2016
SHIAWASSEE COUNTY HAZARD MITIGATION PLAN

SECTION 1 – INTRODUCTION

SECTION 2 – COMMUNITY CHARACTERISTICS

SECTION 3 – PLANNING PROCESS

SECTION 4 – HAZARD IDENTIFICATION & RISK ASSESSMENT

SECTION 5 – MITIGATION STRATEGIES

SECTION 6 – GOALS & OBJECTIVES

SECTION 7 – ADOPTION AND IMPLEMENTATION

SECTION 1- INTRODUCTION

OVERVIEW

Like all communities, Shiawassee County is subject to natural, technological and human-related hazards that threaten the public's health, safety and welfare. These hazards have the potential to threaten a person's life, health, livelihood, and property. To better understand these hazards and their impacts on people and property, and to identify ways to mitigate and reduce the impacts of those hazards, the Shiawassee County Board of Commissioners ("Board") originally adopted and implemented the 2007 Shiawassee County Hazard Mitigation Plan. To further encourage and support federal and state efforts to effectively plan to reduce the potential for hazards as well as mitigate their impact, Shiawassee County hereby presents an updated 2016 Shiawassee County Hazard Mitigation Plan ("Plan").

Hazard mitigation is defined as any action taken before, during, or after a disaster or emergency to reduce the impact of the hazard or reduce the long-term risk of human life and property from natural, technological and human-related hazards. The key features of hazard mitigation include assessment of vulnerability and risk and the development and implementation strategies. Hazard mitigation does not mean that all hazards can be stopped or prevented, and it does not suggest complete elimination of the damage or disruption caused by such incidents. Most natural hazards are well beyond our ability to control. Mitigation does not mean quick fixes. It is a long-term approach to reduce hazard vulnerability.

A hazard is defined as a danger or risk that threatens life and health, most often unavoidable and unpredictable. For purposes of this document, the focus is on hazards that may affect large areas of Shiawassee County or the county as a whole. These hazards range from snowstorms to chemical spills to civil disturbances. Shiawassee County as a whole is vulnerable to more than two dozen different types of recognizable hazards.

A Hazard Mitigation Plan identifies activities that can be undertaken by both the public and the private sectors to reduce safety hazards, health hazards, and property damage caused by natural, technological and human-related hazards. Every community faces different hazards and has the potential to be effected differently by those hazards depending on their geographic location, socio-economic characteristics, and previous experience with the particular hazard. Every community has different resources and interests when considering planning to prevent and mitigate the impact of hazards. As a result, there are many ways to deal with natural hazards and many agencies that are involved in mitigation and response. There is no single solution for managing, mitigating or responding, but planning gives us all a better chance of success.

Planning provides a mechanism to assess the issues and then produce a program of activities that will best mitigate the impact of hazards and meet other needs. A well prepared plan will ensure that variables are reviewed and measures implemented so that issues are addressed by the most appropriate and efficient solutions. It can also assist in ensuring that programmed activities are coordinated with each other and with other goals and activities therefore preventing conflicts and reducing the costs of implementing individual activities.

Examples of existing, ongoing activities that promote or can contribute to hazard mitigation include but are not limited to:

- Capital improvements planning
- Budgeting
- Site-specific hazardous material emergency planning (through Local Emergency Planning Committees)
- Watershed management planning
- Solid waste management planning
- Local community planning and zoning activities
- Regional planning
- Transportation planning
- Recreation planning
- Forest management
- Coastal zone management
- Infrastructure design, regulation and permitting
- Floodplain management
- Public facility design and construction review

The Federal Emergency Management Agency (FEMA) requires that each community have a FEMA approved hazard mitigation plan to be eligible for future FEMA hazard mitigation funding. A hazard mitigation plan is a requirement for Federal mitigation funds. Section 104 of the Disaster Mitigation Act of 2000 (42 USC 5165) states that after November 1, 2003, local governments applying for *pre*-disaster mitigation funds must have an approved local hazard mitigation plan. After November 1, 2004, local governments were required to have a hazard mitigation plan to also be eligible for *post*-disaster mitigation funds.

The 2016 Shiawassee County Hazard Mitigation Plan ("Plan") complies with the requirements of a multi-jurisdictional hazard mitigation plan as outlined by FEMA. Communities within Shiawassee County that have adopted this plan also comply with the FEMA requirement. This document updates the previous 2007 Shiawassee County Hazard Mitigation Plan. This new document contains hazards that were not considered in the previous plan. It has also been restructured so that it is easier to find and use the information contained within it. This should be

helpful for stakeholders to more easily find, review and understand the information that is most relevant for their jurisdictions and areas of interest. The development and implementation of this plan is a whole community effort with the goal of ensuring that Shiawassee County continues to be a vibrant, safe and enjoyable place.

MISSION STATEMENT

The Shiawassee County Emergency Management/Homeland Security Office is the Shiawassee County entity responsible for overseeing the development of the Plan. The Emergency Management/Homeland Security Office has the following responsibilities in Shiawassee County:

1. Investigate the potential for hazards in the community.

2. Act with the Local Emergency Planning Committee to review, improve and implement plans to deal with hazardous chemical accidents.

3. Integrate such plans into Shiawassee County Emergency Action Guidelines (EAG).

4. Disseminate information obtained under Title III to the general public.

5. Act as the Emergency Management Advisory Council to advise and develop plans for utilization of the resources and facilities of the County as set forth in P.A. 390.

The Local Advisory Committee is comprised of volunteers with a variety expertise and interests within Shiawassee County. The purpose of this Committee was to review and comment on Plan components prior to presenting the Plan to public meetings. The Local Advisory Committee is comprised of the following individuals.

The Plan is intended to identify activities that can be undertaken by both the public and the private sectors to reduce safety hazards, health hazards, and property damage caused by natural, technological and human-related hazards. For purposes of this Plan, the following mission statement was adopted:

To foster and promote an emergency management system that protects and effectively responds to all emergencies and disasters. To save lives, prevent injuries and protect property and the environment from the effects of all emergencies and disasters.

Page Intentionally Left Blank

SECTION 2- COMMUNITY CHARACTERISTICS

COUNTY BACKGROUND

The name of Shiawassee County is derived from the Native American name given the major river traversing the County. "Shiawassee River" is reported to have several meanings, including rolling or sparkling water, as well as "the water that lies straight ahead."

Shiawassee County is situated near the southeastern portion of Michigan's Lower Peninsula, approximately eighty miles northwest of Detroit, twenty-five miles west of Flint and thirty miles northeast of Lansing. Appendices, Page ___ illustrates the county's location within the State of Michigan. Shiawassee County is bordered by six neighboring counties: to the north are Saginaw and Gratiot Counties, Genesee County is to the east, to the south are Ingham and Livingston Counties, and to the west is Clinton County. Shiawassee County was proclaimed as a separate county on September 10, 1822 by Governor Cass.

Population

The three (3) major factors which determine population growth are births, deaths, and migration. While local government has little control over births and deaths, migration to or from, the County can be influenced by employment, housing, local government services, and the general quality of life. Evaluation of population trends and projections in view of current and desired conditions can impact the intensity and location of future growth.

