Funding Source(s): FEMA, state funds
- Project Cost: TBD
- Schedule: 2023
- Priority: High
- Goal/Objective Achieved: Goal 2, Objective b

- Benefit(s): Improved/safer road conditions during winter months.

Item 13 (NEW)

Promote the use of smoke detectors and carbon monoxide detectors for every residence and business within the County

Action: Promote and facilitate the installation of carbon monoxide detectors.

- Location: County-wide
- Lead Agency: Fire Chief's Association
- Participating Agencies: OEM, local fire departments
- Hazards Addressed: Fire, hazardous materials (CO poisoning)
- Potential Funding Source(s): FEMA
- Project Cost: NA
- Schedule: Ongoing
- Priority: High
- Goal/Objective Achieved: Goal 2, Objective b; Goal 3, Objective c
- Benefit(s): Mitigated injuries for both citizens and fire staff due to fires or CO poisoning.

Item 14

Encourage the construction of public shelters

Action: Work with local agencies to identify locations for public shelters throughout the County

- Location: County-wide
- Lead Agency: OEM
- Participating Agencies: Gratiot County Parks and Recreation, City of St Louis, Red Cross
- Hazards Addressed: All hazards
- Potential Funding Source(s): FEMA
- Project Cost: NA
- Schedule: 2021
- Priority: High
- Goal/Objective Achieved: Goal 2, Objective b
- Benefit(s): Public provided a safe shelter location during hazardous events.

Item 15 (NEW)

Propose Michigan Public Safety Communication System (MPSCS) tower site.

Action: Collaborate with neighboring counties to cooperatively invest in MPSCS tower construction to mutually benefit public safety-first responders and improve interoperability and improve/enhance radio coverage.

- Location: Southern Gratiot County (site not yet identified)
- Lead Agency: 9-1-1
- Participating Agencies: OEM, local law enforcement and fire departments
- Hazards Addressed: All hazards
- Potential Funding Source(s): 9-1-1 funds, FEMA, state/federal grants
- Project Cost: $1.5 million
- Schedule: 2024
- Priority: High
- Goal/Objective Achieved: Goal 1, Objective a and d, Goal 2, Objective b
- Benefit(s): Improved safety communications coverage and interoperability for all stakeholders.

Item 16 (NEW)

Reduce/eliminate invasive plant species negatively impacting the County

Action: Chemically treat drainage ditches throughout the County to address phragmites, bush honeysuckle, and multiflora rose.

- Location: County-wide
- Lead Agency: EGLE
- Participating Agencies: Drain Commission, Parks and Recreation Departments, Michigan Department of Agriculture & Rural Development (MDARD)
- Hazards Addressed: Invasive Species
- Potential Funding Source(s): Local funds, FEMA, state funds, grants
- Project Cost: TBD
- Schedule: Ongoing
- Priority: High
- Goal/Objective Achieved: Goal 2, Objective b; Goal 3, Objective c, Goal 4, Objective e
- Benefit(s): Reduction/elimination of invasive species improving environment for native species.

Item 17 (NEW)

Acquire backup site generators at critical infrastructure/key resource (CIKR) locations throughout Gratiot County

Action: Work with local units of government to acquire and install backup generators adequate to power critical operations for CIKR categories in sectors of Emergency Services, Government Facilities, Healthcare and Public Health, Information Technology, Transportation Systems, Water and Wastewater Systems.

- Location: County-wide
- Lead Agency: OEM
- Participating Agencies: City of Alma, Village of Ashley, Village of Breckenridge, City of Ithaca, Village of Perrinton, City of Saint Louis, Gratiot County, Gratiot Sheriff,
- Hazards Addressed: All hazards
- Potential Funding Source(s): FEMA, Local, State, and Federal Grants
- Project Cost: $350,000.00
- Schedule:2023
- Priority: High
- Goal/Objective Achieved: Goal 1, Objective d, Goal 3, Objective c and d
- Benefit(s): Improved resiliency and mitigation against energy interruptions

Item 18 (NEW)

Encourage the inclusion of hazard mitigation into other county planning documents

Action: Encourage municipal agencies to include hazard mitigation into master plans/comprehensive land use plans and other planning documents.

- Location: County-wide
- Lead Agency: OEM
- Participating Agencies: Gratiot County, all townships, cities, and villages
- Hazards Addressed: All hazards
- Potential Funding Source(s): FEMA
- Project Costs: NA
- Schedule: Ongoing
- Priority: High

- Goal/Objective Achieved: Goal 4, Objective c
- Benefit(s): The identification of hazard mitigation in other local planning documents will promote community awareness of hazard mitigation, thereby and improving the public health and safety.

Gratiot County Hazard Mitigation Municipal Participation Chart

Table 6.1

Community	Action Item (s)	Most Recent Master Plan Approval Date*
Gratiot County	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18	2018
City of Alma	1, 2, 3, 4, 5, 7, 8, 9, 11, 13, 15, 17, 18	2018
City of Ithaca	2, 4, 7, 11, 13, 17, 18	2018
City of St Louis	1, 2, 3, 4, 5, 6, 7, 9, 10, 11, 13, 14, 15, 16, 17, 18	2018
Village of Ashley	4, 6, 8, 9, 10, 11, 12, 13, 15, 16, 17, 18	2018
Village of Breckenridge	1, 2, 3, 4, 6, 8, 9, 10, 11, 12, 13, 14, 15, 17, 18	2018
Village of Perrinton	1, 2, 3, 4, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18	2018
Arcada Twp.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18	2018
Bethany Twp.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18	2018
Elba Twp.	1, 2, 3, 4, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18	2018
Emerson Twp.	2, 3, 4, 8, 17, 18	2018
Fulton Twp.	1, 4, 6, 7, 8, 11, 14, 15, 17, 18	2018
Hamilton Twp	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18	2018
Lafayette Twp	2, 4, 10, 12, 14, 15, 16, 18	2018
New Haven Twp	18	2018
Newark Twp	6, 11, 14, 18	2018
North Shade Twp	2, 3, 4, 6, 9, 11, 13, 17, 18	2018
North Star Twp	2, 3, 4, 6, 7, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18	2018
Pine River Twp	1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 13, 15, 16, 17, 18	2018
Seville Twp	1, 3, 4, 9, 11, 13, 15, 17, 18	2018
Sumner Twp	3, 4, 6, 9, 10, 11, 13, 14, 15, 16, 17, 18	2018
Washington Twp	1, 3, 4, 11, 13, 18	2018
Wheeler Twp	2, 4, 7, 10, 11, 13, 16, 17, 18	2018

*-The County approved its Master Plan in 2018. Upon its adoption by the County Board, each municipality then chose to adopt the Gratiot County Master Plan as their own master plan.

CHAPTER 7: FOLLOW-UP

The follow-up for Gratiot County is an important part of the planning process. Follow-up is the process in which the plan will be monitored, evaluated, and updated within the five-year cycle. When updated, the plan will be resubmitted to the Michigan State Police, Emergency Management and Homeland Security Division for approval. As appropriate, the plan will also be evaluated after a disaster, or after unexpected changes in land use or demographics in or near hazard areas. The Gratiot County Local Planning Team (GCLPT) will also be kept apprised of a change in federal regulations, programs and policies, such as a change in the allocation of FEMA's funding for mitigation grant programs. These evaluations will be addressed in the plan and may affect the action items for mitigation goals and activities. The hazard mitigation plan should be considered by community planners within Gratiot County when future updates of their comprehensive plans are taking place.

The GCLPT will continue to monitor the status and track the progress of the plan elements on an annual basis. The GCLPT will oversee the progress made on the implementation of the identified action items and update the plan as needed to reflect changing conditions. Representatives will also meet annually to evaluate plan progress and recommend updates. The Gratiot County Emergency Management Coordinator will facilitate the meetings.

Evaluation of the plan will not only include checking the implementation status of mitigation action items, but also assessing their degree of effectiveness and assessing whether other natural hazards needs to be addressed and added to the plan. This will be accomplished by reviewing the benefits (or avoided losses) of the mitigation activities that were in place within each jurisdiction and the County. These will be compared to the goals the Plan has set to achieve. The GCLPT will also evaluate whether mitigation action items need to be discontinued or modified in light of new developments or changes within the County.

As required, this plan will be updated within five (5) years of the date of FEMA's approval of the plan. The plan may be updated earlier, at the discretion of the GCLPT and its jurisdictions. The GCLPT's ability to update the mitigation process by adding new data and incorporating it into the mitigation plan will allow for the efficient use of available resources, staff, and programs. They will meet to discuss the plan and document data collected including hazard events, completed mitigation activities, new mitigation activities, and FEMA grant application efforts. The information will be used for the five (5) year update. The Gratiot County Emergency Management Coordinator will coordinate the annual meeting and keep records of the participants and information received.

In order to have continued public support of the mitigation process, it is important that the public be involved not only in the preparation of the initial plan, but also in any modifications or updates to the plan. The public is invited to the annual meetings, in compliance with the Public Meetings Act.

To ensure that public support is maintained, the following actions may be taken by GCLPT:

- Updates to the plan.
- The Gratiot County plan has been web posted along with contact information that allows any citizen to read it and provide feedback.

- Develop informational mailings to be distributed to the public about mitigation efforts in the county and updates made to the plan.
- Develop mitigation flyers or mailings that contain mitigation activities and action items that promote reducing damages and risks of natural hazards.

APPENDIX A
GRATIOT COUNTY HAZARD MITIGATION ADVISORY COMMITTEE SIGN-IN SHEETS

GRATIOT COUNTY

Date 1-14-2020

MITIGATION PLAN UPDATE SIGN-IN SHEET

NAME (PLEASE PRINT)	ORGANIZATION	PRIMARY CONTACT INFORMATION (PHONE OR EMAIL)	MILES DRIVEN (Round Trip)
Bill Ernat	EMCOG	bernat@emcog.org	—
Brian Hull	MMR	bhull@mobilemedical.org	~~60~~ 56
Kim Bowker	GIHN	kbowker@gihn-mi.org	~ 20
Scott Painter	MSP Collision	painters@michigan	~86
Mike Morris	CoRSH	MMorris@gratiotmi.com	1
Steve Sopocy	CoRSH	SSopocy@gratiotmi.com	1
John Gibson	GCAPA	gibson@alma.edu	~~0~~ 20
Dave Nelson	Ithaca Fire	dnelson@ithacami.com	1
Rich Ramerez	St. Louis PD.	rramerez@stlouismi.com	16
Dan Mosden	911 / County EM	dmosden@gratiotmi.com	~~30~~ 9
Hailey Brewer	MMDHD	hbrewer@mmdhd.org	~~uu~~ 50
Kurt Giles	City of St. Louis	Kgiles@stlouismi.com	17
~~Kelli~~			~~10~~
Kelli Thompson	Gratriot Isabella RESD	Kthompsun@giresd.net	10 (Phone)
MaryJo Boyd			

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GRATIOT COUNTY Date 10-22-19

MITIGATION PLAN UPDATE SIGN-IN SHEET

NAME (PLEASE PRINT)	ORGANIZATION	PRIMARY CONTACT INFORMATION (PHONE OR EMAIL)	MILES DRIVEN (Round Trip)
Bill Ernat	SMCOG	989 992-8200	———
Ashley Brenner	EM	989 875 5280	—
Steven Sopocy	Gratiot County Sheriff	989- 449 - 4205	1
Mike Morris	" " "	989-449-4144	1
Ruben Ramirez	St. Louis Police Department	989-681-5285 rramirez@stlouismi.com	16
Kurt Giles	St. Louis	(989) 681-4377	17
Kelli Thompson	AIRESD	989-875-5101	3
DAVE NELSON	City of ITHACA	989-763-3347	2
Dan Madden	911	989-875-7505	0

GRATIOT COUNTY Date 8-13-19

MITIGATION PLAN UPDATE SIGN-IN SHEET

NAME (PLEASE PRINT)	ORGANIZATION	PRIMARY CONTACT INFORMATION (PHONE OR EMAIL)	MILES DRIVEN (Round Trip)
Bill Ernat	EMCOG	bernat@emcog.org	—
Ashley Brenner	Gratiot Emergency Mgmt	GratiotEMD@gratiotmi.com	—
Kelli Thompson	Gratiot - Isabella RESD	kthompson@givesd.net	—
Jimm Thorsen	Amat. Radio	thorsen@alma.edu	20
John Gibson	Amateur Radio	gibson@alma.edu	20
Scott Duncan	ZFS Ithaca	Scottd@zfsithaca.com	3
Kurt Giles	City of St. Louis	kgiles@stlouismi.com	17
Dean Reardon	911	dreardon@gratiotmi.com	10
Dave Nelson	City of Ithaca	dnelson@ithacami.com	—

GRATIOT COUNTY

Date 6-11-19

MITIGATION PLAN UPDATE SIGN-IN SHEET

NAME (PLEASE PRINT)	ORGANIZATION	PRIMARY CONTACT INFORMATION (PHONE OR EMAIL)	MILES DRIVEN (Round Trip)
Bill Ernat	EMCOG	(989) 992-8700	—
Dan Morden	Gratiot 911	989-875-7505	6
Hailey Brewer	MMDHD	989-763-3577	—
Kelli Thompson	GRATIOT – Isabella RESD	989-875-5101	—
John Gibson	Amateur Radio	979-463-3632	20 mi.
Timm Thorpe	" "	989-463-3944	20 mi.
Scott Duncan	2FS Ithaca	989-449-6104	3m.
Jeff Yonker	MSP EMHSD	517-719-9767	—
Dave Nelson	City of Ithaca	989-763-3347	4W 2
Ashley Brenner	Gratiot Emergency Management	989 875 5280	
Richard Ramerez	St. Louis Police Dept	989 681-5285 rramerezreiz@stlouismi.com	17 miles
Kurt Giles	City of St. Louis	681-4377	

GRATIOT COUNTY Date 3-12-19

MITIGATION PLAN UPDATE SIGN-IN SHEET

NAME (PLEASE PRINT)	ORGANIZATION	PRIMARY CONTACT INFORMATION (PHONE OR EMAIL)	MILES DRIVEN (Round Trip)
Bill Ernat	EMCOG	BERNAT@EMCOG.ORG	—
Dan Marden	911	dmarden@gratiotmi.gov	10
Hailey Brewer	MMDHD	hbrewer@mmdhd.org	—
Ashley Brenner	Gratiot Co. EM	gratiotEMD@gratiotmi.com	—
~~Jeff Yonker~~	MSP-EMHSD	yonkerj@michigan.gov	—
Kasey Zehner	Greater Gratiot	kasey.zehner@gratiot.org	2
Paul Spata	American Red Cross	paul.spata@redeross.org	78
Brian Chambers	American Red Cross	BRIAN.CHAMBERS@REDCROSS.ORG	78
Pete Littlu	Gratiot County Parks	parksandrec@gratiotmi.com	30
Greg Walterhouse	Resident	WALTEGL@BGSU.EDU	25
Mark Williams	Alma DPS	989-620-0083	20
Dave Nelson	Ithaca - City & Fire	dnelson@ithacami.com	—
Eric Leonard	Gratiot Co. SO	eleonard@gratiotmi.com	1
Kurt Giles	St. Louis	Kgiles@stlouismi.com	17

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GRATIOT COUNTY Date 2-19-19

MITIGATION PLAN UPDATE SIGN-IN SHEET

NAME (PLEASE PRINT)	ORGANIZATION	PRIMARY CONTACT INFORMATION (PHONE OR EMAIL)	MILES DRIVEN (Round Trip)
Bill Bernat	EMCOG	(989) 992-8700	—
Ashley Brenner	Gratiot County EM	gratiotEMD@gratiotmi.com	—
GREG WALTERHOUSE	RESIDENT	WALTEGL@BGSU.EDU	25
Mike Morris	Gratiot Co. Sheriff's office	MMorris@gratiotmi.com	2
DSGT Chris Frayre	Michigan State Police	frayreC@michigan.gov	
Kurt Giles	St. Louis	kgiles@stlouismi.com	17
Dan Mordan	Central Dispatch	dmordan@gratiotmi.com	6
Scott Duncan	ZFS Ithaca	Scottd@zfsithaca.com	—
Pete Little	GCPSR	parksandrecr@gratiotmi.com	15
Kasey Zehner	Greater Gratiot	kasey.zehner@gratiot.org	2
DAVE NELSON	City of ITHACA	dnelson@ithacami.com	—

GRATIOT COUNTY Date 1-8-19

MITIGATION PLAN UPDATE SIGN-IN SHEET

NAME (PLEASE PRINT)	ORGANIZATION	PRIMARY CONTACT INFORMATION (PHONE OR EMAIL)	MILES DRIVEN (Round Trip)
Bill Ernat	EMCOG	(989) 992-8700	—
Kelli Thompson	GIRESD	(989) 875-5101	—
Philip Rowley	MDOC	517 230 6799	20
GREG WALTERHOUSE	RESIDENT	WALTEGL@BGSU.EDU	27
Ashley Brenner	EMC		
Michael Morris	BRSM	989 640-8725	—
Richard Ramerez	St. Louis Police Dept	989-681-5285	17
Kurt Giles	St. Louis City	(989) 681-4377	17
DAVE NELSON	City of ITHACA	dnelson@ithacami.com	—
Scott Duncan	ZFS Ithaca LLC	sduncan@ZFSIthaca.com	
Pete Little	Gratiot County Parks	parksandrec@gratiotmi.com	30
Dan Morden	Gratiot Co 911	dmorden@gratiotmi.com	6
Erica Rogers	MSU Extension	roger392@msu.edu	14
Casey Zangaro	MSU Extension	zangaroc@MSU.edu	14

GRATIOT COUNTY Date 11-13-18

MITIGATION PLAN UPDATE SIGN-IN SHEET

NAME (PLEASE PRINT)	ORGANIZATION	PRIMARY CONTACT INFORMATION (PHONE OR EMAIL)	MILES DRIVEN (Round Trip)
Bill Ernat	EMCOG	bernat@emcog.org	—
Greg Walterhaus	Resident	walterg1@bgsu.edu	25
Mike Morris	Gratiot Co. Sheriff's office	detective@gratiotmi.com	1
Kasey Zenner	Greater Gratiot	kasey.zenner@gratiot.org	1
Jeff Yonker	MSP-EMHSD	517-719-9767	100
Kurt Giles	City of St. Louis	(989)681-4377	17
Rich Kamerer	St. Louis Police	989-681-5285	17
Hailey Brewer	MMDHD	989-831-31062	—
Keith Thompson	GIRESD	kthompson@giresd.net	—
Dan Morton	EM + 911	989-640-8736	—

GRATIOT COUNTY Date 10-9-18

MITIGATION PLAN UPDATE SIGN-IN SHEET

NAME (PLEASE PRINT)	ORGANIZATION	PRIMARY CONTACT INFORMATION (PHONE OR EMAIL)	MILES DRIVEN (Round Trip)
Bill Ernst	EMCOG	BERNAT@EMCOG.ORG	—
Dan Morden	Gratiot EMS & Central Dispatch	DMORDEN@Gratiotmi.com	—
Kurt Giles	City of St. Louis	kgiles@stlouismi.com	17
Wm. Leonard	Gratiot Co. Permits	soilerosion@mi.com	—
GREG WALTERHOUSE	RESIDENT	WALTEGL@BGSU.EDU	25
DALE SHERMAN	GRA. Co. Bui. O.	DSHERMAN@GRATIOTMI.COM	1
Tony Miller	Gratiot Co. Permits	tmiller@gratiotmi.com	1
Mike Morris	Gratiot Co. Sheriff's Office	detective@gratiotmi.com	1
Kim Vetter	Michigan State Police	vetterk@michigan.gov	17
Pete Little	Gratiot Co. Parks	Parksandrec@gratiotmi.com	14
John Gibson	GCARA	gibson@alma.edu	20
Hailey Brewer	MMDHD	hbrewer@mmdhd.org	—
Kelli Thompson	Gratiot-Isabella RESD	kthompson@gisresd.net	—
DAVE Nelson	City of ITHACA	dnelson@ithacami.com	—

GRATIOT COUNTY Date 9-11-18

MITIGATION PLAN UPDATE SIGN-IN SHEET

NAME (PLEASE PRINT)	ORGANIZATION	PRIMARY CONTACT INFORMATION (PHONE OR EMAIL)	MILES DRIVEN (Round Trip)
Bill Ernat	EMCOG	(989) 992-8700	—
Dave Medina	EM	989 875 5280	
John Gibson	Amateur radio	gibson@alma.edu	20
Timm Thoson	Amateur radio	thoison@alma.edu	20
Kurt Giles	City of St. Louis	kgiles@stlouismi.com	17
GREG WALTERHASE	RESIDENT	WALTEGL@BGSU.EDU	20
Kasey Zehner	Greater Gratiot Development	Kasey.zehner@gratiot.org	2
Pete Little	Gratiot County Parks	parksandrec@gratiotmi.com	16
Mark Daffin	Gratiot Co 9 11	mdaffin@gratiotmi.com	1
MARK WILLIAMS	ALMA DPS	989-463-8517 mwilliams@ci.alma.mi.us	20
DAVE NELSON	Ithaca Fire / City of Ithaca	989-875-3200 dnelson@ithacami.com	—

GRATIOT COUNTY Date 7-10-18

MITIGATION PLAN UPDATE SIGN-IN SHEET

NAME (PLEASE PRINT)	ORGANIZATION	PRIMARY CONTACT INFORMATION (PHONE OR EMAIL)	MILES DRIVEN (Round Trip)
Bill Ernat	EMCOG	(989) 992-8700 bernat@emcog.org	mi.com
Kurt Giles	St. Louis	(989) 681-4377 kgiles@stlouis	11
Timm Thorsen	Gr. Co. Amateur Radio	" 463-3941 tthorsen@alma.edu	20
John Gibson	Amateur radio	gibson@alma.edu	20
Phil Randy	MDOT	randype michigan.gov	4
MARK WILLIAMS	ALMA DPS	989-620-0050 mwilliams@ci.alma.mi.us	16
Michael Morris	Gratiot Co. Sheriff's Office	989 449-4118 detective@gratiotmi.com	1
DAVE NELSON	dNelson@ithacami.com	989-763-3347	1
David Nichol	Amalgam LLC	989.944.5188	58
Bernie Barnes	Gratiot County Drain Commissioner	989 875 5207 bbarnes@gratiotmi.com	2
STEVE MANN	GRATIOT COUNTY EM	~~989-6~~ mann1993ds@gmail.com	50
Erica Rogers	Gratiot County MSU Extension	roger392@msu.edu	20
Cindy Zangaro	Gratiot County MSU Extension	Zangaroc@MSU.edu	20
Jim Hall	Pine River Superfund Citizen Task Force	517-574-0807	20
Dan Morden	Gratiot Co EM & Central Dispatch	989-875-5280	N/A

GRATIOT COUNTY Date 6-12-18

MITIGATION PLAN UPDATE SIGN-IN SHEET

NAME (PLEASE PRINT)	ORGANIZATION	PRIMARY CONTACT INFORMATION (PHONE OR EMAIL)	MILES DRIVEN (Round Trip)
Bill Ernst	EMCOG	(989) 992-8700	—
John Gibson	Amateur radio	gibson@alma.edu	20
Jason Thorsen	" "	Thorsen@alma.edu	20
DAVE Nelson	Ithaca Fire/City of Ithaca	dnelson@ithacami.com	—
Hailey Brewer	Mid-Michigan District Health Dept	hbrewer@mmdhd.org	—
Pete Little	Gratiot County Parks	parksadvcc gratiotmi.com	30
Bernie Barnes	Gratiot County Drain Commission	bbarnes@gratiotmi.com	2
Kurt Giles	City of St. Louis	kgiles@stlouismi.com	17
Kasey Zehner	Greater Gratiot Development	kasey.zehner@gratiot.org	1
Philip Randby	Michigan Dept of Transportation	Randype michigan.gov	4

GRATIOT COUNTY Date 5-22-18

MITIGATION PLAN UPDATE SIGN-IN SHEET

NAME (PLEASE PRINT)	ORGANIZATION	PRIMARY CONTACT INFORMATION (PHONE OR EMAIL)	MILES DRIVEN (Round Trip)
Bill Bernat	GMCOG	BERNAT@GMCOG.ORG	—
Dan Mordin	EM + 911	GratiotEMD@gratiotmi.com	—
Hailey Brewer	MMDHD	hbrewer@mmdhd.org	—
Pete Little	Gratiot County Parks	parksandrec@gratiotmi.com	30
DAVE NELSON	City of Ithaca | Ithaca Fire	dnelson@ithacami.com	—
Kurt Giles	City of St. Louis	kgiles@stlouismi.com	17
Kelli Thompson	Gratiot - Isabella RESD	kthompsn@gresd.net	0
John Gibson	Amateur radio	gibson@alma.edu	20
Erica Rogers	MSU Extension	rogers392@msu.edu	—
Cheryl Kamp	MMP	289-3095	60
Julie Spencer	Gratiot Conservation District	julie.spencer@macd.org	—

5-1-18 Meeting @ Drain Commission Office

Name	Company	Contact Info
Bill Grant	EMCOG	(989) 992-6700
Bernie Barnes	GCDC	~~*9898755207 989-506-~~
Joe Sherwood	GCDC	9895755207
[signature]	GCD	989-560-1144

GRATIOT COUNTY Date April 10, 2018

MITIGATION PLAN UPDATE SIGN-IN SHEET

NAME (PLEASE PRINT)	ORGANIZATION	PRIMARY CONTACT INFORMATION (PHONE OR EMAIL)	MILES DRIVEN (Round Trip)
Bill Ernat	EMCOG	BERNAT@EMCOG.ORG	—
Dan Morden	EM + 911 Interim Dir	DMORDEN@Gratiotmi.com	
John Gibson	Amateur Radio	gibson@alma.edu	20
GREG WALTERHOUSE	RESIDENT	WALTEGL@BGSU.EDU	24
Hailey Brewer	MMDHD	hbrewer@mmdhd.org	—
Pete Little	Gratiot County Parks	Parksandrec@gratiotmi.com	30
DAVE NELSON	City of ITHACA	DNelson@ithacami.com	—
Kurt Giles	City of St. Louis	kgiles@stlouismi.com	17
Cheryl Kampf	MMR	CKampf@mobile.medical.org	60
Stefanie Studt	Ashley Village	studtmail@gmail.com	30

GRATIOT COUNTY Date 3-13-18

MITIGATION PLAN UPDATE SIGN-IN SHEET

NAME (PLEASE PRINT)	ORGANIZATION	PRIMARY CONTACT INFORMATION (PHONE OR EMAIL)	MILES DRIVEN (Round Trip)
BILL ERNAT	EMCOG	BERNAT@EMCOG.ORG	—
Kelli Thompson	Gratiot - Isabella RESD	K.thompson@giresd.net	—
Pete Little	Gratiot County Parks	parksandrec@gratiotmi.com	30
Deb Malley	Alma Dialysis DaVita	debra.malley@davita.com	~~30~~
DAVE Nelson	Ithaca Fire / City of Ithaca	dnelson@ithacami.com	—
MARK WILLIAMS	ALMA DEPARTMENT OF PUBLIC SAFETY	mwilliams@ci.alma.mi.us	~~20~~
Hailey Brewer	Mid-Michigan District Health Dept.	hbrewer@mmdhd.org	—
John Gibson	GCARA	gibson@alma.edu	20
GREG WALTERHOUSE	RESIDENT	WALTEGL@BGSU.EDU	24

GRATIOT COUNTY Date 2-13-18

MITIGATION PLAN UPDATE SIGN-IN SHEET

NAME (PLEASE PRINT)	ORGANIZATION	PRIMARY CONTACT INFORMATION (PHONE OR EMAIL)	MILES DRIVEN (Round Trip)
Bill Ernat	EMCOG	BERNAT@EMCOG.ORG	—
Dan Morden	Gratiot EM	GratiotEMD@gratiotmi.com	—
Kelli Thompson	Gratiot-Isabella RESD	kthompson@giresd.net	—
GREG WALTERHOUSE	RESIDENT	WALTEGL@BGSU.EDU	24
Timm Thorsen	Amateur Radio	thorsen@alma.edu	20
John Gibson	Amateur Radio	gibson@alma.edu	20
Dave Nelson	Ithaca fire / Gratiot County Fire Chiefs	dnelsone ithacami.com	—
Philip Rondy	Michigan Dept of Corrections	rondype michigan.gov.	20
Peter Little	Gratiot County Parks	parksandrec@gratiotmi.com	30
Bernard Barnes	Gratiot County Drain Commissioner	bbarnes@gratiotmi.com	20
Earl Hunt	Gratiot County Sheriff	ehunt@gratiotmi.com	1
STEVE MANN	GRATIOT COUNTY EMERGENCY MGMT	mann1993ds@gmail.com	40
Kay Kawasaki	Gratiot County Commission on Aging (intern)	Kayhill2719@gmail.com	1
Hailey Brewer	Mid-Michigan District Health Dept	hbrewer@mmdhd.org	50

GRATIOT COUNTY Date 1-9-18

MITIGATION PLAN UPDATE SIGN-IN SHEET

NAME (PLEASE PRINT)	ORGANIZATION	PRIMARY CONTACT INFORMATION (PHONE OR EMAIL)	MILES DRIVEN (Round Trip)
Bill Ernat	EMCOG	bernat@emcog.org	—
Dan Mordeau	EMC Riverton Village	dmordeau@gratiotmi.com	—
Kelli Thompson	GIRESD	kthompsun@giresd.net	—
Kurt Giles	City of St. Louis	kgiles@stlouismi.com	17
Pete Little	Gratiot County Parks	parksandrec@gratiotmi.com	15
Stefanie Studt	Ashley Village	Studtmail@gmail.com	30
MARK WILLIAMS	ALMA DPS	mwilliams@ci.alma.mi.us	30
Tracey Corder	Gratiot County	Tcorder@gratiotmi.com	~~4~~ 2
DAVE NELSON	Ithaca fire/City of Ithaca	dvelson@ithacami.com	2
Timmy Thorsen	Gratiot Amateur Radio	tthorsen@alma.edu	20
John Gibson	GCARA	gibson@alma.edu	20
JAy Cooper	MMR	jcooper@mobilemedical.org	~~40~~ 0