Shiawassee County is a predominately rural community with, according to the 2010 U.S. Census, approximately 70,600 people. The population has decreased by 1.4% from 2000 to 2010. Of the 70,648 people residing in Shiawassee County, 50.6% are female. 89.9% of the residents over 25 years of age are high school graduates (includes equivalency). Also, 68,315 (96.7%) are white, 325 (0.5%) are Black or African American, 350 (0.5%) are American Indian or Alaskan Natives, 256 (0.4%) are Asian and 1,695 (2.4%) are Hispanic or Latino. The median age is 40.3 and the average household size is 2.54 persons compared to an average family size of 3.00 persons. Its largest municipality is the City of Owosso that has a population of approximately 15,200 people.

Area Name	Population				
	1990	2000	2010	2000 – 2010	1990 - 2010
Shiawassee County	**69,770**	**71,687**	**70,648**	**-1.4%**	**+1.3%**
Antrim Township	1,679	2,050	2,161	**+5.4%**	**+28.7%**
Bennington Township	2,726	3,017	3,168	**+5.0%**	**+16.2%**
Burns Township	3,019	2,905	2,876	**-1.0%**	**-4.7%**
Byron Village	573	595	581	**-2.4%**	**+1.4%**
Caledonia Charter Township	4,514	4,427	4,475	**+1.1%**	**-0.9%**
Corunna City	3,091	3,381	3,497	**+3.4%**	**+13.1%**
Durand City	4,283	3,933	3,446	**-12.4%**	**-19.5%**
Fairfield Township	790	745	755	**+1.3%**	**-4.4%**
Hazelton Township	2,294	1,603	1,490	**-7.0%**	**-35.0%**
New Lothrop Village	596	603	581	**-3.6%**	**-2.5%**
Laingsburg City	1,148	1,223	1,283	**+4.9%**	**+11.8%**
Middlebury Township	1,536	1,489	1,504	**+1.0%**	**-2.1%**
Ovid Village (pt.)	1	2	6	**+200.0%**	**+500.0%**
New Haven Township	1,286	1,293	1,329	**+2.8%**	**+3.3%**
Owosso City	16,322	15,713	15,194	**-3.3%**	**-6.9%**
Owosso Charter Township	4,121	4,670	4,821	**+3.2%**	**+17.0%**
Perry City	2,163	2,065	2,188	**+6.0%**	**+1.2%**
Perry Township	3,698	3,556	3,400	**-4.4%**	**-8.1%**
Morrice Village	630	882	927	**+5.1%**	**+47.1%**
Rush Township	1,405	1,409	1,291	**-8.4%**	**-8.1%**
Sciota Township	1,578	1,801	1,833	**+1.8%**	**+16.2%**
Shiawassee Township	2,731	2,291	2,295	**+0.2%**	**-16.0%**
Bancroft Village	599	616	545	**-11.5%**	**-9.0%**
Venice Township	2,812	2,156	2,149	**-0.3%**	**-23.6%**
Lennon Village (pt.)	450	432	429	**-0.7%**	**-4.7%**
Vernon Township	4,989	4,133	3,831	**-7.3%**	**-23.2%**
Vernon Village	913	847	783	**-7.6%**	**-14.2%**
Woodhull Township	3,585	3,850	3,810	**-1.0%**	**+6.3%**

Age Composition

Age composition is one of the more important characteristics of a population. For example, age groupings can indicate the number of school-age children, the size of the workforce, and the size of the elderly population. This information can be used for school enrollment projections, planning for recreation facilities, special services for the elderly, and other governmental services. The median age in Shiawassee County continues to increase. The median age in 1990 for the entire County was 32.5. That median age has increased to 40.3 in 2010. In the more rural Planning Area, the median age has increased from almost 33 to 42.8. An increasing median age could mean that less

young people are staying in the community which is likely attributed to the lack of employment opportunities.

Area Name	Median Age by Census Year			Age Change 2000 – 2010
	1990	2000	2010	
Shiawassee County	**32.5**	**36.4**	**40.3**	**+3.9**
Antrim Township	32.2	36.9	42.5	+5.6
Bennington Township	34.5	38.1	43.8	+5.7
Burns Township	33.0	35.3	40.5	+5.2
Byron Village	-	33.5	33.0	-0.5
Caledonia Charter Township	35.0	39.6	43.8	+4.2
Corunna City	32.0	35.2	36.0	+0.8
Durand City	30.9	34.7	37.2	+2.5
Fairfield Township	32.0	37.9	42.2	+4.3
Hazelton Township	31.6	38.4	44.1	+5.7
New Lothrop Village	-	34.9	40.4	+5.5
Laingsburg City	29.6	32.0	33.3	+1.3
Middlebury Township	32.9	36.3	42.6	+6.3
Ovid Village (pt.)	-	-	-	-
New Haven Township	33.4	39.9	46.3	+6.4
Owosso City	31.7	34.2	34.8	+0.6
Owosso Charter Township	36.4	40.5	46.4	+5.9
Perry City	29.9	32.6	34.1	+1.5
Perry Township	30.6	32.6	36.6	+4.0
Morrice Village	-	29.5	32.6	+3.1
Rush Township	36.0	39.3	45.9	+6.6
Sciota Township	32.5	36.8	42.2	+5.4
Shiawassee Township	32.4	37.4	41.8	+4.4
Bancroft Village	-	32.4	35.9	+3.5
Venice Township	35.3	39.5	43.2	+3.7
Lennon Village (pt.)	-	-	-	-
Vernon Township	32.5	37.4	43.6	+6.2
Vernon Village	-	35.3	38.7	+3.4
Woodhull Township	32.0	38.0	44.5	+6.5

Housing Characteristics

Nationwide there is a trend towards smaller household sizes. This decrease in household size is likely related to the overall aging of the population.

Area Name	Average Household Size (persons/household)			Percent Change 2000 - 2010
	1990	2000	2010	
Shiawassee County	**2.78**	**2.64**	**2.54**	**-3.8%**
Antrim Township	3.04	2.95	2.70	**-8.5%**
Bennington Township	3.05	2.80	2.69	**-3.9%**
Burns Township	2.99	2.94	2.77	**-5.8%**
Byron Village	-	2.73	2.79	**+2.2%**
Caledonia Charter Township	2.80	2.58	2.48	**-3.9%**
Corunna City	2.54	2.33	2.34	**+0.4%**
Durand City	2.77	2.55	2.45	**-3.9%**
Fairfield Township	2.96	2.74	2.71	**-1.1%**
Hazelton Township	3.01	2.73	2.54	**-7.0%**
New Lothrop Village	-	2.60	2.50	**-3.8%**
Laingsburg City	2.77	2.77	2.77	**+0.0%**
Middlebury Township	3.02	2.64	2.50	**-5.3%**
Ovid Village (pt.)	-	-	-	**-**
New Haven Township	2.94	2.67	2.66	**-0.4%**
Owosso City	2.50	2.45	2.41	**-1.6%**
Owosso Charter Township	2.72	2.56	2.37	**-7.4%**
Perry City	2.94	2.73	2.66	**-2.6%**
Perry Township	2.91	2.83	2.75	**-2.8%**
Morrice Village	-	2.79	2.53	**-9.3%**
Rush Township	2.83	2.79	2.59	**-7.2%**
Sciota Township	3.01	2.86	2.72	**-4.9%**
Shiawassee Township	3.05	2.88	2.73	**-5.2%**
Bancroft Village	-	3.03	2.85	**-5.9%**
Venice Township	2.90	2.64	2.65	**+0.4%**
Lennon Village (pt.)	-	-	-	**-**
Vernon Township	2.81	2.65	2.52	**-4.9%**
Vernon Village	-	2.75	2.68	**-2.5%**
Woodhull Township	3.00	2.77	2.60	**-6.1%**

Land Use

Shiawassee County can be divided into several land use categories typical of many communities. The 2016 Shiawassee County Master Plan defines the following designations in their future land use plan:

Important Agricultural

The intent of land designated as Important Agriculture is to maintain and protect agricultural operations against increasing development pressure. This land consists of prime farmland important to the overall economy of Shiawassee County. Residential development in these areas would be at very low densities. The majority of this land is located in the northern half of Shiawassee County, while smaller pockets are found in the southern half.

Agricultural/Rural Residential

The intent of the Agricultural/Rural Residential future land use is to provide land for rural residential development within a predominantly agricultural landscape. Extension of sanitary sewer and water to these areas are discouraged. This future land use category is by far the largest residential type of land use and dominates the southern half of the Planning Area.

Low-Density Residential

Lands designated as Low-Density Residential consist of existing and proposed locations for low-density residential development. Some of these areas are already served by sanitary sewer while the undeveloped but planned areas are located such that the extension of public services is probable. Planned unit developments and cluster housing is encouraged in these areas.

Medium/High Density Residential

As illustrated by the Future Land Use Map, there is very little land designated as Medium/High Density Residential. This land is served by public water and sewer systems and is located near more urbanized areas. Land within this category consists of or are planned for condominiums, cluster and multi-family housing, and planned unit developments.

Manufactured Home Park/Subdivision

Most of the land designated as Manufactured Home Park/Subdivision are existing but may be in the process of expanding or have vacancies. The intent of mobile home parks is to provide an area for the coordinated development of manufactured homes. Due to the high density nature of this type of housing development, mobile home parks are planned for areas than can be served by existing sewer and water services. Land planned for subdivisions consist of single-family homes and are also generally higher in density and therefore must be located where sewer and water are available.

Public and Non-Profit Organizations
Areas designated as Public and Non-Profit Organizations on the Future Land Use Map are sites of existing community services such as governmental, religious, institutional, and educational. Examples include cemeteries, town halls, vocational training centers, ambulance and fi re stations, and rural schools.

Commercial
The intent of the Commercial land use designation is to promote commercial development in optimal locations such as at major intersections and/or interchanges or along high traffic roadways. These locations provide ease of access for patrons of existing and/or future commercial enterprises.

Industrial
The intent of the Industrial land use designation is to concentrate future industrial uses in a location that is accessible to adequate roads, has availability of sanitary sewer and is compatible with neighboring land use. Land designated as Industrial is generally located near I-69. Two (2) small areas of land located east of New Lothrop and in Rush Township are also designated as Industrial.

Active Landfill
This classification is intended to locate sites identified in the County Solid Waste Management Plan as permitted landfill sites.

Large Natural Feature Complexes
These areas are dispersed throughout the Planning Area and correspond to the irregular boundaries of wetlands, floodplains, and conservation areas. They provide vital ecological benefits such as wildlife habitat, flood control, and aquifer recharge zones. Protection of these important areas should be coordinated between municipalities.

Other jurisdictions that conduct their own planning and zoning and therefore have their own adopted future land use plans, are more urbanized. These jurisdictions would have similar land use categories and classifications.

Employment/Labor
Consideration of the local economic base is included in the planning process in order to ensure that land reserved for commercial and industrial uses is of adequate size and location to meet the aspirations of the community. Economic activities may create job

opportunities for local residents and contribute to the improvement of the Planning Area's tax base.

Overall employment in the Planning Area increased by nearly nine (9) percent from 19,158 to 20,822 persons from 1990-2000. Unemployment rates for the Planning Area were not available, however, within the entire county unemployment increased from approximately five (5) percent in 1990 to nine (9) percent in 2000. (US Census. www. census.gov) The agriculture and retail industries experienced the most dramatic decreases of 23.7 percent and 24.5 percent, respectively. Public administration and construction had remarkable employment increases of 110.5 and 64.9 percent, respectively.

Shiawassee County's workers aged 16 and over comprised 60.9 % of the total labor force, and 33,974 were in the labor force. This information also reported Shiawassee County's unemployment rate as 7.0% and the per capita income for Shiawassee County was $22,957. That has probably changed with the closing of several area manufacturing sites in the county, as well as the state. Employment by industry is profiled below. Consistent with national trends, the service industry employs the largest percentage of workers in Shiawassee County. Manufacturing and retail trade also comprise large shares of the work force. The table below lists the major employers for Shiawassee County. Major manufacturers in Shiawassee County are located primarily in Owosso.

In 2010 health care and social assistance had the largest amount of employees in the county of the twenty (20) major sectors of business with 2,390 employees as defined by the U.S. Census Bureau. It had an average wage per job of $30,042. Per capita income grew by 16.2% between 1999 and 2012.

Industry	Number	Percent
Agriculture, forestry, fishing and hunting, and mining	592	2.0
Construction	2,110	7.0
Manufacturing	4,903	16.3
Wholesale trade	623	3.1
Retail trade	4,143	13.8
Transportation and warehousing, and utilities	1,398	4.5
Information	339	1.1
Finance and insurance, and real estate and rental and leasing	1,398	4.7
Professional, scientific, and management, and administrative and waste management services	1,914	6.4
Educational services, and health care and social assistance	6,838	22.8
Arts, entertainment, and recreation,	2,314	7.7

and accommodation and food services		
Other services, except public administration	2,024	6.7
Public administration	1,462	4.9
Total	30,023	100.0

Shiawassee County Civilian Employment by Industry

Source: U.S. Census Bureau, 2008-2012 American Community Survey

Company	CITY	EMPLOYEES
Memorial Healthcare Center	Owosso	800
County of Shiawassee	Corunna	300
Owosso Schools	Owosso	300
Toledo Commutator	Owosso	280
Meijer	Corunna	275
Woodard Inc	Owosso	250
Machine Tool & Gear Inc	Corunna	200
Motor Products-Owosso Corp	Owosso	200
Durand Convalescent Center	Durand	160
Shiawassee RESD	Corunna	160
Simplicity Engineering Inc	Durand	160
Baker College	Owosso	150
Durand Schools	Durand	125
Corunna Schools	Corunna	120
Wal-Mart	Owosso	120
Georgia-Pacific Corp	Owosso	118
Vaungarde Inc	Owosso	105
Bryon School District	Bryon	100
Davis cartage	Owosso	100
Home Depot	Owosso	100
Laingsburg School District	Laingsburg	100
Midwest Bus Co	Owosso	100
New Lothrop School District	New Lothrop	100
Perry School District	Perry	100
Waste Management	Corunna	100
Nero Plastics Inc	Owosso	85
G & L Owosso Trim	Owosso	75
Met-Pro Corp/Duall Div	Owosso	74

Source: Harris Publishing, 1998 Industrial Directory

Shiawassee County Major Employers

Shiawassee U.S. Ranking

People & Income Overview (By Place of Residence)	Value	Rank in U.S.	Industry Overview (2003) (By Place of Work)	Value	Rank in U.S.
Population (2010)	70,648	699	Covered Employment	30,023	960
Growth (%) since 2000	-1.4%	2010	Average wage per job	$30,602	1278
Households (2010)	27,481	704	Manufacturing - % all jobs in County	15.4%	1182
Labor Force (persons) (2012)	33,974	716	Average wage per job	$35,005	1131
Unemployment Rate (2012)	7.0	607	Transportation & Warehousing - % all jobs in County	0.7%	2544
Per Capita Personal Income (2012)	$22,957	1723	Average wage per job	$37,718	611
Median Household Income	$47,106	507	Health Care, Social Assist. - % all	D	N/A