GRATIOT COUNTY Date 12-12-17

MITIGATION PLAN UPDATE SIGN-IN SHEET

NAME (PLEASE PRINT)	ORGANIZATION	PRIMARY CONTACT INFORMATION (PHONE OR EMAIL)	MILES DRIVEN (Round Trip)
Bill Ernat	EMCOG	BERNAT@EMCOG.ORG	—
Hailey Brewer	MMDHD	hbrewer@mmdhd.org	—
Kasey Zehner	GGDI	kasey.zehner@gratiot.org	9
Jim Hall	Pine River Superfund Citizen	517-574-0807	16
GREG WALTERHOUSE	RESIDENT	WALTEGL@BGSU.EDU	24
Jag Cooper	MMR	jcooper@mobilsmedical.org	~~40~~ 80
DAVE Nelson	Ithaca fire	dnelson@ithacami.com	2
John Gibson	Ameteir radio	gibson@elma.edu	20
Pete Little	Gratiot County Parks & Rec	parksandrec@gratiotmi.com	15
STEVE MANN	GRATIOT COUNTY E.M.	mann1993ds@gmail.com	~~25~~ 50
Tracey Cordes	County	tcordes@gratiotmi.com	—

GRATIOT COUNTY Date 11-14-17

MITIGATION PLAN UPDATE SIGN-IN SHEET

NAME (PLEASE PRINT)	ORGANIZATION	PRIMARY CONTACT INFORMATION (PHONE OR EMAIL)	MILES DRIVEN (Round Trip)
BILL ERNAT	EMCOG	BERNAT@EMCOG.ORG	—
DAN Mordin	Gratiot EMC / Village of Perrinton	dmordin@gratiotmi.com	
Rich Martin	MSP - EMHSD	martinr13@michigan.gov	
Jim Hall	PRSCTF	517-574-0807	16
GREG WALTERHOUSE	CITIZEN	WALTEGL@BGSU.EDU	
DAVE NELSON	Ithaca fire Dept	dnelson@ithacami.com	2
MARK WILLIAMS	ALMA DPS	mwilliams@ci.alma.mi.us 463-8317	14
John Gibson	Gmatar radio	gibson@alma.edu	20
Kurt Giles	St. Louis	kgiles@stlouismi.com	16
John Ney	Perrinton	pfd2955@yahoo.com	14
Peter Little	Gratiot County Parks & Rec	parksandrec@gratiotmi.com	15
Stefanie Studt	Village of Ashley	Studtmail@gmail.com	18
MICHAEL JOHNSTON	GRATIOT COUNTY IT	MJOHNSTON@GRATIOTMI.COM	2
Kevin Beeson	Pine River Twp	supervisor@pineriver twp.org	16
Ray Welke	Gratiot County Road Comm.	Superintend of operations	—
JAY Cooper	Mobile Medical Response	Director Ambulance Svcs	82 miles
Hailey Brewer	Mid-Michigan District Health Dept	hbrewer@mmdhd.org	—
Kelli Thompson	Isabella-Gratiot RESD		—

Gratiot County
Hazard Mitigation Advisory Committee

Sept 12, 2017

NAME	AGENCY REPRESENTED	EMAIL ADDRESS	PHONE NUMBER	Miles Driven (round trip)
Bill Ernat	EMCOG	BERNAT@EMCOG.org	(989) 992-8700	
EARL HUNT	SHERIFF'S OFFICE	EHUNT@GRATIOTMI.COM	(989) 875-5214	1
Jim Hall	PINE RIVER Superfund CTF	jerrabean@frontier.com	517-574-0807	16
~~Joelle~~ Joelle Snyder	RESD	jmacdonaldsnyder@gmail.com	989-875-5101	0
Kelli thompson	GI-RESD	kthompson@giresa.net	989.875.5101	0
Kasey Zenner	Greater Gratiot Development	kasey.zehner@gratiot.org	989-875-2083	3
ERIC VAN RIPER	MDEQ	vanripere@michigan.gov	989-413-1377	90
Cathy Kelbey	Consumers Energy	Cathy.Kelbey@cmsenergy.com	989 280 5994	150
Phil Randy	Michigan Dept of Corrections	PRandy@michigan.gov	517 230-6799	20
Sarah McClung	Gratiot Co. CofA	SMcClung@gratiotMI.com	989-875-5246	3
DAVE NELSON	Gratiot County Fire Chief's	DNelson@ithacami.com	989-763-3347	1
Dan Maryland	Gratiot EMC	dmaryland@gratiotemi.com	989-640-8736	
John Gibson	Gratiot County Airport Rep	~~randyp@michigan.gov~~ jibs...@alma.edu	989-463-3677	20
KAY KAWASAKI	Gratiot County C of A			

GRATIOT COUNTY Date August 8, 2017

MITIGATION PLAN UPDATE SIGN-IN SHEET

PRINTED NAME	SIGNATURE	ORGANIZATION	MILES DRIVEN (Round Trip)
Bill Ernat	Bill Ernat	EMCOG	—
Sue Joyce	Sue Joyce	Healthy Pine River	
Jane Keon	Jane Keon	Friends of Pine River	20
Dave Nelson	Dave Nelson	Gratiot County Fire Chiefs / Ithaca Fire	1
Ray Knapp	Ray Knapp	Retired	22
Marcus Cheatham	Marcus Cheatham	Mid Mich Pub Health	52
LYNDA at Home	Linda Guttierrez	[illegible]	40
Kurt Giles	Kurt Giles	City of St. Louis	16
Bernie Barnes	Bernie Barnes	Gratiot County Drain Commissioner	20

GRATIOT COUNTY Date August 8, 2017

MITIGATION PLAN UPDATE SIGN-IN SHEET

PRINTED NAME	SIGNATURE	ORGANIZATION	MILES DRIVEN (Round Trip)
Dan Mordent		Gratiot County Co Emer Mgt	0
STEVE MANN		MOBILE MEDICAL RESPONSE	50
GARY RAYBURN		HPR	16
Pat Knapp	Patricia P. Knapp	Home Owner	22
DAN SCHURR		Greater Gratiot Dev.	2
CHRIS PONKER		City of Ithaca	7

APPENDIX B
GRATIOT COUNTY LOCAL COMMUNITY SUBSECTIONS

All local communities were encouraged to participate in the update of the Hazard Mitigation Plan ("Plan") update. Their input was requested on two different levels, participation in the Plan itself, and the submittal of a survey that addressed the issues of that particular community.

Participation in the Plan update included attending any of a number of meetings of the Gratiot County Local Planning Team (LPT), which was used in advisory capacity for the Gratiot County data. The LPT have regularly scheduled bimonthly meetings and additional meetings were held during the off months in order to complete the Plan in a timely manner. The second means to participate was the completion of a community survey. The results of the survey are found below and provide feedback on the issues facing each community.

Below is a list of the participating communities and their local representatives.

Gratiot County: Dan Morden, Tracey Cordes, County Administrator; Ashley Brenner, Emergency Management Coordinator; Bernie Barnes, Drain Commissioner; Peter Little, Gratiot county Parks and Recreation Director; Dan Morden. Emergency Management Coordinator/9-1-1 Director, Earl Hunt, Undersheriff
City of Alma: Mark Williams, Public Safety Director
City of Ithaca: David B. Nelson III, Fire Chief; Chris Yonker, City Manager
City of St. Louis: Kurt Giles, City Manager; Rich Rameriez, Police Chief
Village of Ashley: Stephanie Studt, Village Council Board Member
Village of Breckenridge: Jeff Ostrander, Village Manager
Village of Perrinton: Dan Morden, Fire Lieutenant; John Ney, Public Works Director
Arcada Township: Douglas Merchant, Township Supervisor
Bethany Township: Donald Long, Township Supervisor
Elba Township: Roger Slavik, Township Supervisor
Emerson Township: James Weburg, Township Supervisor
Fulton Township: Denise Rossman, Township Supervisor
Hamilton Township: Matt Ahearn, Township Supervisor
Lafayette Township: Justin Stoneman, Township Supervisor
New Haven Township: Dirk Longanbach, Township Supervisor
Newark Township: Tammy Skinner, Township clerk; Becky Roslund, Township Supervisor
North Shade Township: John Peck, Township Supervisor
North Star Township: John Hardman, Township Supervisor
Pine River Township: Kevin Beeson, Township Supervisor
Seville Township: Terresa Frisbie, Township clerk; Tish Mallory, Township Supervisor
Sumner Township: Ronald Hunt, Township Supervisor
Washington Township: Don Cook, Township Supervisor
Wheeler Township: Jerome Rohde, Township Supervisor

It should be noted that the language within this Appendix was shaped by the EMC and EMCOG staff, in order to better reflect FEMA planning requirements, and thus was not a verbatim response provided by

these local representatives. Inquiries about this may be directed to the Gratiot OEM as well as local community representatives.

1. **Does your community have large seasonal shifts in population? Are there a significant number of seasonal homes in the community? What is the reason for the large influx of population? Does the influx of population create a threat to your community, and if so why?**

City of Ithaca: No. No. NA.

City of St. Louis: No. No. NA

Village of Ashley: No. No. NA.

Village of Breckenridge: No. No. NA.

Village of Perrinton: No. No. NA.

Arcada Township: No. No. NA.

Bethany Township: No. No. NA.

Elba Township: No. No. NA.

Fulton Township: No. No. NA.

Lafayette Township: No. No. NA.

New Haven Township: No. No. NA.

Newark Township: No. No. NA.

North Star Township: No. No. NA.

Pine River Township: No. No. NA.

Seville Township: No. No. NA.

Sumner Township: No. No. NA.

Wheeler Township: No. No. NA.

2. **Are there any annual events held in the community that attract large numbers of people? If so, describe the event(s), location, dates and approximate attendance.**

City of Ithaca: Annual Car Show approx. 1,000 people, Annual Cruise and Show 3rd Thursday in August approx. 1,500 people, youth soccer program September-October every Saturday-approx. 1,000 people

City of St. Louis: Annual 4th of July fireworks on Saturday after 4th, US-27 Car Tour and 2-day Blues Festival in August, both attract 300-500 visitors to downtown St Louis

Village of Ashley: Polar Express Christmas Train-6 weekends in Nov-Dec. Trains bring 900 5 times per weekend.

Village of Breckenridge: July 4th celebration-500-600 visitors; December5th-Christmas in the Village-100-200 visitors; Fall Festival/Homecoming Parade, September-100-200 visitors

Village of Perrinton: Summer Festival first weekend in August.

Arcada Township: "Fly In" at airport in August

Bethany Township: No.

Elba Township: Ashley Country Christmas Train-20,000+ visitors in November and December

Fulton Township: NA

Lafayette Township: No.

New Haven Township: No.

Newark Township: No.

North Star Township: No.

Pine River Township: None.

Seville Township: No.

Sumner Township: No.

Wheeler Township: 4th of July celebration.

3. Using the criteria below, please rate the following natural hazards 0-10, with 0 being a low threat to your community and 10 a high threat on the capacity to cause damage to property and/or bodily harm/death.

Capacity to Cause Physical Damages/Casualties

10. multi-county occurrence causing extensive damage/multiple deaths
9. county-wide occurrence causing extensive damage/multiple deaths
8. multi-jurisdictional occurrence causing extensive damage/multiple deaths
7. local occurrence causing extensive damage/multiple deaths
6. county-wide occurrence causing moderate damage/ a death with injuries
5. multi-jurisdictional occurrence causing moderate damage/ a death with injuries
4. local occurrence causing moderate damage/ a death with injuries
3. county-wide occurrence causing minimal damage/injuries
2. multi-jurisdictional occurrence causing minimal damage/injuries
1. local occurrence causing minimal damage/injuries
0. event occurring within the County with no reported deaths or injuries

	A	B	C	D	E	F	G
City of Ithaca:	8	8	1	6	0	7	5
City of St. Louis:	6	3	2	2	2	7	2
Village of Ashley	6	6	0	6	0	3	3
Village of Breckenridge:	6	6	1	2	2	7	4
Village of Perrinton:	6	6	2	6	2	4	4
Arcada Township:	1	2	0	3	2	1	1
Bethany Township:	6	6	2	3	2	5	3
Elba Township:	3	5	2	4	4	8	2
Fulton Township:	6	6	2	3	2	5	3
Lafayette Township:	10	10	1	10	10	4	9
New Haven Township:	1	2	2	0	1	3	0
Newark Township:	8	3	1	8	2	5	1
North Star Township:	6	5	1	4	3	4	3
Pine River Township:	4	2	2	1	3	5	1

Seville Township:	6	6	2	3	2	5	3
Sumner Township	6	6	2	3	2	5	3
Wheeler Township	9	2	4	6	2	6	8

A-Severe Winter Weather (Ice/Sleet/Snow Storms, Extreme Cold); B-Severe Summer Weather (Lightning, Severe Winds, Thunderstorms, Extreme Heat, Hail); C-Wildfires; D-Flooding Related Hazards (Shoreline Flooding, Shoreline Erosion, Riverine Flooding); E-Drought; F-Tornadoes; G-Fog

4. **Using the criteria below, please rate the following man-made/technological hazards 0-10, with 0 being a low threat to your community and 10 a high threat on the capacity to cause damage to property and/or bodily harm/death.**

Capacity to Cause Physical Damages/Casualties

10. multi-county occurrence causing extensive damage/multiple deaths
9. county-wide occurrence causing extensive damage/multiple deaths
8. multi-jurisdictional occurrence causing extensive damage/multiple deaths
7. local occurrence causing extensive damage/multiple deaths
6. county-wide occurrence causing moderate damage/ a death with injuries
5. multi-jurisdictional occurrence causing moderate damage/ a death with injuries
4. local occurrence causing moderate damage/ a death with injuries
3. county-wide occurrence causing minimal damage/injuries
2. multi-jurisdictional occurrence causing minimal damage/injuries
1. local occurrence causing minimal damage/injuries
0. event occurring within the County with no reported deaths or injuries

	A	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**
City of Ithaca:	1	1	10	8	2	7	7	4	5	7
City of St. Louis:	2	2	0	4	1	4	2	1	5	4
Village of Ashley	5	0	0	0	0	6	0	0	0	0
Village of Breckenridge:	1	1	10	7	0	4	7	0	7	4
Village of Perrinton:	1	3	1	4	1	4	4	4	6	1
Arcada Township:	0	0	0	0	0	0	1	0	0	0
Bethany Township:	1	2	1	1	1	4	4	1	6	1
Elba Township:	1	2	1	1	1	4	4	4	1	1

Fulton Township:	1	2	1	1	1	4	4	1	6	1
Lafayette Township:	1	1	0	2	1	1	1	8	5	1
New Haven Township:	2	2	10	5	1	1	1	2	2	1
Newark Township:	1	1	0	0	1	2	2	1	3	2
North Star Township:	1	2	1	1	1	3	3	1	5	1
Pine River Township:	1	4	0	1	0	1	4	1	2	4
Seville Township:	1	2	1	1	1	4	4	1	6	1
Sumner Township	1	2	1	1	1	4	4	1	6	1
Wheeler Township	7	7	1	6	1	8	8	1	6	2

A-Civil Disturbance; B-Infrastructure Failure; C-Nuclear Incident (nuclear Attack, Nuclear Power Plant Incident) ; D-Terrorism/Sabotage; E-Seasonal/Major Population Change; F-Transportation Accident; G-Hazard Materials Incident (Fixed Site Hazmat Incidents, Transportation Hazmat Incidents) ; H-Oil/Gas Well Accidents; I-Public Health Emergency; J-Structural or Scrap Tire Fire

5. **Does your staff utilize data back-up systems and anti-virus software for the municipality's computers? If no, why not?**

City of Ithaca: Yes.

City of St. Louis: Yes.

Village of Ashley: Yes.

Village of Breckenridge: Yes.

Village of Perrinton: Yes.

Arcada Township: Yes.

Bethany Township: No, did not think of it.

Elba Township: Yes.

Fulton Township: Yes.

Lafayette Township: Yes.

New Haven Township: Yes.

Newark Township: Yes.

North Star Township: Yes.

Pine River Township: Yes.

Seville Township: No, never considered it.

Sumner Township: No never thought of it.

Wheeler Township: Yes.

6. **Has your community installed lightning protection devices on the community's infrastructure? If no, why not?**

City of Ithaca: Yes.

City of St. Louis: Yes.

Village of Ashley: Yes.

Village of Breckenridge: Yes.

Village of Perrinton: On well house only.

Arcada Township: No.

Bethany Township: No, no electrical infrastructure.

Elba Township: NA.

Fulton Township: No, there is no electrical infrastructure.

Lafayette Township: No. No reason probably should.

New Haven Township: Yes.

Newark Township: Yes.

North Star Township: Yes.

Pine River Township: Yes.

Seville Township: No, no electrical infrastructure.

Sumner Township: No, no electrical infrastructure.

Wheeler Township: Ground wires and surge protectors.

7. Does your staff use surge protectors on critical electronic equipment? If no, why not?

City of Ithaca: Yes.

City of St. Louis: Yes.

Village of Ashley: Yes

Village of Breckenridge: Yes.

Village of Perrinton: Yes.

Arcada Township: Yes.

Bethany Township: Yes.

Elba Township: NA.

Fulton Township: Yes.

Lafayette Township: Not sure, equipment is properly maintained.

New Haven Township: Yes.

Newark Township: Yes.

North Star Township: Yes.

Pine River Township: Yes.

Seville Township: Yes.

Sumner Township: Yes.

Wheeler Township: Yes.

8. What hazard (natural or technological) that can be mitigated do you feel your community is best prepared to mitigate (lessen the impact)? Why?

City of Ithaca: Flooding-mitigating through zoning and building codes, and stormwater management. Extreme temperatures-shelters are available for both cooling and warming during these times.
Structural and Scrap Tire Fires-a well-trained professional staff with mutual aid partners, as well as the use of zoning, building, and fire codes.

City of St. Louis: Infrastructure failure-St Louis has its own electrical utility and many of the essential components for water and wastewater have redundancy provisions, including emergency power back-up.

Village of Ashley:

Village of Breckenridge: IT emergencies, IT support and updating technology

Village of Perrinton: Severe winter storm/snow storm-DPW and as well as Road Commission (if necessary) have equipment for snow removal.

Arcada Township:

Bethany Township: Winter Storm/Power Outage-able to utilize generator at township hall to provide heat and shelter to residents.

Elba Township: None.

Fulton Township: Snow/wind storms/power outages-the township has a generator that can be used for powering hall and pump stations, the hall could be used as a temporary shelter.

Lafayette Township: Not sure.

New Haven Township: They have a generator if power goes out.

Newark Township: Cannot think of anything.

North Star Township: Loss of power/Storm-they have a back-up generator

Pine River Township: HazMat situation-lots of resources, training, and mutual aid to assist.

Seville Township: Winter storms/Power outages-installation of a generator at the village hall, which could be used as a temporary shelter.

Sumner Township: Winter storms/Power outages-installation of a generator at the village hall, which could be used as a temporary shelter.

Wheeler Township: Power outages and storms.

9. What hazard (natural or technological) that can be mitigated do you feel your community is least prepared to mitigate (lessen the impact)? Why?

City of Ithaca: Energy emergencies-the City does not own its own energy sources and does not have the proper backup systems.

City of St. Louis: Public Health Emergencies-would require outside assistance, which the City cannot control.

Village of Ashley:

Village of Breckenridge: Inadequate warning system for natural disasters.

Village of Perrinton: Infrastructure failure (power) as there are insufficient funds for back-up generators.

Arcada Township:

Bethany Township: Tornado. No public warning system.

Elba Township: Severe storms, and hazmat incidents

Fulton Township: Tornado-no outdoor warning system.

Lafayette Township: Flooding, then ice/cold.

New Haven Township: Tornado, they do not have a siren.

Newark Township: Hazardous gas or waste spill.

North Star Township: Tornado-no alert system.

Pine River Township: Terrorism/sabotage-they are an open community.

Seville Township: Tornado warning, no outdoor sirens.

Sumner Township: Tornado warning, no outdoor sirens.

Wheeler Township: Water, air, or food contamination.

10. What types of initiatives, improvements or efforts do you think could be implemented that would help reduce your community's vulnerability to specific hazards?

City of Ithaca: Assistance with disaster planning-the emergency management coordinator is a part-time position and does not have the sufficient time to assist local communities in their mitigation efforts for emergency management.

City of St. Louis: Investing in infrastructure improvements and enhancing public notification system.

Village of Ashley:

Village of Breckenridge: Improved public warning systems.

Village of Perrinton: Better system of public notification of potential hazards.

Arcada Township: Improved public awareness.

Bethany Township: Use of modern technology for warning of potential hazards (cell phones, texting, social media)

Elba Township:

Fulton Township: Educational workshops in emergency/hazard management. Improved county system to alert for potential hazards, better use of phones for alerts.

Lafayette Township: Not sure.

New Haven Township: A warning system using social media.

Newark Township: Do not know.

North Star Township: Better communication county-wide.

Pine River Township: Keep public informed.

Seville Township: Work with county to provide modern forms of advanced warning, such as phones, texting, and social media.

Sumner Township: Work with county to provide modern forms of advanced warning, such as phones, texting, and social media.

Wheeler Township: Educating the public on fire.

11. Are you aware of any properties that have experienced flood damage to their homes on multiple occasions as a result of flood waters?

City of Ithaca: No.

City of St. Louis: No residential, but the School's Athletic Complex has had costs due to both flooding and wastewater overflows.

Village of Ashley: No.

Village of Breckenridge: No.

Village of Perrinton: No.

Arcada Township: Yes.

Bethany Township: No.

Elba Township: No.

Fulton Township: No.

Lafayette Township: Not aware of any.

New Haven Township: No.

Newark Township: Yes.

North Star Township: Not sure.

Pine River Township: No.

Seville Township: No.

Sumner Township: No.

Wheeler Township: No.

12. Please identify mitigation measures that would benefit your community.

City of Ithaca: funding for infrastructure and infrastructure protection; better zoning and code enforcement activities; better collaboration between communities; and restoration of revenue sharing to local communities, which would increase funding for local first responders.

City of St. Louis: Increased investment in infrastructure, increased investment in public safety departments (Police, Fire, Medical First Responders, and Building Department)

Village of Ashley:

Village of Breckenridge: Advance warning of weather-related and other natural disasters.

Village of Perrinton: Improved public warning system using multiple systems.

Arcada Township:

Bethany Township: Cannot think of anything.

Elba Township: Cannot think of anything.

Fulton Township: Cannot think of anything.

Lafayette Township:

New Haven Township: No ideas at this time.

Newark Township: Flood insurance, sump pump, sealcoat basement.

North Star Township: Installation of sidewalks, keeping pedestrians off the roads.

Pine River Township:

Seville Township: Cannot think of any.

Sumner Township: Cannot think of any.

Wheeler Township: Training for emergencies.

For the purposes of consistency between the County and the municipalities in determining hazards, the following definitions were used by the County.

GLOSSARY OF TERMS

CIVIL DISTURBANCES-Collective behavior that results in a significant level of law-breaking, perceived threat to public order, or disruption of essential functions and quality of life.

CYBER ATTACKS-involve the use of computers, electronic devices, and/or the internet to attack computer systems.

DAM FAILURE-The collapse or failure of an impoundment (water held back by a dam) resulting in downstream flooding.

DROUGHT-A water shortage caused by a deficiency of rainfall, generally lasting for an extended period of time.

EARTHQUAKE-A shaking or trembling of the crust of the earth caused by the breaking and shifting of rock beneath the surface.

ENERGY EMERGENCY-An actual or potential shortage of gasoline, electrical power, natural gas, fuel oil, or propane-of sufficient magnitude and duration to potentially threaten public health and safety, and/or economic and social stability.

EXTREME TEMPERATURES (COLD)-Prolonged periods of very low temperatures often accompanied by exacerbating conditions such as heavy snowfall and high winds.

EXTREME TEMPERATURES (HEAT)-Prolonged periods of very high temperatures often accompanied by exacerbating conditions such as high humidity and lack of rain.

FOG-Condensed water vapor in cloudlike masses lying close to the ground and limiting visibility**.**

GOALS-general guidelines that explain what is desired to be achieved in the community. They are usually long-term and represent global visions such as "protect public health and safety."

HAIL-Condition where atmospheric water particles from thunderstorms form into rounded or irregular lumps of ice that fall to the earth.

HAZARDOUS MATERIAL INCIDENTS/FIXED SITE-An uncontrolled release of hazardous materials from a fixed site, capable of posing a risk to life, health, safety, property, or the environment.

HAZARDOUS MATERIAL INCIDENTS/TRANSPORTATION-An uncontrolled release of hazardous materials during transport, capable of posing a risk to life, health, safety, property, or the environment.

ICE/SLEET STORM-A storm that generates sufficient quantities of ice or sleet to result in hazardous conditions and/or property damage.

INFRASTRUCTURE FAILURES- failure of critical public or private utility infrastructure that results in a temporary loss of essential functions and/or services.

INVASIVE SPECIES-A species that has been introduced by human action to a location where it did not previously occur naturally, becomes capable of establishing a breeding population in the new location without further intervention by humans, and becomes a pest by threatening local biodiversity and causing human health impacts, significant economic costs, and/or harmful ecological effects.

LIGHTNING-The discharge of electricity from within a thunderstorm.

MITIGATION: "Measures taken in advance of a disaster aimed at decreasing or eliminating its impact on society and on environment." (UNDHA Internationally Agreed Glossary…, 1992, p.53) United Nations Department of Humanitarian Affairs

NSFHA-Non-Sufficient Flood Hazard Area-an area that is in moderate-to-low-risk flood zones. It is not in any immediate dangers from flooding caused by overflowing rivers or hard rains. However, it is important to note that structures within a NSFHA are still at risk.

NUCLEAR ATTACK-A hostile action taken against the United States which involves nuclear weapons and results in destruction of property and/or loss of life.

NUCLEAR POWER PLANT ACCIDENT-An actual or potential release of radioactive material at a commercial nuclear power plant, in sufficient quantity to constitute a threat to the health and safety of the off-site population.

OBJECTIVES-define strategies or implementation steps to attain the identified goals. They are specific, measurable and may have completion dates. Local communities are encouraged to incorporate these goals and objectives into their other planning activities, such as master plans, and capital improvement plans.

OIL/NATURAL GAS WELL INCIDENT-An uncontrolled release of oil or gas, or the poisonous by-product hydrogen sulfide, from production wells.

PETROLEUM AND NATURAL GAS PIPELINE ACCIDENT-An uncontrolled release of petroleum or natural gas, or the poisonous by-product hydrogen sulfide, from a pipeline.

PUBLIC HEALTH EMERGENCY-A widespread and/or severe epidemic, incident of contamination, or other situation that presents a danger to or otherwise negatively impacts the general health and well-being of the public.

RIVERINE FLOODING-The overflowing of rivers, streams, drains, and lakes due to excessive rainfall, rapid snowmelt or ice.

SABOTAGE-The destruction of property or he disruption of operation in an attempt to harm a business, government or other entity

SCRAP TIRE FIRE-A large fire that burns scrap tires being stored for recycling/re-use**.**

SEVERE WINDS-Non-tornadic winds 58 miles per hour (mph) or greater.

SNOWSTORM-A period of rapid accumulation of snow often accompanied by high winds, cold temperatures, and low visibility.

STRUCTURAL FIRE-A fire, of any origin, that ignites one or more structures, causing loss of life and/or property.

SUBSIDENCE-The lowering or collapse of the land surface caused by natural or human-induced activities that erode or remove subsurface support.

TERRORISM-"…activities that involve violent… or life-threatening acts…that are a violation of the criminal laws of the United States or any State and …appear to be intended (i) to intimidate or coerce a civilian population; (ii) to influence the policy of a government by intimidation or coercion; or (iii) to affect the conduct of a government by mass destruction, assassination, or kidnapping" Federal Criminal Code. 18 U.S.C. §2331

THUNDERSTORMS-Weather systems accompanied by strong winds (at least 56 mph), lightning, heavy rain (that could cause flooding), hail (at least ¾" in diameter), or tornadoes.

TORNADO-A violently whirling column of wind that extends from the base of a severe thunderstorm to the ground.

TRANSPORTATION ACCIDENTS: AIR, LAND, AND WATER-A crash or accident involving an air, land or water-based commercial passenger carrier.

WILDFIRE-An uncontrolled fire in grass or brushlands, or forested areas.

WIND FARM INCIDENT-an accident involving wind turbine(s) that pose a risk of health and safety to lives, property and the environment.

APPENDIX C
GRATIOT COUNTY FINAL MITIGATION STRATEGIES

1 Public early warning systems and networks.
~~2~~ Tree trimming and maintenance to prevent limb breakage and safeguard nearby utility lines.
3 Encourage use of surge protectors on critical electronic equipment.
4 Installing lightning protection devices on the community's communications infrastructure.
5 Establishing heating centers/shelters for vulnerable populations.
6 Pre-arranging for shelters for stranded motorists/travelers, and others.
7 Using snow fences or "living snow fences" (rows of trees or vegetation) to limit blowing and drifting of snow over critical roadway segments.
8 Organizing outreach to vulnerable populations during periods of extreme temperatures, including establishing and building awareness of accessible heating and/or cooling centers in the community, and other public information campaigns about this hazard.
9 Floodplain (and coastal zone) management – planning acceptable uses for areas prone to flooding (through comprehensive planning, code enforcement, zoning, open space requirements, subdivision regulations, land use and capital improvements planning) and involving drain commissioners, hydrologic studies, etc. in these analyses and decisions.
10 Acceptable land use densities, coverage and planning for particular soil types and topography (decreasing amount of impermeable ground coverage in upland and drainage areas, zoning and open space requirements suited to the capacity of soils and drainage systems to absorb rainwater runoff, appropriate land use and capital improvements planning) and involving drain commissioners, hydrologic studies, etc. in these analyses and decisions.
11 “Floating” architectural designs for structures in flood-prone areas.
12 Construction of elevated or alternative roads that are unaffected by flooding or making roads more flood-resistant through better drainage and/or stabilization/armoring of vulnerable shoulders and embankments.
13 Government acquisition, relocation, or condemnation of structures within floodplain or floodway areas, purchase or transfer of development rights – to discourage development in floodplain areas.
14 Obtain flood insurance. (Requires community participation in the NFIP.)
15 Joining the National Flood Insurance Program (NFIP).
16 Participation in the Community Rating System (CRS).
17 Structural projects to channel water away from people and property (dikes, levees, floodwalls) or to increase drainage or absorption capacities (spillways, water detention and retention basins, relief drains, drain widening/dredging or rerouting, debris detention basins, logjam and debris removal, extra culverts, bridge modification, dike setbacks, flood gates and pumps, wetlands protection and restoration).
18 Higher engineering standards for drain and sewer capacity, or the expansion of infrastructure to higher capacity.
19 Drainage easements (allowing the planned and regulated public use of privately owned land for temporary water retention and drainage).
20 Installing (or re-routing or increasing the capacity of) storm drainage systems, including the separation of storm and sanitary sewage systems.