(2012)			jobs in County		
Poverty Rate (2012)	14.4	2719	Average wage per job	D	N/A
H.S. Diploma or More - % of Adults 25+ (2000)	84.4	713	Finance and Insurance - % all jobs in County	2.1%	1968
Bachelor's Deg. or More - % of Adults 25+ (2010)	13.7	1,736	Average wage per job	30,602	1805

Climate

Shiawassee County is situated in southeastern Michigan, where the lake effect is not as pronounced as in other counties. The main lake effect noticed in the county is the increased cloudiness late in fall and early winter when the prevailing winds move cold air across the warmer lake water. Shiawassee County is subject to a wide variety of weather characteristics. There is a wide range of seasonal temperatures that may occur, and frequent weather changes are very common. The chart below indicates the temperatures that Shiawassee County may experience in any given year. Annual precipitation is about 29 inches, and the county receives approximately 41 inches of snowfall yearly. The growing season averages about 144 days. In January, the average minimum temperature is 14° F / -10° C. In July the average minimum temperature is 59° F / -15°.

Month	Avg. High	Avg. Low	Avg. Precip.	Rec. High	Rec. Low
January	29.0° F	14.0° F	1.53 in	65.0° (01/26/1950)	-20.0° F (01/20/1994)
February	32.0° F	15.0° F	1.31 in	67.0° (02/12/1999)	-20.0° F (02/17/1979)
March	43.0° F	24.0° F	2.03 in	79.0° (03/28/1989)	-10.0° F (03/02/1962)
April	56.0° F	34.0° F	2.83 in	86.0° (04/25/1990)	3.0° F (04/07/1982)
May	69.0° F	44.0° F	2.79 in	92.0° (05/21/1977)	22.0° F (05/01/1978)
June	78.0° F	54.0° F	3.17 in	99.0° (06/26/1988)	33.0° F (06/08/1949)
July	82.0° F	58.0° F	2.74 in	101.0° (07/07/1988)	40.0° F (07/01/1988)
August	79.0° F	56.0° F	3.44 in	99.0° (08/27/1948)	37.0° F (08/28/1986)
September	72.0° F	49.0° F	3.56 in	99.0° (09/01/1953)	26.0° F (09/28/1991)
October	60.0° F	39.0° F	2.57 in	90.0° (10/03/1953)	17.0° F (10/19/1972)
November	46.0° F	30.0° F	2.45 in	79.0° (11/01/1950)	-5.0° F (11/26/1949)
December	34.0° F	20.0° F	2.12 in	66.0° (12/04/1998)	-12.0° F (12/31/1976)

Cultural Facilities

Shiawassee County offers a number of events and attractions to the public. One of the more notable events includes the Shiawassee County Fair, located in Shiawassee Township. This annual event features agricultural aspects of the county and involves both young and old alike. Durand's Railroad Days and the Curwood Festival in Owosso bring people into the area from all over the state. Others include events in Corunna, Bancroft, Byron, Laingsburg, Lennon, New Lothrop, Perry and Vernon. The Lebowsky Center and Mitchell Center provide entertainment throughout the year. Railroad enthusiasts visit the Steam Railroading Institute's museum and the restored locomotive Project 1225 in Owosso. Curwood Castle is a Michigan historical attraction located in Owosso.

Recreational Facilities & Events

Below are commonly used recreation areas and events in the County.

Shiawassee County Fair

The Shiawassee County Fair has been held in Shiawassee County since 1853. It had been held for over 53 years at McCurdy Park in Corunna. Then in 1988 an entirely new fairgrounds was constructed on E. Hibbard Road in Shiawassee Township, approximately one mile south of Corunna and 3 miles southeast of Owosso.

Curwood Festival

In 1978, the City of Owosso commemorated the 100th anniversary of James Oliver Curwood's birth with a celebration centered around his castle. Since then, it has grown to three full days of activities for the entire family, with hundreds of volunteers working all year long and dozens of community organizations taking part. The festival commemorates Curwood in particular and Owosso's heritage in general and provides a weekend of fun, relaxation and homecoming.

Durand Railroad Days

The idea to have a yearly festival in Durand to celebrate our Railroad Heritage was born in November of 1975 when the Grand Trunk Western Baggage Car was permanently placed in Iron Horse Park to serve as Durand's Railroad History Museum. Acquiring, restoring, and outfitting the car as our Railroad History Museum was truly a community project. Since then, Durand Railroad Days has been celebrated the weekend after Mother's day in May for the past forty years.

Corunna 4th of July Celebration
The city's annual 4th of July Celebration attracts approximately 20,000 persons.

Campgrounds
Moon Lake Resort (Laingsburg)
Walnut Hills Family Campground and Canoe Livery (Durand)

Major Parks
Public

- Bentley Park – City of Owosso
- McCurdy Park - Corunna
- Parker Soccer Fields – City of Owosso
- Bennett Field City of Owosso
- Green Meadows / Harman Partridge park – Owosso Township
- Henderson Park – Rush Township
- Kerby Road Park – Caledonia Township
- Optimus Park – City of Durand
- Trumbell Park – City of Durand

Private

- Holiday Shores – Vernon Township
- Leisure Lake – Vernon Township
- Walnut Hills – Burns Township
- Shoreline Lake – Shiawassee Township

Educational Facilities

There are eight (8) school districts, the Shiawassee Regional Area School District, thirty-three (33) public school buildings and eight (8) private schools. Shiawassee County is also the home of Baker College of Owosso. See Appendices, Page ___ for a map of Shiawassee County community facilities and the tables below for a list of Shiawassee County education facilities.

District	Year	Student Count
Byron Area Schools	2015-16	977
Corunna Public Schools	2015-16	1,886
Durand Area Schools	2015-16	1,437
Laingsburg Community Schools	2015-16	1,125
Morrice Area Schools	2015-16	515
New Lothrop Area Public Schools	2015-16	932
Owosso Public Schools	2015-16	3,204
Perry Public Schools	2015-16	1,247

Lansing Community College	2015-16	17,589
Mott Community College	2015-16	15,407
Baker College	2015-16	22,432
Michigan State University	2015-16	39,143
University of Michigan, Flint	2015-16	7,143

Chart 8

Community Facilities (Hospitals/Police/Fire)

Shiawassee County has three (3) major medical facilities (Memorial Healthcare Center in Owosso, Shiawassee Medical Care Facility (Pleasant View) and Durand Convalescent Center). There are several private facilities with satellite offices throughout the county. The Shiawassee County Health Department offers health-related services to the community. There are also many clinics available throughout the County, as well as nursing homes and adult care facilities. See Appendices, Page ___ for a map of the locations of medical facilities in Shiawassee County.

In Shiawassee County there are twelve (12) Fire Departments that provide services to the county. Fire protection in Shiawassee County consists of eleven (11) paid part-time departments and one (1) full-time department, that being the City of Owosso Fire Department, which is staffed with approximately eighteen (18) firefighters. These Fire Departments typically have mutual or auto aid agreements between them and with surrounding Fire Departments in adjoining counties. The County has two Fire Associations, the Shiawassee County Fire Chiefs Association and the Shiawassee County Firefighters Association that may include members of the mutual or auto aid agencies.