21 Farmland and open space preservation.
22 Elevating mechanical and utility devices above expected flood levels.
23 Flood warning systems and the monitoring of water levels with stream gauges and trained monitors.
24 Back-up generators for pumping and lift stations in sanitary sewer systems, and other measures (alarms, meters, remote controls, switchgear upgrades) to ensure that drainage infrastructure is not impeded.
25 Detection and prevention/discouragement of illegal discharges into storm-water sewer systems, from home footing drains, downspouts and sump pumps.
26 Increasing the function and capacity of sewage lift stations and treatment plants (installation, expansion, and maintenance), including possible separation of combined storm/sanitary sewer systems, if appropriate.
27 Stormwater management ordinances or amendments.
28 Use of check valves, sump pumps and backflow preventers in homes and buildings.
29 Garnering community support for a funding mechanism to assist dam owners in the removal or repair of dams in disrepair.
30 Regulate development in the dam's hydraulic shadow (where flooding would occur if a severe dam failure occurred).
31 Ensuring that dams meet or exceed the design criteria required by law.
32 Pump and flood gate installation/automation.
33 Storage of water for use in drought events (especially for human needs during periods of extreme temperatures, and for responding to structural fire and wildfire events).
34 Legislative acts, local ordinances, and other measures to prioritize or control water use.
35 Encouragement of water-saving measures by consumers (including landscaping, irrigation, farming, and low-priority lawn maintenance and non-essential auto washing).
36 Anticipation of potential drought conditions, and the preparation of drought contingency plans.
37 Designs and plans for water delivery systems that include a consideration of drought events.
38 Proper maintenance of property in or near wildland areas.
39 Use of structural fire mitigation systems such as interior and exterior sprinklers, firewalls, smoke detectors, and fire extinguishers (especially in tall buildings, dormitories, attached buildings, and special facilities).
40 Arson prevention activities, including reduction of blight (cleaning up areas of abandoned or collapsed structures, accumulated junk or debris, and lands with a history of flammable substances stored, spilled, or dumped on them).
41 Keeping roads, overpasses. and driveways accessible to vehicles and fire equipment to maximize access and emergency response times to all inhabited or developed areas of a community—driveways should be relatively straight and flat, with at least some open spaces to turn, bridges that can support emergency vehicles, and clearance wide and high enough for two-way traffic and emergency vehicle access (spare keys to gates for properties should be provided to the local fire department, and an address should be visible from the road so homes can be located quickly).
42 Proper storage and safe use of flammables and maintenance/cleaning of fireplaces and chimneys (with the use of spark arresters and emphasis on proper storage of flammable items). Residents should be encouraged to inspect chimneys at least twice a year and clean them at least once a year.
43 Have adequate water supplies for emergency firefighting (in accordance with NFPA standards).

44 Use of native species or other population control techniques to prevent proliferation of invasive species.
45 Code existence and enforcement.
46 Measures to reduce urban blight and associated arson (possibly including Crime Prevention through Environmental Design).
47 Defensible space around structures in fire-prone wildland areas.
48 Efficient response to fallen power lines.
49 Transportation planning that provides roads, overpasses, etc. to maximize access and improve emergency response times to all inhabited or developed areas of a community. (Not just planning for average traffic volumes in the community.)
50 Enforced fireworks regulations.
51 Elimination of clandestine methamphetamine laboratories through law enforcement and public education.
52 Condominium-type associations for maintaining safety in attached housing/building units or multi-unit structures.
53 Proper siting of tire storage and processing facilities (land use planning that recognizes scrap tire sites as a real hazard and environmental threat).
54 Pest-control measures for mosquitoes and other nuisances around scrap tire yards.
55 Compliance with/enforcement of Resource Conservation and Recovery Act (RCRA) standards.
56 Identification of radioactive soils and high-radon areas
57 Proper separation and buffering between industrial areas and other land uses.
58 Enhanced security and anti-terrorist/sabotage/civil disturbance measures.
59 Improved design, routing, and traffic control at problem roadway areas.
60 Long-term planning that provides more connector roads for reduced congestion of arterial roads.
61 Railroad inspections, maintenance and improved designs at problem railway/roadway intersections (at grade crossings, rural signs/signals for RR crossing).
62 Proper planning, design, maintenance of, and enhancements to designated truck routes.
63 Use of ITS (intelligent transportation systems) technology.
64 Locating schools, nursing homes, and other special facilities away from major hazardous material transportation routes.
65 Increasing public awareness and widespread use of the "MISS DIG" utility damage prevention service (800-482- 7171).
66 Proper pipeline design, construction, maintenance and inspection.
67 Using buffer strips to segregate wells, storage tanks, and other production facilities from transportation routes and adjacent land uses, in accordance with state regulations, and consistent with the level of risk.
68 Adherence to all regulations and best industry practices, especially for relatively new techniques of hydraulic fracturing, in order to preserve Michigan’s environmental quality and public confidence in the industry.
69 Proper location, design, and maintenance of water and sewer systems (to include insulation of critical components to prevent damage from ground freeze).
70 Redundancies in utility and communications systems, especially "lifeline" systems; to increase resilience (even if at the cost of some efficiency).
71 Use of generators for backup power at critical facilities.

72 Replacement or renovation of aging structures and equipment (to be made as hazard-resistant as economically possible).
73 Redundancies and alternatives in the energy supply system; provision of backup supply systems.
74 The capacity to use more than one type of fuel to sustain necessary operations and functions.
75 Use of alternative sources of energy (e.g. solar, wind sources) for key functions.
76 Architectural designs that reduce the need for outside energy inputs.
77 Airport maintenance, security, and safety programs.
78 Some suggest that design, management, integration, and lowered density blighted areas will reduce vandalism, crime, and some types of riot events. Crime Prevention Through Environmental Design (CPTED) is a field of planning that deals with this.
79 Design requirements for schools, factories, office buildings, shopping malls, hospitals, correctional facilities, stadiums, recreation areas, etc. that take into consideration emergency and security needs.
80 Immunization programs to vaccinate against communicable diseases.
81 Improving ventilation techniques in areas, facilities, or vehicles that are prone to crowding, or that may involve exposure to contagion or noxious atmospheres.
82 Radon detection and abatement activities, to reduce concentrations of radon in homes and buildings.
83 Maintaining community water and sewer infrastructure at acceptable operating standards.
84 Demolition and clearance of vacant condemned structures and brownfields to prevent rodent infestations.
85 Free or reduced-expense community clinics and school health services.
86 Proper location, installation, cleaning, monitoring, and maintenance of septic tanks.
87 Establishing avenues of reporting (and rewards) for information preventing terrorist incidents and sabotage.

APPENDIX D
GRATIOT COUNTY POSSIBLE MITIGATION STRATEGIES

Summer Weather Hazards

1. Increased coverage and use of NOAA Weather Radio.
2. Producing and distributing family emergency preparedness information relating to thunderstorm hazards.
3. Public education and awareness of summer weather dangers.
4. Training and increased use of weather spotters.
5. Public early warning systems and networks.
6. Tree trimming and maintenance to prevent limb breakage and safeguard nearby utility lines. (Ideal: Establishment of a community forestry program with a main goal of creating and maintaining a disaster-resistant landscape in public rights-of-way.)
7. Buried/protected power and utility lines.
8. Encourage residents to develop a Family Disaster Plan which includes the preparation of a Disaster Supplies Kit.
9. Pre-planning for debris management staging and storage areas. (Debris could be rubble, vehicles, objects from destroyed/damaged structures, vegetation or other items knocked down or blown by winds.)
10. Pre-planning for debris management staging and storage areas. (Debris is usually vegetation such as tree branches that have fallen under the impact of hail, or broken power or phone lines that had frozen or been weighted down by ice or fallen branches.)
11. Using surge protectors on critical electronic equipment.
12. Installing lightning protection devices on the community's communications infrastructure.
13. Proper anchoring of manufactured homes and exterior structures such as carports and porches.
14. Establishing safe and appropriate locations for temporary debris disposal sites.
15. Securing loose materials, yard, and patio items indoors or where winds cannot blow them about.
16. Pre-planning for debris management staging and storage areas. (Debris could be rubble, vehicles, objects from destroyed/damaged structures, vegetation or other items knocked down or blown by winds, or broken power or phone lines that had frozen or been weighted down by fallen branches and trees.)

Drought

17. Anticipation of potential drought conditions, and preparation of drought contingency plans.
18. Obtaining agricultural insurance.

Winter Weather Hazards

19. Increased coverage and use of NOAA Weather Radio.
20. Producing and distributing family emergency preparedness information relating to severe winter weather hazards.
21. Tree trimming and maintenance to prevent limb breakage and safeguard nearby utility lines. (Ideal: Establishment of a community forestry program with a main goal of creating and maintaining a disaster-resistant landscape in public rights-of-way.)
22. Buried/protected power and utility lines.
23. Establishing heating centers/shelters for vulnerable populations.
24. Organizing outreach to isolated, vulnerable, or special-needs populations.

25. Encourage residents to develop a Family Disaster Plan which includes the preparation of a Disaster Supplies Kit.
26. Pre-planning for debris management staging and storage areas. (Debris is usually the snow and ice itself, or vegetation such as tree branches that have fallen under the impact of winds or the weight of ice. Broken power or phone lines that had frozen or been weighted down by ice or fallen branches could be part of the problem. Some storage areas will definitely be needed for snow removal during blizzards.)
27. Home and public building maintenance to prevent roof and wall damage from "ice dams."
28. Pre-planning for debris management staging and storage areas. (Debris is usually the sleet and ice itself being cleared from roads and roofs, or vegetation such as tree branches that have fallen under the impact of winds or the weight of ice. Broken power or phone lines that had frozen or been weighted down by ice or fallen branches could be part of the problem. In some cases, roofs may collapse under the weight of ice and snow.)
29. Proper building/site design and code enforcement relating to snow loads, roof slope, snow removal and storage, etc.
30. Farmer preparedness to address livestock needs/problems.
31. Pre-arranging for shelters for stranded motorists/travelers, and others.
32. Maintaining adequate road and debris clearing capabilities.
33. Pre-planning for debris management staging and storage areas. (Debris is usually the sleet and ice itself being cleared from roads and roofs, or vegetation such as tree branches that have fallen under the impact of winds or the weight of ice. Broken power or phone lines that had frozen or been weighted down by ice or fallen branches could be part of the problem. In some cases, roofs may collapse under the weight of ice and snow. Some storage areas will definitely be needed for snow removal during blizzards.)

Extreme Temperatures

34. Organizing outreach to vulnerable populations during periods of extreme temperatures, including establishing and building awareness of accessible heating and/or cooling centers in the community, and other public information campaigns about this hazard.
35. Increased coverage and use of NOAA Weather Radio.
36. Special arrangements for payment of heating bills.

Wildfires

37. Proper maintenance of property in or near wildland areas (including short grass; thinned trees and removal of low hanging branches; selection of fire-resistant vegetation; use of fire resistant roofing and building materials; use of functional shutters on windows; keeping flammables such as curtains securely away from windows or using heavy fire-resistant drapes; creating and maintaining a buffer zone (defensible space) between structures and adjacent wild lands; use of the fire department's home safety inspections; sweeping/ cleaning dead or dry leaves, needles, twigs, and combustibles from roofs, decks, eaves, porches, and yards; keeping woodpiles and other combustibles away from structures; use of boxed or enclosed eaves on house; thorough cleaning-up of spilled flammable fluids; and keeping garage areas protected from blowing embers).
38. Safe disposal of yard and house waste rather than through open burning.
39. Use of fire spotters, towers, planes.
40. Keep handy household items that can be used as fire tools; a rake, axe, hand/chainsaw, bucket and shovel. Install and maintain smoke detectors and fire extinguishers. Install a smoke alarm on each floor of buildings and homes. Test monthly and change the batteries two times each year. Teach family members how to use the fire extinguisher.
41. Post fire emergency telephone numbers.

42. Organizing neighborhood wildfire safety coalitions (to plan how the neighborhood could work together to prevent a wildfire).
43. Residents should plan several escape routes away from their homes - by car and by foot.
44. Use of structural fire mitigation systems such as interior and exterior sprinklers, smoke detectors, and fire extinguishers.
45. Arson prevention activities, including reduction of blight (cleaning up areas of abandoned or collapsed structures, accumulated junk or debris, and with any history of flammable substances stored, spilled, or dumped on them).
46. Public education on smoking hazards and recreational fires.
47. Proper maintenance and separation of power lines. Ask the power company to clear branches from power lines.
48. Efficient response to fallen power lines.
49. Training and exercises for response personnel.
50. GIS mapping of vegetative coverage, for use in planning decisions and analyses through comparison with topography, zoning, developments, infrastructure, etc.
51. Media broadcasts of fire weather and fire warnings.
52. Create and enforce local ordinances that require burn permits and restrict campfires and outdoor burning.
53. Mutual aid pacts with neighboring communities.
54. Prescribed burns and fuel management (thinning of flammable vegetation, possibly including selective logging to thin out some areas. Fuels cleared can be given away as firewood or chipped into wood chips for distribution.)
55. The creation of fuel breaks (areas where the spread of wildfires will be slowed or stopped due to removal of fuels, or the use of fire-retardant materials/vegetation) in high-risk forest or other areas.
56. Keeping roads and driveways accessible to vehicles and fire equipment—driveways should be relatively straight and flat, with at least some open spaces to turn, bridges that can support emergency vehicles, and clearance wide and high enough for two-way traffic and emergency vehicle access (spare keys to gates around property should be provided to the local fire department, and an address should be visible from the road so homes can be located quickly).
57. Enclosing the foundations of homes and buildings rather than leaving them open and the underside exposed to blown embers or materials.
58. Safe use and maintenance/cleaning of fireplaces and chimneys (with the use of spark arresters and emphasis on proper storage of flammable items). Residents should be encouraged to inspect chimneys at least twice a year and clean them at least once a year.
59. Proper maintenance and storage of motorized equipment that could catch on fire.
60. Proper storage and use of flammables, including the use of flammable substances (such as when fueling machinery). Store gasoline, oily rags and other flammable materials in approved safety cans. Stack firewood at least 100 feet away and uphill from homes.
61. Obtaining insurance.
62. Including wildfire safety information in materials provided by insurance companies to area residents.
63. Residents should be instructed on proper evacuation procedures, such as wearing protective clothing (sturdy shoes, cotton or woolen clothing, long pants, a long-sleeved shirt, gloves and a handkerchief to protect the face); taking a Disaster Supplies Kit; and choosing a route away from fire hazards.
64. Encourage residents to develop a Family Disaster Plan which includes the preparation of a Disaster Supplies Kit.

Dam Failures

65. Ensuring consistency of dam Emergency Action Plan (EAP) with the local Emergency Operations Plan (EOP).
66. Regulate development in the dam's hydraulic shadow (where flooding would occur if there was a severe dam failure).
67. Public awareness and warning systems.
68. Obtaining insurance.
69. Increased coverage and use of NOAA Weather Radio.
70. Developing site emergency plans for schools, factories, office buildings, shopping malls, hospitals, correctional facilities, stadiums, recreation areas, and other appropriate sites.
71. Constructing emergency access roads to dams.
72. Real estate disclosure laws that identify a home's location within a dam's hydraulic shadow.
73. Trained, equipped, and prepared search and rescue teams.
74. Encourage residents to develop a Family Disaster Plan which includes the preparation of a Disaster Supplies Kit.

Riverine and Urban Flooding/Shoreline Flooding and Erosion

75. Accurate identification and mapping of flood-prone areas.
76. Floodplain/coastal zone management – planning acceptable uses for areas prone to flooding (through comprehensive planning, code enforcement, zoning, open space requirements, subdivision regulations, land use and capital improvements planning) and involving drain commissioners, hydrologic studies, etc. in these analyses and decisions.
77. Acceptable land use densities, coverage and planning for particular soil types and topography (decreasing amount of impermeable ground coverage in upland and drainage areas, zoning and open space requirements suited to the capacity of soils and drainage systems to absorb rainwater runoff, appropriate land use and capital improvements planning) and involving drain commissioners, hydrologic studies, etc. in these analyses and decisions.
78. Dry floodproofing of structures within known flood areas (strengthening walls, sealing openings, use of waterproof compounds or plastic sheeting on walls).
79. Wet floodproofing of structures (controlled flooding of structures to balance water forces and discourage structural collapse during floods).
80. Elevation of flood-prone structures above the 100-year flood level.
81. Government acquisition, relocation, or condemnation of structures within floodplain or floodway areas.
82. Public awareness of the need for permits (MDEQ Part 31) for building in floodplain areas.
83. Employing techniques of erosion control within the watershed area (proper bank stabilization, techniques such as planting of vegetation on slopes, creation of terraces on hillsides, use of riprap boulders and geotextile fabric, etc.).
84. Dredging and clearance of sediment and debris from drainage channels.
85. Protection (or restoration) of wetlands and natural water retention areas.
86. Enforcement of basic building code requirements related to flood mitigation.
87. Developing site emergency plans for schools, factories, office buildings, shopping malls, hospitals, correctional facilities, stadiums, recreation areas, and other appropriate sites.
88. Obtaining insurance.
89. Joining the National Flood Insurance Program.
90. Participating in the Community Rating System (CRS).

91. Drainage easements (allowing the planned and regulated public use of privately owned land for temporary water retention and drainage).
92. Farmland and open space preservation.
93. Elevating mechanical and utility devices above expected flood levels.
94. Improved/updated floodplain mapping.
95. Real estate disclosure laws.
96. Public education and flood warning systems.
97. Monitoring of water levels with stream gauges and trained monitors.
98. Increased coverage and use of NOAA Weather Radio.
99. Training for local officials on flood fighting, floodplain management, floodproofing, etc.
100. Anchoring of manufactured homes to a permanent foundation, but preferably these structures would be readily movable if necessary or else permanently relocated outside of flood-prone areas.
101. Road closures and traffic control in flooded areas.
102. Trained, equipped, and prepared search and rescue teams.
103. Control and securing of debris, yard items, or stored objects (including oil, gasoline, and propane tanks, and paint and chemical barrels) in floodplains that may be swept away, damaged, or pose a hazard when flooding occurs.
104. Back-up generators for pumping and lift stations in sanitary sewer systems, and other measures (alarms, meters, remote controls, switchgear upgrades) to ensure that drainage infrastructure is not impeded.
105. Employing techniques of erosion control in the area (bank stabilization, planting of vegetation on slopes, creation of terraces on hillsides).
106. Purchase or transfer of development rights – to discourage development in floodplain areas.
107. Stormwater management ordinances or amendments.
108. Wetlands protection regulations and policies.
109. Regional/watershed cooperation.
110. Use of check valves, sump pumps and backflow preventers in homes and buildings.
111. Encourage residents to develop a Family Disaster Plan which includes the preparation of a Disaster Supplies Kit.

Fixed Site Hazardous Material Incidents (including explosions and industrial accidents)

112. Maintaining an active and viable Local Emergency Planning Committee (LEPC).
113. Developing and exercising site emergency plans and community response plans as required under SARA Title III.
114. Development of Risk Management Plans for sites that manufacture, store, or handle hazardous materials, to comply with EPA regulations. (For guidance, see the EPA's CEPPO web site at http://www.epa.gov/swercepp/acc-pre.html.)
115. Training in and compliance with all safety procedures and systems related to the manufacture, storage, transport, use, and disposal of hazardous materials.
116. Policies stressing the importance of safety above other considerations.
117. Trained, equipped, and prepared site and local hazardous material emergency response teams.
118. Compliance with/enforcement of Resource Conservation and Recovery Act (RCRA) standards.
119. Elimination of clandestine methamphetamine laboratories through law enforcement and public education.
120. Hazardous material public awareness and worker education programs.
121. Facility and community training and exercise programs.
122. Brownfield cleanup activities.

123. Proper separation and buffering between industrial areas and other land uses.
124. Location of industrial areas away from schools, nursing homes, etc.
125. Evacuation plans and community awareness of them.
126. Developing site emergency plans for schools, factories, office buildings, shopping malls, hospitals, correctional facilities, stadiums, recreation areas, and other appropriate sites.
127. Public warning systems and networks for hazardous material releases.
128. Increased coverage and use of NOAA Weather Radio (which can provide notification to the community during any period of emergency, including large scale hazardous material incidents).
129. Road closures and traffic control in accident areas.
130. Trained, equipped, and prepared search and rescue teams.
131. Compliance with all industrial, fire, and safety regulations.
132. Insurance coverage.
133. Enhanced security and anti-terrorist/sabotage/civil disturbance measures.
134. Encourage residents to develop a Family Disaster Plan which includes the preparation of a Disaster Supplies Kit.

Hazardous Material Transportation Incidents

135. Improvements in driver education, traffic law enforcement, and transportation planning that balance the needs of hazardous material transporters with the safety of the general public.
136. Improved design, routing, and traffic control at problem roadway areas.
137. Long-term planning that provides more connector roads for reduced congestion of arterial roads.
138. Railroad inspections and improved designs at problem railway/roadway intersections (at grade crossings, rural signs/signals for RR crossing).
139. Proper planning, design, maintenance of, and enhancements to designated truck routes.
140. Enforcement of weight and travel restrictions for truck traffic.
141. Training, planning, and preparedness for hazardous material incidents along roadways and railways (in addition to fixed site emergencies).
142. Public warning systems and networks.
143. Increased coverage and use of NOAA Weather Radio (which can provide notification to the community during any period of emergency, including large scale hazardous material incidents).
144. Use of ITS (intelligent transportation systems) technology.
145. Compliance with and enforcement of USDOT and MDOT regulations regarding hazardous materials transport.
146. Locating schools, nursing homes, and other special facilities away from major hazardous material transportation routes.
147. Road closures and traffic control in accident areas.
148. Trained, equipped and prepared local hazardous materials emergency response teams.
149. Trained, equipped, and prepared search and rescue teams.
150. Evacuation plans and community awareness of them.
151. Encourage residents to develop a Family Disaster Plan which includes the preparation of a Disaster Supplies Kit.

Infrastructure Failures

152. Proper location, design, and maintenance of water and sewer systems (to include insulation of critical components to prevent damage from ground freeze).
153. Burying electrical and phone lines, where possible, to resist damage from severe winds, lightning, ice, and other hazards.
154. Redundancies in utility and communications systems, especially "lifeline" systems.

155. Mutual aid assistance for failures in utility and communications systems (including 9-1-1).
156. Programs/networks for contacting elderly or homebound persons during periods of infrastructure failure, to assess whether they have unmet needs.
157. Use of generators for backup power at critical facilities.
158. Regular maintenance and equipment checks.
159. Replacement or renovation of aging structures and equipment (to be made as hazard-resistant as economically possible).
160. Protecting electrical and communications systems from lightning strikes.
161. Tree-trimming programs to protect utility wires from falling branches. (Ideal: Establishment of a community forestry program with a main goal of creating and maintaining a disaster-resistant landscape in public rights-of-way.)
162. Increasing public awareness and widespread use of the "MISS DIG" utility damage prevention service (1-800-482-7171).
163. Encourage residents to develop a Family Disaster Plan which includes the preparation of a Disaster Supplies Kit.

Oil and Natural Gas Well Accidents

164. Community and operator compliance with industry safety regulations and standards.
165. Awareness of hydrogen sulfide gas dangers and personal protection actions for these dangers.
166. Using buffer strips to segregate wells, storage tanks, and other production facilities from transportation routes and adjacent land uses, in accordance with state regulations, and consistent with the level of risk.
167. Developing site emergency plans for schools, factories, office buildings, shopping malls, hospitals, correctional facilities, stadiums, recreation areas, and other appropriate sites.
168. Contingency plans for worker and public protection, including the inclusion of rescue and evacuation procedures for well hazard areas in the local emergency operations plan.
169. Encourage residents to develop a Family Disaster Plan which includes the preparation of a Disaster Supplies Kit.

Public Health Emergencies

170. Encouraging residents to receive immunizations against communicable diseases.
171. Maintaining community water and sewer infrastructure at acceptable operating standards.
172. Providing back-up generators for water and wastewater treatment facilities to maintain acceptable operating levels during power failures.
173. Demolition and clearance of vacant condemned structures to prevent rodent infestations.
174. Maintaining a community public health system with sufficient disease monitoring and surveillance capabilities to adequately protect the population from large-scale outbreaks.
175. Increasing public awareness of the causes, symptoms, and protective actions for disease outbreaks and other potential public health emergencies.
176. Community support of free or reduced-expense clinics and school health services.
177. Preventing public contact with contaminated sites or waters (including floodwaters).
178. Brownfield and urban blight clean-up activities.
179. Pollution control, enforcement, and cleanup; proper disposal of chemicals and scrap materials.
180. Proper location, installation, cleaning, monitoring, and maintenance of septic tanks.
181. Separation of storm and sanitary sewer systems.

Sabotage/Terrorism/Weapons of Mass Destruction (WMD)

182. Development of a thorough community risk and threat assessment that identifies potential vulnerabilities and targets for a sabotage/terrorism/WMD attack.

183. Alertness, awareness, and monitoring of organizations and activities that may threaten the community.
184. Implementing school safety and violence prevention programs.
185. Providing legitimate channels of political and public expression.
186. Heightening security at public gatherings, special events, and critical community facilities and industries.
187. Using laminated glass and other hazard-resistant, durable construction techniques in public buildings and critical facilities.
188. Greater awareness of, and provision for, mental health services in schools, workplaces, and institutional settings.
189. Training, planning, and preparedness by local law enforcement and other responders for terrorist/ sabotage/WMD attacks.
190. The development and testing of internal emergency plans and procedures by businesses and organizations.
191. Developing site emergency plans for schools, factories, office buildings, shopping malls, hospitals, correctional facilities, stadiums, recreation areas, and other appropriate sites.
192. Establishing avenues of reporting (and rewards) for information preventing terrorist incidents and sabotage.
193. Consistent use of computer data back-up systems and anti-virus software.
194. Encourage residents to develop a Family Disaster Plan which includes the preparation of a Disaster Supplies Kit.
195. Pre-planning for debris management staging and storage areas. (Debris could be rubble, vehicles, etc. that would get in the way or be left over following an attack or incident. The area may simultaneously need to be treated as a crime scene, site of urban search and rescue, area of hazardous materials, and/or a public health threat.

Population Increase (Seasonal/Event)

196. Provide personnel on a temporary basis to handle greater loads on public services.
197. Provide for emergency equipment to deal with higher call rates.
198. Develop plans for excessive traffic patterns.

Civil Disturbances (prison or institutional rebellions, disruptive political gatherings, violent labor disputes, urban protests or riots, or large-scale uncontrolled festivities)

199. Law enforcement training, staffing, and resource provision.
200. Incident anticipation and planning, and video documentation of events for later study and use.
201. Local law enforcement mutual aid, and support from the Michigan State Police and National Guard.
202. It is possible that design, management, integration, and lowered density of poor or blighted areas may reduce vandalism, crime, and some types of riot events. Crime Prevention Through Environmental Design (CPTED) is a field of planning that deals with this.
203. Insure structures and property in risky areas.
204. Developing site emergency plans for schools, factories, office buildings, shopping malls, hospitals, correctional facilities, stadiums, recreation areas, and other appropriate sites.
205. Design requirements for schools, factories, office buildings, shopping malls, hospitals, correctional facilities, stadiums, recreation areas, etc. that take into consideration emergency and security needs.

Earthquakes (biggest Michigan threats would be to pipelines, buildings that are poorly designed and constructed, and shelving, furniture, mirrors, gas cylinders, etc. within structures that could fall and cause injury or personal property damage)

206. Adopt and enforce appropriate building codes.
207. Use of safe interior designs and furniture arrangements.
208. Obtain insurance.
209. "Harden" critical infrastructure systems to meet seismic design standards for "lifelines."
210. Encourage residents to develop a Family Disaster Plan which includes the preparation of a Disaster Supplies Kit.

Scrap Tire Fires

211. Policies for regulated disposal and management of scrap tires, and enforcement of regulations related to them (separation of stored scrap tires from other materials; limits on the size of each pile; minimum distances between piles and property lines; covering, chemically treating, or shredding tires to limit mosquito breeding; providing for fire vehicle access to scrap tire piles; training employees in emergency response operations; installation of earthen berms around storage areas; prevention of pools of standing water in the area; control of nearby vegetation; an emergency plan posted on the property; storing only the permitted volume of tires authorized for that site).
212. Proper siting of tire storage and processing facilities (land use planning that recognizes scrap tire sites as a real hazard and environmental threat).
213. Local awareness of scrap tire risk, training and preparedness of responders.
214. Law enforcement to prevent illegal dumping of tires at the site.
215. Pest-control measures for mosquitoes and other nuisances around scrap tire yards.

Structural Fires

216. Code existence and enforcement.
217. Designs that include the use of firewalls and sprinkler systems (especially in tall buildings, dormitories, attached structures, and special facilities).
218. Public education and school programs (especially about the use of stoves, heaters, fireworks, matches/ lighters, etc.)
219. Landlords and families can install and maintain smoke detectors and fire extinguishers. Install a smoke alarm on each level of homes (to be tested monthly, with the batteries changed twice each year).
220. Family members and residents should know how to use a fire extinguisher.
221. Proper installation and maintenance of heating systems (especially those requiring regular cleaning, those using hand-loaded fuels such as wood, or using concentrated fuels such as liquid propane).
222. Safe and responsible use of electric and "space" heaters (placed at least 3 feet from objects, with space near hot elements free of combustibles).
223. Developing site emergency plans for schools, factories, office buildings, shopping malls, hospitals, correctional facilities, stadiums, recreation areas, and other appropriate sites.
224. Safe use and maintenance/cleaning of fireplaces and chimneys (with the use of spark arresters and emphasis on proper storage of flammable items). Residents should be encouraged to inspect chimneys at least twice a year and clean them at least once a year.
225. Post fire emergency telephone numbers.
226. Education and practice of safe cigarette handling and disposal (also candles, fireworks, campfires, holiday lights)
227. Measures to reduce urban blight and associated arson (including CPTED?).

228. Proper workplace procedures, training and exercising, and handling of explosive and flammable materials and substances.
229. Pre-planned escape routes and fire alert responses.
230. Improved and continuing training for emergency responders, and provision of equipment for them.
231. Defensible space around structures in fire-prone wildland areas.
232. Proper maintenance of power lines, and efficient response to fallen power lines.
233. Transportation planning that provides roads, overpasses, etc. to maximize access and improve emergency response times, and evacuation potential, for all inhabited or developed areas of a community (not just designing for the minimum amount of road capacity to handle normal traffic volumes in the community.) This includes transportation access within developed sites (shopping malls, stadiums, office & commercial parking lots, etc.)
234. Control of civil disturbances and criminal activities that could lead to arson.
235. Enforced fireworks regulations.
236. Elimination of clandestine methamphetamine laboratories through law enforcement and public education.
237. Condominium-type associations for maintaining safety in attached housing/building units or multi-unit structures.
238. Obtain insurance.
239. Encourage residents to develop a Family Disaster Plan which includes the preparation of a Disaster Supplies Kit.