In an emergency or disaster situation, responding fire departments are coordinated from a single emergency coordination location. This may be an Emergency Operations Center (EOC) or a Command Post at the scene. A Fire Coordinator is to be present on a twenty-four (24) hour basis to coordinate all fire service operations. This person is the Fire Coordinator or Assistant Fire Coordinator as designated by the Shiawassee County Fire Chiefs Association. This person secures the most current and accurate information on the situation. The Fire Coordinator communicates directly with responding fire departments, which manage their operations according to normal procedures. They report and inform the Fire Coordinator regarding activities performed, underway, or planned, as well as, equipment and personnel used or planned for use. Information received is used to prioritize and request mobilization of resources as necessary to provide fire services to affected areas and to accomplish assigned tasks.

In some situations, a fire representative may function as the Incident Commander. This person will establish the Command Post and coordinate activities at the immediate incident scene.

Each fire department is responsible for fire response in its own jurisdiction. If an emergency occurs solely within the confines of a jurisdiction, the Fire Chief of that jurisdiction will function as the Fire Service Coordinator.

Police protection for Shiawassee County is provided by the Michigan State Police Post #15, the Shiawassee County Sheriff's Department and local police departments. There are four communities providing full-time law enforcement, while seven communities have part-time departments. There are no township police departments. See Appendices, Page ___ for a map of the County's police and fire station.

Government

The main decision-making body of the County is the Shiawassee County Board of Commissioners. There are seven (7) districts in the county who elect one commissioner every two years to serve on the board. Each year a commissioner is elected chairperson from the group. Other elected officials are: County Clerk, County Prosecutor, Registrar of Deeds, Sheriff, Treasurer and Drain Commissioner. In addition to the above listed offices, there are judges serving Probate, Circuit and District Courts. Several appointed positions in Shiawassee County are filled by members of the Board of Commissioners. Two other appointments are County Coordinator and District Court Magistrate.

GOVERNMENT			
COMMUNITY	**PHONE NUMBER**	**COMMUNITY**	**PHONE NUMBER**
Antrim Twp	(989) 634-9051	Bancroft (Village of)	(989) 634-5375
Bennington Twp	(989) 723-5555	Burns Twp	(989) 266-6220
Byron (Village of)	(989) 266-4386	Caledonia Twp	(989) 743-5300
Corunna (City of)	(989) 743-4422	Durand (City of)	(989) 288-3113
Fairfield Twp	(989) 661-7844	Hazelton Twp	(989) 638-5862
Laingsburg (City of)	(989) 651-5374	Lennon (Village of)	(989) 621-4285
Middlebury Twp	(989) 834-5285	Morrice (Village of)	(989) 625-4170
New Haven Twp	(989) 743-5595	New Lothrop (Village of)	(989) 638-5767
Owosso (City of)	(989) 725-0540	Owosso Twp	(989) 723-2187
Perry (City of)	(989) 625-6155	Perry Twp	(989) 625-4597
Rush Twp	(989) 723-3962	Sciota Twp	(989) 651-2167
Shiawassee County	(989) 743-2279	Shiawassee Twp	(989) 634-9700
Venice Twp	(989) 621-4096	Vernon (Village of)	(989) 288-2300
Vernon Twp	(989) 288-4403	Woodhull Twp	(989) 675-5122

Emergency Management

The Shiawassee County Emergency Management/Homeland Security Office is located in the James P. Capitan Center and serves as the disaster services coordination office and the Emergency Operations Center. Services offered by the Office of Emergency Management & Homeland Security include the following:

- Preparedness planning: Providing informational presentations to groups and organizations.
- Working with various Governmental units to benefit from Federal grant opportunities.
- Mitigation-Coordinating emergency management activities with a variety of disciplines.
- CERT - Citizen Emergency Response Team: Volunteer organization training.
- LEPC - Local Emergency Planning Committee: Local planning for chemical incidents.

Shiawassee County communications is served by the emergency 911 communications center, which is housed at the Shiawassee County Sheriff's Department facility. All police, fire and EMS are dispatched through this center.

Shelters

Shiawassee County has thirty-four (34) community shelters that can be used to serve residents after a hazard has occurred. Many of the shelters are schools located within the eight school districts.

Early Warning Sirens/Alerts

Shiawassee County does not have county-wide siren coverage. However, the cities of Bancroft, Durand, Corunna, Laingsburg, Perry, Owosso and the Village of Vernon have their own systems. The twelve (12) installed early warning sirens activation are controlled by each local jurisdiction. See Appendices, Page ___ for the location of the sirens. Working off of estimated siren ranges, approximately 28,848 (37.5%) of the population is covered by a siren, leaving (62.5%) of the population outside the estimated range of a siren.

The County also participates with CodeRED. This is a high-speed web-based emergency and mass notification system. The emergency notification system is used as a public alerting tool to deliver critical communications including evacuations, active shooter, declarations of emergency, shelter or warming locations, missing persons and recoveries, etc. It is a reverse 911 system that gives authorized users the ability to send mass phone calls, text messages, emails, social media messages, RSS, website widgets and through the public safety alerting application, CodeRED Mobile Alert. The system is capable of notifying selected areas through a mapping interface which allows users to find a specific address, load areas of interest, and select a radius around selected locations.

Dams and Bridges

A total of eighteen (18) dams can be found in Shiawassee County, with two of those dams classified as a "Significant Hazard". High Hazard dams have the potential to cause severe property damage or cause loss of life. The Shia Dam, one of those classified as a "Significant Hazard", has initiated the removal of the dam via several funding sources, including grants monies and County funds. In addition, there are 105 bridges included in the county's infrastructure. See Appendices, Page___ for a map of Shiawassee County dams and bridges.

Utilities/Solid Waste

There are no oil or natural gas wells in Shiawassee County. Consumers Energy, the local power supplier, has several substations. In addition, there are water wells and lift stations throughout the county. Shiawassee County has 2 landfills: Venice Park (run by Waste Mgt. of MI) in Venice Township, and Pollard Disposal, Inc. in Owosso Township. In 2003, 2,894,707 cubic yards of waste were disposed of in Shiawassee County landfills. Area phone companies include SBC, Century, GTE, AT&T, MCI and Sprint. Consumers Power and Detroit Edison supply electricity and gas to the area.

Hazardous Material Sites - Fixed

There are currently fourteen (14) sites in Shiawassee County designated SARA Title III, Section "302 Sites". These are sites where hazardous materials are stored. These sites are required to have an emergency plan on file with the Local Emergency Management Office, Fire Department, and their own facility. See Appendices, Page ___ for a map of the "302" sites.

Major Transportation

Roads

There are approximately fourteen hundred (1,400) total roadway miles in Shiawassee County with about 53 of those miles being interstate roadway. Shiawassee County is served by interstate I-69, running east and west.

The I-69 corridor is a major trade route from Toronto, Canada to Michigan, Chicago, Illinois, and other Midwest destinations. Recent traffic counts on I-69 show approximately 15,000 vehicles per day, and truck traffic is estimated to be approximately 10% of total traffic volume.

Bus Routes

Shiawassee County has a public transportation system, SATA (Shiawassee Area Transit Authority). SATA began operations in February of 2000. Currently the service provides approximately 80 trips per day for the residents of the townships of Bennington, Caledonia, Owosso, Venice and Vernon, and the cities of Owosso, Corunna, Durand and Perry. Trips are provided on a demand-response basis. SATA operates under an inter-local agreement among the participating municipalities and the intermediate school district. It generally restricts service to those areas although it will serve passengers in other areas of the County if resources (buses) are available. Indian Trails, a charter transit service in Shiawassee County, offers service to the public either daily or on an on-call basis.