Nuclear Attack

240. Community awareness of designated fallout shelters and attack warning systems.
241. Developing and promoting workable population protection plans (evacuation and in-place sheltering plans, as appropriate).
242. Construction of concrete safe rooms (or shelters) in houses, trailer parks, community facilities, and business districts.
243. Using laminated glass and other hazard-resistant, durable construction techniques in public buildings and critical facilities.
244. Developing site emergency plans for schools, factories, office buildings, shopping malls, hospitals, correctional facilities, stadiums, recreation areas, and other appropriate sites.
245. Increased coverage and use of NOAA Weather Radio (which can provide notification to the community during any period of emergency, including enemy attack).
246. Encourage residents to develop a Family Disaster Plan which includes the preparation of a Disaster Supplies Kit.

Nuclear Power Plant Accidents

247. Proper awareness of, training on, and implementation of radiological emergency procedures (to include both primary and secondary Emergency Planning Zones, as appropriate).
248. Community awareness of designated shelters and accident warning systems.
249. Increased coverage and use of NOAA Weather Radio (which can provide notification to the community during any period of emergency, including enemy attack).
250. Developing site emergency plans for schools, factories, office buildings, shopping malls, hospitals, correctional facilities, stadiums, recreation areas, and other appropriate sites.
251. Encourage residents to develop a Family Disaster Plan which includes the preparation of a Disaster Supplies Kit.

Pipeline Accidents (Petroleum and Natural Gas)

252. Locating pipelines away from dense development, critical facilities, special needs populations, and environmentally vulnerable areas whenever possible.
253. Increasing public awareness of pipeline locations and appropriate emergency procedures.
254. Developing site emergency plans for schools, factories, office buildings, shopping malls, hospitals, correctional facilities, stadiums, recreation areas, and other appropriate sites.
255. Increasing public awareness and widespread use of the "MISS DIG" utility damage prevention service (800=482-7171).
256. Proper pipeline design, construction, maintenance and inspection.
257. Encourage residents to develop a Family Disaster Plan which includes the preparation of a Disaster Supplies Kit.

Subsidence

258. Identification, mapping, and preventing or limiting development in old mining areas or geologically unstable terrain.
259. Filling or buttressing subterranean open spaces (such as abandoned mines) to discourage their collapse.
260. Hydrological monitoring of groundwater levels in subsidence-prone areas.
261. Obtain insurance for subsidence hazards.
262. Real estate disclosure laws.
263. Community awareness of subsidence risks and effects.
264. Encourage residents to develop a Family Disaster Plan which includes the preparation of a Disaster Supplies Kit.

Transportation Accidents

265. Improvements in driver education, traffic law enforcement, and transportation planning that balance the needs of hazardous material transporters with the safety of the general public.
266. Improved design, routing, and traffic control at problem roadway areas.
267. Long-term planning that provides more connector roads for reduced congestion of arterial roads.
268. Railroad inspections and improved designs at problem railway/roadway intersections (at grade crossings, rural signs/signals for RR crossing).
269. Enforcement of weight and travel restrictions for truck traffic.
270. Use of ITS (intelligent transportation systems) technology.
271. Use of designated truck routes.
272. Marine safety and general boater awareness programs.
273. Commercial operator training and skill enhancement programs.
274. Training, planning, and preparedness for mass-casualty incidents involving all modes of public transportation.
275. Trained, equipped, and prepared search and rescue teams.

APPENDIX E

Item 1

Upgrade the warning systems, including sirens, throughout County to be able to inform public for all hazards

Action: Upgrade the warning systems throughout the County, encourage the residents to enroll in the County's wireless emergency alert system

- Location: County-wide
- Lead Agency: Emergency 9-1-1
- Participating Agencies: OEM, Fire Chiefs Association
- Hazards Addressed: All hazards
- Potential Funding Source(s): 9-1-1 funds, FEMA
- Project Cost: TBD
- Schedule: 2020
- Priority: High
- Goal/Objective Achieved: Goal 1, Objective a
- Benefit(s): Improved public notification of hazardous events.

Item 2

Expand the county drain capacity to help protect existing businesses and future business development

Action: Identify inadequate drain systems, and improve accordingly

- Location: County-wide
- Lead Agency: Drain Commission
- Participating Agencies: Road Commissions, Farm Bureau
- Hazards Addressed: Flooding, infrastructure failure
- Potential Funding Source(s): Drain Commission, Road Commission, FEMA
- Project Cost: TBD
- Schedule: Ongoing
- Priority: High
- Goal/Objective Achieved: Goal 2, Objective b; Goal 3, Objective c
- Benefit(s): Improved infrastructure thereby reducing local flooding.

Item 3

Reconstruct bridges and culverts and remove debris to eliminate obstructions to the floodway

Action: Identify and improve bridges and culverts and identify potential logjam areas to eliminate obstructions in floodway

- Location: County-wide
- Lead Agency: Road Commission
- Participating Agencies: Drain Commission, MDOT
- Hazards Addressed: Infrastructure failure, flooding
- Potential Funding Source(s): Road Commission, MDOT, Drain Commission, FEMA
- Project Cost: TBD
- Schedule: Ongoing
- Priority: High
- Goal/Objective Achieved: Goal 2, Objective b; Goal 3, Objective c

- Benefit(s): Improved infrastructure and reduced flooding.

Item 4 (NEW)
Increase investment for first responders
Action: Seek additional funds for equipment/training.

- Location: County-wide
- Lead Agency: OEM
- Participating Agencies: Local Municipalities
- Hazards Addressed: All hazards
- Potential Funding Source(s): Grants
- Project Cost: TBD
- Schedule: Ongoing
- Priority: High
- Goal/Objective Achieved: Goal 1, Objective d
- Benefit(s): First responders better informed/prepared for hazardous events.

Item 5 (NEW)
Initiate automated hydrological monitoring at the Pine River Gauge in Alma.
Action: Acquire and install automated United States Geological Survey (USGS) approved river gauge monitoring equipment.

- Location: Existing manually read River Gauge on Pine River at Alma 43°22'47.1"N 84°39'20.3"W
- Lead Agency: OEM
- Participating Agencies: Drain Commission, City of Alma, City of St Louis
- Hazards Addressed: Riverine Flooding
- Potential Funding Source(s): FEMA, local match for upkeep
- Project Cost: TBD
- Schedule: 2021
- Priority: High
- Goal/Objective Achieved: Goal 2, Objective b
- Benefit(s): Improved flood monitoring with automated regular reporting of real-time data to USGS and National Weather Service (NWS).

Item 6 (NEW)
Acquire and install three networked weather monitoring stations to collect real-time weather data for Gratiot county Central Dispatch
Action: Acquire and install networked capable weather monitoring stations (wind/temperature/air pressure/precipitation gauge etc) at critical locations in the County and network feed data to Gratiot County Central Dispatch and NWS.

- Location: City of St Louis Fire Department, Gratiot County Central Dispatch, and Village of Perrinton Fire Department
- Lead Agency: OEM
- Participating Agencies: NWS, Central Dispatch, Fire Chiefs Association, City of St Louis Fire Department, and Village of Perrinton Fire Department
- Hazards Addressed: All weather hazards, fires, hazardous material events
- Potential Funding Source(s): FEMA
- Project Cost: TBD

- Schedule: 2022
- Priority: High
- Goal/Objective Achieved: Goal 1, Objective b; Goal 2, Objective c
- Benefit(s): Improved data for first responders enabling better decision-making based upon hazard information.

Item 7

Separate sanitary and storm sewers to prevent overflow during severe weather events, which can cause local flooding, public health issues, and sewer backups

Action: Identify local sewer systems that need to be separated, separate accordingly.

- Location: County-wide
- Lead Agency: Mid-Michigan Health Department
- Participating Agencies: City of Alma, City of Ithaca, City of St Louis, Village of Ashley, Village of Breckinridge, Village of Perrinton
- Hazards Addressed: Public health emergencies, flooding
- Potential Funding Source(s): FEMA
- Project Cost: TBD
- Schedule: Ongoing
- Priority: High
- Goal/Objective Achieved: Goal 3, Objective b
- Benefit(s): Improved public health, reduced flooding due to overloaded sewer systems.

Item 8

Encourage all municipalities to participate in National Flood Insurance Program (NFIP) and to adopt FEMA Floodplain maps

Action: Contact local municipalities to encourage joining NFIP and adopting FEMA floodplain maps

- Location: County-wide
- Lead Agency: OEM
- Participating Agencies: Alma, Ithaca, St. Louis, Bethany Township, Fulton Township, Newark Township, and Sumner Township
- Hazards Addressed: flooding
- Potential Funding Source(s): FEMA
- Project Cost: NA
- Schedule: Ongoing
- Priority: High
- Goal/Objective Achieved: Goal 4, Objectives a, b, d, and e
- Benefit(s): Improved insurance coverage for residents/businesses in floodplains.

Item 9 (NEW)

Install lightning protection devices at municipal facilities and schools

Action: Identify facilities requiring protection from lightning strikes, purchase/install protection devices

- Location: County-wide
- Lead Agency: OEM
- Participating Agencies:
- Hazards Addressed: Lightning, local infrastructure
- Potential Funding Source(s): Local funds, FEMA
- Project Cost: TBD

- Schedule: 2021
- Priority: High
- Goal/Objective Achieved: Goal 2, Objective c; Goal 3, Objective c
- Benefit(s): Municipal infrastructure protected from damaged by lightning.

Item 10 (NEW)

Identify and plan to eliminate/reduce invasive species negatively impacting the County

Action: Working with county and local officials, identify invasive species that negatively impact the County and work on a plan to mitigate their impact.

- Location: County-wide
- Lead Agency: EGLE
- Participating Agencies: DNR, Parks & Recreation Departments, MDARD
- Hazards Addressed: Invasive Species
- Potential Funding Source(s): State funds, FEMA
- Project Cost: TBD
- Schedule: Ongoing
- Priority: High
- Goal/Objective Achieved: Goal 2, Objective a
- Benefit(s): Reduction/elimination of invasive species, improving environment for native species.

Item 11 (NEW)

Maintain water quality for potable and recreational purposes.

Action: Collaborate with local, state, and federal agencies to ensure safe groundwater and surface water for potable and recreational purposes.

- Location: County-wide
- Lead Agency: Michigan Department of Environment, Great Lakes, & Energy (EGLE)
- Participating Agencies: Park & Recreation Departments, Mid-Michigan District Health Department
- Hazards Addressed: Flooding, Public Health Issues
- Potential Funding Source(s): State funds, FEMA
- Project Cost: TBD
- Schedule: Ongoing
- Priority: High
- Goal/Objective Achieved: Goal 1, Objective c; Goal 3, Objective a
- Benefit(s): Water that is safe for consumption and recreational purposes.

Item 12 (NEW)

Develop a plan to reduce/eliminate hazardous road conditions

Action: Plant living snow fences along designated roadways.

- Location: County-wide
- Lead Agency: Road Commission
- Participating Agencies: MDOT
- Hazards Addressed: Severe winter weather conditions
- Potential Funding Source(s): FEMA, state funds
- Project Cost: TBD
- Schedule: 2023
- Priority: High

- Goal/Objective Achieved: Goal 2, Objective b
- Benefit(s): Improved/safer road conditions during winter months.

Item 13 (NEW)

Promote the use of smoke detectors and carbon monoxide detectors for every residence and business within the County

Action: Promote and facilitate the installation of carbon monoxide detectors.

- Location: County-wide
- Lead Agency: Fire Chief's Association
- Participating Agencies: OEM, local fire departments
- Hazards Addressed: Fire, hazardous materials (CO poisoning)
- Potential Funding Source(s): FEMA
- Project Cost: NA
- Schedule: Ongoing
- Priority: High
- Goal/Objective Achieved: Goal 2, Objective b; Goal 3, Objective c
- Benefit(s): Mitigated injuries for both citizens and fire staff due to fires or CO poisoning.

Item 14

Encourage the construction of public shelters

Action: Work with local agencies to identify locations for public shelters throughout the County

- Location: County-wide
- Lead Agency: OEM
- Participating Agencies: Gratiot County Parks and Recreation, City of St Louis, Red Cross
- Hazards Addressed: All hazards
- Potential Funding Source(s): FEMA
- Project Cost: NA
- Schedule: 2021
- Priority: High
- Goal/Objective Achieved: Goal 2, Objective b
- Benefit(s): Public provided a safe shelter location during hazardous events.

Item 15 (NEW)

Propose Michigan Public Safety Communication System (MPSCS) tower site.

Action: Collaborate with neighboring counties to cooperatively invest in MPSCS tower construction to mutually benefit public safety-first responders and improve interoperability and improve/enhance radio coverage.

- Location: Southern Gratiot County (site not yet identified)
- Lead Agency: 9-1-1
- Participating Agencies: OEM, local law enforcement and fire departments
- Hazards Addressed: All hazards
- Potential Funding Source(s): 9-1-1 funds, FEMA, state/federal grants
- Project Cost: $1.5 million
- Schedule: 2024
- Priority: High
- Goal/Objective Achieved: Goal 1, Objective a and d, Goal 2, Objective b

- Benefit(s): Improved safety communications coverage and interoperability for all stakeholders.

Item 16 (NEW)

Reduce/eliminate invasive plant species negatively impacting the County

Action: Chemically treat drainage ditches throughout the County to address phragmites, bush honeysuckle, and multiflora rose.

- Location: County-wide
- Lead Agency: EGLE
- Participating Agencies: Drain Commission, Parks and Recreation Departments, Michigan Department of Agriculture & Rural Development (MDARD)
- Hazards Addressed: Invasive Species
- Potential Funding Source(s): Local funds, FEMA, state funds, grants
- Project Cost: TBD
- Schedule: Ongoing
- Priority: High
- Goal/Objective Achieved: Goal 2, Objective b; Goal 3, Objective c, Goal 4, Objective e
- Benefit(s): Reduction/elimination of invasive species improving environment for native species.

Item 17 (NEW)

Acquire backup site generators at critical infrastructure/key resource (CIKR) locations throughout Gratiot County

Action: Work with local units of government to acquire and install backup generators adequate to power critical operations for CIKR categories in sectors of Emergency Services, Government Facilities, Healthcare and Public Health, Information Technology, Transportation Systems, Water and Wastewater Systems.

- Location: County-wide
- Lead Agency: OEM
- Participating Agencies: City of Alma, Village of Ashley, Village of Breckenridge, City of Ithaca, Village of Perrinton, City of Saint Louis, Gratiot County, Gratiot Sheriff,
- Hazards Addressed: All hazards
- Potential Funding Source(s): FEMA, Local, State, and Federal Grants
- Project Cost: $350,000.00
- Schedule:2023
- Priority: High
- Goal/Objective Achieved: Goal 1, Objective d, Goal 3, Objective c and d
- Benefit(s): Improved resiliency and mitigation against energy interruptions

Item 18 (NEW)

Encourage the inclusion of hazard mitigation into other county planning documents

Action: Encourage municipal agencies to include hazard mitigation into master plans/comprehensive land use plans and other planning documents.

- Location: County-wide
- Lead Agency: OEM
- Participating Agencies: Gratiot County, all townships, cities, and villages
- Hazards Addressed: All hazards
- Potential Funding Source(s): FEMA
- Project Costs: NA

- Schedule: Ongoing
- Priority: High
- Goal/Objective Achieved: Goal 4, Objective c
- Benefit(s): The identification of hazard mitigation in other local planning documents will promote community awareness of hazard mitigation, thereby and improving the public health and safety.

Item 19

Encourage each municipality to update building and property maintenance codes

Action: Work with local municipalities to update building and property maintenance codes to meet current standards

- Location: County-wide
- Lead Agency: County Permit Department
- Participating Agencies: City of St Louis
- Hazards Addressed: All hazards
- Potential Funding Source(s): NA
- Project Cost: NA
- Schedule: 2021
- Priority: Medium
- Goal/Objective Achieved: Goal 2, Objective a, Goal 4, Objective d
- Benefit(s): Reduced risk to exposure from hazardous events.

Item 20

Work with local agencies to identify vulnerable populations. Using GIS, plot relationship of vulnerable populations with local shelters

Action: Identify vulnerable populations throughout the County in relation to shelter locations

- Location: County-wide
- Lead Agency: OEM
- Participating Agencies: GIS Authority, Commission on Aging, Mid-Michigan District Health Department, District 1 Regional Medical Response Coalition (D1RMRC)
- Hazards Addressed: All Hazards
- Potential Funding Source(s): GIS Authority, grants
- Project Cost: TBD
- Schedule: 2021
- Priority: Medium
- Goal/Objective Achieved: Goal 2, Objective b
- Benefit(s): Provide safe environment for vulnerable populations.

Item 21

Encourage adopting zoning ordinances that enhance/preserve floodplain management

Action: Encourage local municipalities to adopt zoning ordinances that prohibit new construction and purchase of flood-prone properties with local floodplains

- Location: County-wide
- Lead Agency: OEM
- Participating Agencies: County Permits, St Louis, Ithaca
- Hazards Addressed: flooding
- Potential Funding Source(s): NA

- Project Cost: NA
- Schedule: Ongoing
- Priority: Medium
- Goal/Objective Achieved: Goal 2, Objective a; Goal 4, Objectives a, b, d
- Benefit(s): Reduce flooding of inhabited properties.

Item 22

Work with local municipalities to develop county-wide communication plan and to assure interoperability with first responders (fire, police and EMS)

Action: Implement county-wide interoperability communication plan

- Location: County-wide
- Lead Agency: 9-1-1
- Participating Agencies: Police Chiefs Association, Fire Chiefs Association, Gratiot County Amateur Radio Association, Mobile Medical Response (MMR)
- Hazards Addressed: All hazards
- Potential Funding Source(s): 9-1-1, grants
- Project Cost: TBD
- Schedule: Ongoing
- Priority: Medium
- Goal/Objective Achieved: Goal 1, Objective a
- Benefit(s): Improved communications and response times.

Item 23 (NEW)

Work with local school districts to develop county-wide communication plan and to assure interoperability with first responders (fire, police, EMS)

Action: Implement county-wide interoperability communication plan schools

- Location: County-wide
- Lead Agency: 9-1-1
- Participating Agencies: RESD, local first response departments, OEM
- Hazards Addressed: All hazards
- Potential Funding Source(s): school district budgets, community foundation grants
- Project Cost: TBD
- Schedule: 2021
- Priority: Medium
- Goal/Objective Achieved: Goal 1, Objective a
- Benefit(s): Enhanced communication between schools and local public safety during emergencies.

Item 24 (NEW)

Provide training and exercises for first responders

Action: Seek funding sources for training and exercises for first responders

- Location: County-Wide
- Lead Agency: Office of Emergency Management (OEM)
- Participating Agencies: Local Police Departments, Local Fire Departments, Local Municipalities
- Hazards Addressed: All hazards
- Potential Funding Source(s): Grants
- Project Costs: TBD

- Schedule: Ongoing
- Priority: Medium
- Goal/Objective Achieved: Goal 1, Objective d; Goal 2, Objective d
- Benefit(s): First responders better informed/prepared for hazardous events.

Item 25 (NEW)

Promote subscription to Rave Alerts, Smart 911, and Rave Facilities for Businesses

Action: Work with local groups and organizations to promote Rave Alerts, Smart 911 and Rave Facilities for Businesses.

- Location: County-wide
- Lead Agency: 9-1-1
- Participating Agencies: OEM
- Hazards Addressed: All hazards
- Potential Funding Source(s): 9-1-1 grants, local grants,
- Project Cost: TBD
- Schedule: 2021
- Priority: Medium
- Goal/Objective Achieved: Goal 1, Objective a, b, and d
- Benefit(s): Provides additional information to 9-1-1, who can then forward it to the first responders as they assist in the emergency.

Item 26

Develop map layers identifying areas where hazardous materials are stored

Action: Using GIS, identify storage locations of hazardous materials

- Location: County-wide
- Lead Agency: OEM
- Participating Agencies: GIS Authority, Local Fire Departments
- Hazards Addressed: Hazardous materials, infrastructure
- Potential Funding Source(s): GIS Authority, Grants
- Project Cost: TBD
- Schedule: 2021
- Priority: Medium
- Goal/Objective Achieved: Goal 2, Objective b
- Benefit(s): Improved first responder situational awareness.

Item 27

Develop map layers identifying areas where critical infrastructure is located

Action: Using GIS, identify storage locations of critical infrastructure

- Location: County-wide
- Lead Agency: OEM
- Participating Agencies: GIS Authority
- Hazards Addressed: All hazards
- Potential Funding Source(s): GIS Authority, Grants
- Project Cost: TBD
- Schedule: 2021
- Priority: Medium

- Goal/Objective Achieved: Goal 3, Objective e
- Benefit(s): Improved first responder situational awareness**.**

Item 28 (NEW)

Educate Public about hazards and safety precautions

Action: Using multi-media and attending county events, promote the dangers of hazardous events and the importance of safety measures

- Location: County-Wide
- Lead Agency: Office of Emergency Management (OEM)
- Participating Agencies: Local Fire Departments, Local Police Departments
- Hazards Addressed: All hazards
- Potential Funding Source(s): Grants
- Project Costs: TBD
- Schedule: Ongoing
- Priority: Medium
- Goal/Objective Achieved: Goal 1, Objective b; Goal 2, Objective d
- Benefit(s): Public better informed/prepared for hazardous events.

Item 29 (NEW)

Continue to Develop Emergency Plans for Businesses, Schools, Governmental Facilities, and Special Events.

Action: Work with local organizations and agencies on the development of emergency plans

- Location: County-wide
- Lead Agency: OEM
- Participating Agencies: Gratiot-Isabella RESD, local business, Greater Gratiot Development
- Hazards Addressed: All hazards
- Potential Funding Source(s): NA
- Project Cost: NA
- Schedule: Ongoing
- Priority: Medium
- Goal/Objective Achieved: Goal 1, Objective b; Goal 2, Objective d
- Benefit(s): Safer environments for public during emergency situations.

Item 30 (NEW)

Strive to become Integrated Public Alert & Warning System (IPAWS) certified user

Action: Work towards becoming IPAWS certified for use of Rave Alerts for emergency push notifications.

- Location: County-wide
- Lead Agency: OEM
- Participating Agencies: 9-1-1
- Hazards Addressed: All hazards
- Potential Funding Source(s): Homeland Security grants and Community Foundation grants
- Project Cost: TBD
- Schedule: 2021
- Priority: Medium
- Goal/Objective Achieved: Goal 1, Objective a
- Benefit(s): Improved method to mass alert public prior to emergencies or disasters.

Item 31 (NEW)

Educate public on Emergency Planning Preparedness

Action: Educate the public on the need to develop Family Disaster Plans, Family Disaster Kits, and emergency planning for pets and livestock.

- Location: County-wide
- Lead Agency: OEM
- Participating Agencies: Local municipalities, public safety departments
- Hazards Addressed: All hazards
- Potential Funding Source(s): Local funding, local grants, state funding
- Project Cost: TBD
- Schedule: Ongoing
- Priority: Medium
- Goal/Objective Achieved: Goal 1, Objective b; Goal 2, Objective d
- Benefit(s): Better educated/prepared public during emergencies, providing an improved public response.

Item 32 (NEW)

Reduce the vulnerability of seniors to cyber security and fraud

Action: Educate seniors on cyber security and fraud.

- Location: County-wide
- Lead Agency: Michigan State Police
- Participating Agencies: OEM, local public safety departments, Commission on Aging
- Hazards Addressed: Cyber Fraud
- Potential Funding Source(s): NA
- Project Cost: NA
- Schedule: Ongoing
- Priority: Medium
- Goal/Objective Achieved: Goal 1, Objective b; Goal 2, Objective d
- Benefit(s): Reduced victims of cyber fraud.

Item 33

Work with MDOT to complete a study to evaluate the overall safety on US-127 in Gratiot County

Action: Evaluate US-127 in Gratiot County to determine if design changes are needed to improve safety conditions in Gratiot County.

- Location: US-127 Corridor
- Lead Agency: Sheriff's Department
- Participating Agencies: OEM, MDOT, Road Commission
- Hazards Addressed: Transportation Accidents
- Potential Funding Source(s): MDOT
- Project Cost: TBD
- Schedule: 2025
- Priority: Medium
- Goal/Objective Achieved: Goal 2, Objective b
- Benefit(s): Improved travel conditions on US-127 and alternate routes for US-127.

Item 34

Increase education regarding the importance of securing all structures as well as taking care of clutter to help eliminate flying debris

Action: Provide information to public on local building codes and property maintenance

- Location: County-wide
- Lead Agency: County Permits
- Participating Agencies: OEM, City of St Louis, Fire Chiefs Association
- Hazards Addressed: Weather related hazards
- Potential Funding Source(s): NA
- Project Cost: NA
- Schedule: 2020
- Priority: Moderate
- Goal/Objective Achieved: Goal 1, Objective b; Goal 2, Objective d
- Benefit(s): Reduced risk to exposure from hazardous events.

Item 35

Develop map layers identifying areas where previous hazardous events occurred

Action: Using GIS, identify storage locations of hazardous materials

- Location: County-wide
- Lead Agency: OEM
- Participating Agencies: GIS Authority, Local Fire Departments, Local Police Departments
- Hazards Addressed: All hazards
- Potential Funding Source(s): GIS Authority, Grants
- Project Cost: TBD
- Schedule: 2021
- Priority: Moderate
- Goal/Objective Achieved: Goal 2, Objective b; Goal 3, Objective c; Goal 4, Objective e
- Benefit(s): Improved first responder situational awareness.

Item 36 (NEW)

Supplemental Emergency Operation Plans for communities

Action: Encourage local communities to write/adopt supplemental Emergency Operation Plans (EOP)

- Location: County-wide
- Lead Agency: OEM
- Participating Agencies: St Louis, Alma
- Hazards Addressed: All hazards
- Potential Funding Source(s): NA
- Project Cost: NA
- Schedule: 2022
- Priority: Moderate
- Goal/Objective Achieved: Goal 1, Objective b; Goal 2, Objective a; Goal 2, Objective e
- Benefit(s): Improved/enhanced local planning for all hazards.

Item 37 (NEW)

Work towards a long-term automatic mutual aid system for first responders

Action: Promote enlistment into Mutual Aid Box Alarm System (MABAS) or create a similar automatic mutual aid system.

- Location: County-wide
- Lead Agency: Fire Chief's Association
- Participating Agencies: Municipal fire departments, 9-1-1
- Hazards Addressed: Fire, Hazardous Materials
- Potential Funding Source(s): Municipal budgets
- Project Cost: TBD
- Schedule: 2021
- Priority: Moderate
- Goal/Objective Achieved: Goal 2, Objective a, b; Goal 3, Objective e
- Benefit(s): Improved response/coverage for life/safety on calls.

Item 38 (NEW)

Promote Emergency Evacuation Day

Action: Host an annual "Emergency Evacuation Day" to evaluate plans for schools, businesses, medical facilities, factories, governmental buildings throughout the County.

- Location: County-wide
- Lead Agency: OEM
- Participating Agencies: Local public safety departments
- Hazards Addressed: All hazards
- Potential Funding Source(s): NA
- Project Cost: NA
- Schedule: 20419/2020
- Priority: Moderate
- Goal/Objective Achieved: Goal 1, Objective b
- Benefit(s): Better educated/prepared public during emergencies, providing an improved public response.

Item 39 (NEW)

Develop fuel/propane gas emergency suppliers list

Action: Work with fuel and propane gas distributors to develop a list of suppliers that can distribute fuel and propane gas during power outages and other emergencies.

- Location: County-wide
- Lead Agency: OEM
- Participating Agencies: local municipalities, private sector fuel suppliers
- Hazards Addressed: Infrastructure failure
- Potential Funding Source(s): NA
- Project Cost: NA
- Schedule: 2020
- Priority: Moderate
- Goal/Objective Achieved: Goal 3, Objective e
- Benefit(s): Quicker access to available propane and fuel during infrastructure failures.

Item 40 (NEW)

Aid local fire, rescue, and public safety departments in recruitment/retention efforts

Action: Promote the need to increase the number of fire, police, and safety personnel.

- Location: County-wide
- Lead Agency: OEM
- Participating Agencies: Local fire and public safety departments
- Hazards Addressed: All hazards
- Potential Funding Source(s): NA
- Project Cost: NA
- Schedule: Ongoing
- Priority: Moderate
- Goal/Objective Achieved: Goal 2, Objective c
- Benefit(s): Improved staffing and retention of qualified fire fighters and public safety personnel.

Item 41 (NEW)

Create an inventory of municipal equipment and services that can be utilized during emergencies

Action: Collect and maintain the inventory of municipal equipment and services.

- Location: County-wide
- Lead Agency: OEWM
- Participating Agencies: Local municipalities
- Hazards Addressed: All hazards
- Potential Funding Source(s): NA
- Project Cost: NA
- Schedule: Ongoing
- Priority: Moderate
- Goal/Objective Achieved: Goal 3, Objective e
- Benefit(s): Improved response due to better communications on accessible equipment/services for use during emergency responses.

Item 42

Promote the use of NOAA weather radios through the distribution of brochures at community events

Action: Using social media and attending county events, promote the advantages of utilizing NOAA weather radios.

- Location: County-Wide
- Lead Agency: Office of Emergency Management (OEM)
- Participating Agencies: Gratiot County Parks and Recreation
- Hazards Addressed: All hazards
- Potential Funding Source(s): National Weather Service, Grants
- Project Costs: TBD
- Schedule: 2020
- Priority: Moderate
- Goal/Objective Achieved: Goal 1, Objective a
- Benefit(s): Public better informed/prepared for hazardous events.

Item 43 (NEW)

Increase investment for first responders

Action: Seek additional funds for responder recruitment

- Location: County-wide
- Lead Agency: OEM
- Participating Agencies: Gratiot County all townships, cities, and villages
- Hazards Addressed: All hazards
- Potential Funding Source(s): Grants
- Project Cost: TBD
- Schedule: Ongoing
- Priority: Moderate
- Goal/Objective Achieved: Goal 2, Objective c
- Benefit(s): Increase in responders would be beneficial for addressing any hazardous/dangerous situations.