Trucking

There are 34 trucking firms operating in the county, with daily trips ranging from 1 to 500, depending on the fleet size of the company. Over 16,000 trucks travel daily on I-69 in Shiawassee County. The passage of the North American Free Trade Agreement (NAFTA) has resulted in more cargo and freight movement into and out of Shiawassee County, as trade barriers dissolve between the U.S., Canada and Mexico.

Railroad Lines

The Canadian National and Tuscola & Saginaw Bay railroad companies operate freight routes through Shiawassee County. They serve the automotive industry and rail/highway transfer operations by providing both “piggyback” and flow-through rail/truck distribution facilities. Amtrak provides passenger services from Port Huron through Shiawassee County to Chicago, Illinois on the CN line.

Aviation

The county's largest and busiest airport, Owosso Community Airport, serves small and twin engine planes, with three (3) runways that are over 2,470 feet long and handle private planes and cargo services. It is centrally located between the City of Owosso and the City of Corunna. There are also three private airports in the county.

Bishop International Airport is 17 miles to the East, Capital City Airport is 24 miles to the West and MBS Airport is 47 miles to the North. All three airports offering a link to major air carriers, and AMTRAK passenger and CNX freight service, are available via an east-west rail line corridor. The County has an integrated transportation network. See Appendices, Page ___ for the Shiawassee County road system map.

Page Intentionally Left Blank

SECTION 3- PLANNING PROCESS

PLANNING PROCESS

The purpose of a hazard mitigation plan is to inventory possible hazards, assess the vulnerability of the community to potential hazards, and to provide possible mitigation activities for those hazards. The focus of the Plan should be to develop projects and policies to reduce or prevent losses from future disasters. The intent of the planning process is to ensure that persons in the community understand risks and vulnerability associated with hazards. Whether they are involved in government, work or live in the community, the planning process provides an opportunity to participate and therefore work with the community to support policies, actions, and tools that with diligence and a sense of ownership, reduce future losses over the long-term. The end result of any planning process should be to utilize the discovered commonalities and community values to support financial, technical, and human resources to achieve a common desired outcome.

Any successful planning activity involves a cross-section of stakeholders and the public to achieve desired outcomes or to resolve issues preventing achievement of desired outcomes. Overtime, leadership, staff, officials and property owners may change. the description of the planning process serves as a permanent record that explains how decisions were reached and who involved.

PLAN UPDATE PROCESS AND DEVELOPMENT

Below is a description of the planning process to update the Plan, which provides the timeframe for the plan development, activities undertaken, the persons, agencies, authorities, communities involved and the actions taken.

The process of Hazard Mitigation Planning update consists of the following steps:

- ✓ Review and update descriptive information, such as updated demographics, climate, land use, etc.

- ✓ Reviewed and updated the identifications of hazards identification. The committee updated information on wildfires, severe weather, severe wind storms, extreme temperatures, other natural hazards, and other (social/technological) hazards.

- ✓ Conversion of paper tax maps to digital maps for future development of a Geographic Information System (“GIS”) for current and future use in hazard mitigation planning and response.

- ✓ Reviewed and updated risk and vulnerability assessment information, including valuation criteria, hazard analysis evaluation measures and benchmarks.

- ✓ Reviewed and updated goals and objectives.

- ✓ Reviewed and updated mitigation strategies and priorities.

Information was disseminated to the general public and local communities through the use of public meetings, presentations, news releases, and contacts. The planning process also provides opportunity to educate community leaders and citizens concerning hazard awareness and mitigation efforts. Educating the general public and community leaders positively effects the decision making process so that more informed decisions in the future.

The hazard mitigation plan update was developed through the Local Advisory Committee ("LAC"). The LAC was comprised of interested participants following an outreach to local units of governments and local, state and federal agencies. LAC members provided feedback throughout plan development, including identification of hazards and high hazard areas, identification of hazard mitigation strategies and selection of an implementation plan.

Members of the LAC included the following individuals and their department, agency or constituency that the represent:

- General Grant – Trustee, Owosso Public Schools Board of Education
- Jodi DeFrann – Emergency Preparedness Coordinator, Shiawassee County Health Department
- Lt. Pamela Battinkoff – Director, Shiawassee Central Dispatch
- Phil Heavilin – Director, Shiawassee County Buildings and Grounds Director/ Pleasant View Buildings and Grounds Director
- Richard Warner – Director, Shiawassee County Emergency Management/Homeland Security
- Peter Preston – Manager, Shiawassee County Community Development Department /Equalization Department
- Matthew Lafferty – Land Use Planner, Shiawassee County Community Development Department

The 2016 Shiawassee County Hazard Mitigation Plan ("Plan") includes five (5) cities, sixteen (16) townships, and six (6) villages.

Antrim Township
Bennington Township
Burns Township
Caledonia Township
City of Corunna
City of Durand
City of Laingsburg
City of Owosso
City of Perry
Fairfield Township
Hazelton Township
Middlebury Township
New Haven Township
Owosso Township
Perry Township
Rush Township
Sciota Township
Shiawassee Township
Venice Township
Vernon Township
Village of Bancroft
Village of Byron
Village of Lennon
Village of Morrice
Village of New Lothrop
Village of Vernon
Woodhull Township

Below is a contact list for the above jurisdictions:

Community	Position	Name	Address
Antrim Township	Supervisor	Jerry Gutting	11445 S. Scribner Rd. Morrice, MI 48418
Village of Bancroft	President	William Johnson	108 Warren St. P.O. Box 97 Bancroft, MI 48414
Bennington Township	Supervisor	Leonard Ash	6490 S. M-52 Owosso, MI 48867
Burns Township	Supervisor	David Mitchell	6502 E. Beard Rd. Byron, MI 48418
Village of Byron	President	Kathryn Brunell	146 Saginaw St. P.O. Box 4 Byron, MI 48418
Caledonia Charter Township	Supervisor	Joe DeCaire	4726 E. M-21 Corunna, MI 48817
City of Corunna	City Manager	Joseph Sawyer	402 N. Shiawassee St. Corunna, MI 48817
City of Durand	City Manager	Amy J. Roddy	215 W. Clinton St. Durand, Mi 48429
Fairfield Township	Supervisor	Les Loynes	8850 N. Carland Rd. Elsie, MI 48831
Hazelton Township	Supervisor	James R. Sheridan	11215 E. Riley Rd. Flushing, MI 48433
City of Laingsburg	Mayor	Micheal Culpepper	P.O. Box 178 Laingsburg, MI 48848
Village of Lennon	President	Rebecca Alderman Smith	11904 Lennon Rd. P.O. Box 349 Lennon, MI 48449
Middlebury Township	Supervisor	Mike Herendeen	9604 Krouse Rd. Ovid, MI 48866
Village of Morrice	President	Harold Dickerson	401 N. Main St. P.O. Box 315

			Morrice, MI 48418
New Haven Township	Supervisor	Tim Hill	293 E. Haven Dr. Owosso, MI 48867
Village of New Lothrop	President	Jerry Burns	9434 Beech P.O. Box 313 New Lothrop, MI 48460
Owosso Charter Township	Supervisor	Danny Miller	2450 Wellington Dr. Owosso, MI 48867
City of Owosso	City Manager	Donald Crawford	301 W. Main St. Owosso, MI 48867
City Of Perry	Mayor	James Huguelet	203 W. Polly St. Perry, MI 48872
Perry Township	Supervisor	Sidney Grinnell	14495 S. Morrice Rd. Perry, MI 48872
Rush Township	Supervisor	Rodney Spitler	4174 N. M-52 Owosso, MI 48867
Sciota Township	Supervisor	Phillip Matthews	6401 S. Austin Rd. Laingsburg, MI 48848
Shiawassee Township	Supervisor	Anthony Karhoff	5110 E. Exchange Rd. Bancroft, MI 48414
Venice Township	Supervisor	Kevin S. Kingsbury	6421 E. M-21 Corunna, MI 48817
Vernon Township	Supervisor	Bert DeClerg	10052 E. Prior Rd. Durand, MI 48429
Village of Vernon	President	Gayle Steele	120 Main St. P.O. Box 175 Vernon, MI 48476
Woodhull Township	Supervisor	Diana Hasse	P.O. Box 166 Shaftsburg, MI 48882

Below is the stakeholder list utilized in the development of this Plan update:

Stakeholder	Position	Name	Address
American Red Cross Mid-Michigan Chapter	Disaster Program Manager	Cindy Havens	1800 East Grand River Ave. Lansing, MI 48909
Shiawassee County Health Department	Health Director	Larry Johnson	149 E. Corunna Ave., 2nd Floor Corunna, MI 48817
Shiawassee County Environmental Health	Director	Larry Johnson	201 N. Shiawassee St., 3rd Floor Corunna, MI 48817
Shiawassee County Emerg. Mgmt/Homeland Sec.	Coordinator	Richard Warner	149 E. Corunna Ave., Lower Level Corunna, MI 48817
Shiawassee County Community Development	Contracted Director	Peter Preston	201 N. Shiawassee St., 3rd Floor Corunna, MI 48817

Shiawassee County Road Commission	Managing Director	Brent Friess	701 W. Corunna Ave. Corunna, MI 48817
Shiawassee County Drain Office	Commissioner	Tony Newman	149 E. Corunna Ave., Level 1 Corunna, MI 48817
Shiawassee County Sheriff's Office	Sheriff	George R. Braidwood II	201 E. McArthur St. Corunna, MI 48817
Michigan State University Extension	District Coordinator	Deanna East	701 S. Norton St. Corunna, MI 48817
Shiawassee Area Transportation Agency		Mary Rice	180 N. Delaney Rd. Owosso, MI 48867
Michigan State Police			G-4495 Corunna Rd. Flint, MI 48532
Council on Aging	Director	Cynthia Mayhew	300 N. Washington St. Owosso, MI 48867
Michigan Department of Human Services	Director	Alison Morrison	1720 E. Main St., Suite 1 Owosso, MI 48867
Memorial Healthcare		Brian Long	826 W. King St. Owosso, MI 48867

The planning process provided several opportunities for public, community and agency input and comments. The project was introduced via a kick-off meeting. Notice was provided through the Shiawassee County Michigan Township Association, as well as direct invitation to all jurisdictions, stakeholders, and emergency response agencies. Attendance was limited.

The Local Advisory Committee met many times during plan development. The group was instrumental in guiding plan development. All LAC meeting were open to the public. The draft plan was made available to the public by posting the plan on the County's web site, as well as being available in the Shiawassee County Community Development Department.

Below is a sequence of activities and meetings held to involve the general public, local jurisdictions, agencies, and stakeholders.

1. September 8, 2011- Prior to applying for the grant that provided funding for this Plan update, the Community Development Department staff mailed a letter of intent to apply for the grant to all twenty (27) local units of government. That letter asked for each community to sign a prepared letter of intent to participate. A follow-up letter was provided on November 3, 2011 encouraging participation. The Community Development Department received a signed copy of the letter of intent to participate from all twenty (27) local units of government. Copies held on file and available for review.

2. June 17, 2014- A letter to Shiawassee County identified stakeholders, community officials and other organizations was sent requesting participation in the Shiawassee County Hazard Mitigation Plan update process.

3. June 26, 2014 staff held the first Shiawassee County Hazard Mitigation update kick-off meeting. The purpose of the Hazard Mitigation Plan was discussed, along with timelines, community profiles and hazard identification. Staff began collecting data related to Shiawassee County hazards from various local, county and state agencies along with certain private organizations.

4. August 28, 2014- First meeting of the Local Advisory Committee for the Shiawassee County Hazard Mitigation Plan Update. At this meeting, the scope of work was development for the overall Plan update.

5. November 6, 2014- The Local Advisory Committee again met for a general review of sections of the Plan update related to introduction, demographics, community history and community facilities. An introduction to hazard ranking and analysis was presented.

6. December 18, 2014- The Local Advisory Committee met to review hazard rankings and have a discussion of the involvement and cooperation of all involved in the update process.

7. February 18, 2015- The Local Advisory Committee met to review the process and assign characteristics to vulnerability assessment process.

8. July 22, 2015- The Future Planning Committee, a sub-committee of the Shiawassee County Planning Commission, met to discuss the mapping being generated via the Plan update process and its utilization in the County's Master Planning process.

9. January 27, 2016- Shiawassee County Planning Commission received revised Master Plan containing reference to support contents of current and future update to Shiawassee County Hazard Mitigation Plan.

10. June 22, 2016- The Local Advisory Committee met to review the draft plan in preparation for presentation to the general public, including but not limited to stakeholders and local jurisdictions. The intent of the public meeting is to address plan contents and request feedback from those in attendance.

11. June 20, 2016- Staff released a memorandum to all Shiawassee County jurisdictions, including those agencies directly involved in hazard and emergency response, and asked for a list of projects, equipment, and other items that the community or agency

sees as necessary to properly respond to hazards and emergency situations resulting from hazards.

12. June 22, 2016- The Local Advisory Committee met to discuss revisions to the Plan prior to releasing for public review.

13. June 23, 2016- An invitation was sent to all Shiawassee County jurisdictions and identified stakeholders to join the Local Advisory Committee to discuss the Plan update at a Hazard Mitigation Open House scheduled at four (4) different locations in key areas of the County. All were advised that the open house was open to the public and that anyone with interest is welcome attend. A public meeting notice was also placed in the Argus Press, all editions of the Independent, and on the County's website. A draft of the Plan was made available on-line and made available in the Community Development Department and Equalization and Tax Description Office for public review.

14. July 6th, 2016- Hazard Mitigation Open House held at Owosso Charter Township Hall and Burns Township Hall between the hours of 1:00 P.M. and 6:00 P.M. Each open house was staffed by planner from the County's Community Development Department. Each planner was provided with a PowerPoint presentation, specific talking points and instructions for taking public comment. The Owosso Charter Township open house had nine (9) attendees and the Burns Township open house had one (1) attendee. No specific public comment was received.

15. July 7th, 2016- Hazard Mitigation Open House held at the Venice Township Hall and the Perry Township Hall between the hours of 1:00 P.M. and 6:00 P.M. Each open house was staffed by planner from the County's Community Development Department. Each planner was provided with a PowerPoint presentation, specific talking points and instructions for taking public comment. Neither open house on July 7th had attendees.

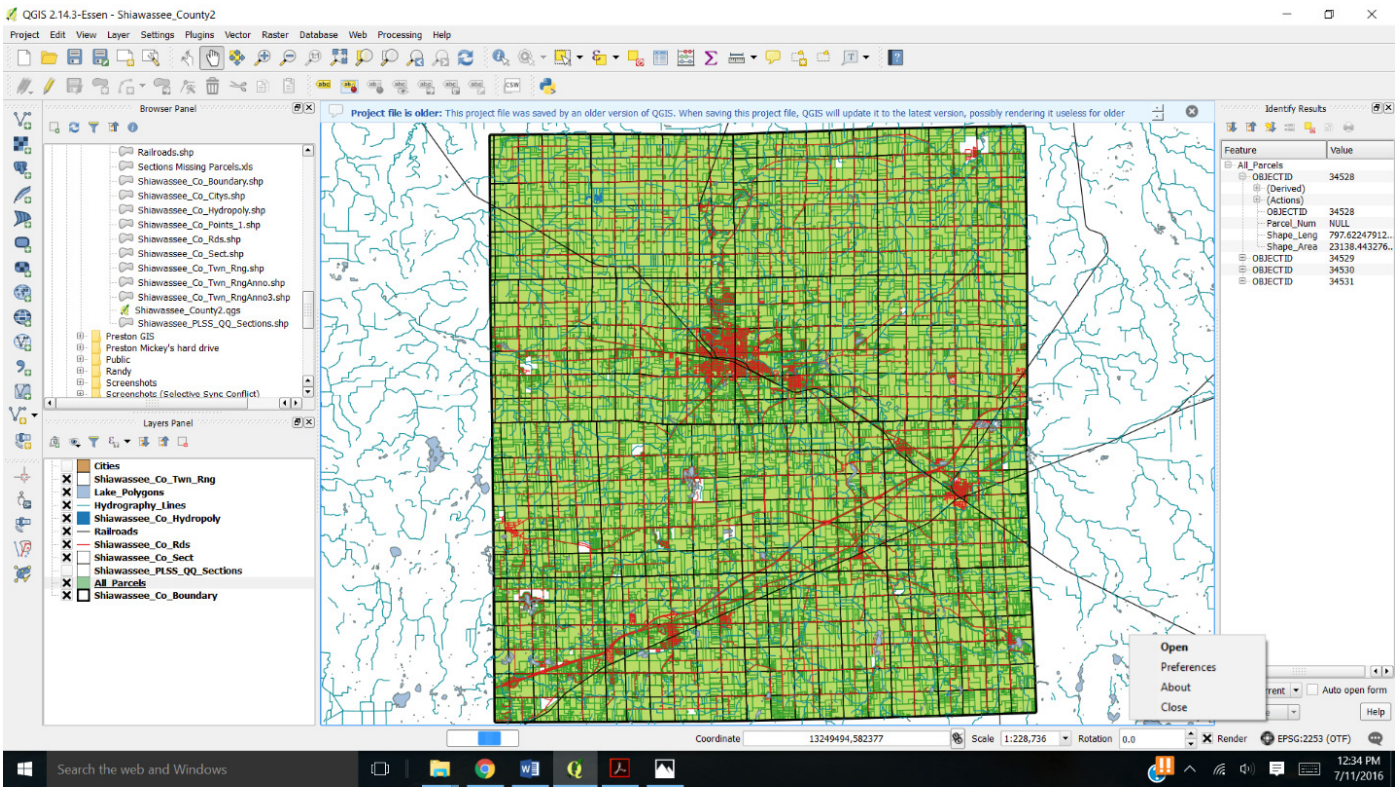
16. July 10, 2016- The LAC met to consider comment received at the scheduled open houses, develop final mitigation strategies and authorize submittal to for preliminary approval prior to Board of Commissioners approval.

17. July 11, 2016- Draft Plan Update delivered to the State for preliminary approval.

Mapping

A major component of this Plan update involved digitizing of the County tax maps from paper form into a digital layer capable of being utilized in future Geographic Information Systems ("GIS"). In the application for grant funding, it was set forth that a base map only was intended to be created as funds were limited for development and implementation of fully functional GIS. The base map was created and was created with the appropriate information to be able to be linked to the County Equalization's record database, BS&A. Although this is not a fully functioning GIS, it is the first step ever for Shiawassee County to be able to tie property information (owner name, owner address, property address, assessed value, etc.) to a geographic location.

Although this base map was not able to be used to a significant extent in this planning process, great strides have been made for the County. Below is a screenshot of the County's base map and the very beginnings of GIS for the County. The Shiawassee County Drain Commission is also working with the State of Michigan to acquire aerial photography and LIDAR at a reduced cost. With these capabilities, it is anticipated that future plan updates will be more intensive as information never having been available to the County will be at its fingertips.



Public Input for Plan Approval

The draft hazard mitigation plan was posted on the Shiawassee County web site and made available for review and comment by citizens, local communities and any agencies. The draft plan was transmitted to the Michigan State Police for preliminary review and comment. The LAC reviewed and addressed comments from all sources.

Review and Adoption of Plan

Comments and suggestions obtained in this review process were incorporated into the final Plan. The final Plan contains mitigation strategies and an action plan that assigns priorities for specific hazards and mitigation measures; defines roles and responsibilities; and identifies the process for reviewing and updating the plan. The Plan also contains more general goals and objectives to guide future hazard mitigation planning and actions taken to mitigate hazards.

Upon final approval, the hazard mitigation plan will be presented to the Shiawassee County Board of Commissioners, and transmitted to all minor civil divisions requesting their approval.

Page Intentionally Left Blank

SECTION 4- HAZARD IDENTIFICATION & RISK ASSESSMENT

A risk assessment provides the factual basis for activities proposed in the mitigation strategy that is to reduce losses from identified hazards. A quality risk assessments makes a clear connection between the community's vulnerability and the hazard mitigation actions. In other words, it provides sufficient information to enable the jurisdiction(s) to identify and prioritize appropriate hazard mitigation actions.

HAZARD ASSESSMENT

Hazard assessment is a process that incorporates historical data, social factors, geographic and climatic factors, public perception, and population data to determine a community's vulnerability to specific hazards. The first step is to identify potential hazards to a community, no matter how remote the probability of occurrence. To compile a list of potential hazards, records of historic events that have occurred in the community were reviewed, geographic and climatic data for the community was gathered, the county's transportation system was analyzed, and the current political and social climate was assessed for potential threats.

As part of the Plan update, a comprehensive update of all the material that had previously appeared in the Plan was incorporated. The plan update also includes additional detail concerning catastrophic incidents, national emergencies, and celestial impacts. The catastrophic incidents section that has been added to in part better tie the Plan in with similar concepts being addressed in the Michigan Emergency Management Plan, and other documents and recommendations set forth at the federal level. These changes make the Plan more compliant with FEMA and State planning standards with a more rounded consideration of natural hazards, technological hazards, human-related hazards, as well as greater linkages between hazard mitigation and the other phases of emergency management preparedness, response and recovery.

The following is a list of specific hazards in their respected categories that have been identified in the initial assessment by the Local Advisory Committee ("LAC"). For the most part, the list is similar to the list utilized in the previous Plan, with modifications to categorize the hazards and update to bring the Plan into more compliance with State and Federal guidelines.

<u>Initial List of Potential Hazards</u>

Natural Hazards

Drought

Earthquakes
Extreme Temperatures
Earthquakes
Wildfires
Dam Failure
Riverine Flooding
Subsidence
Inclement Weather (Thunderstorms, Hail, Lightning & Severe Winds)
Tornadoes
Snow

Technological Hazards
Scrap Tire Fires
Structure Fires
Hazardous Material Incidents (Fixed Sites)
Hazardous Material Incidents (Transportation)
Infrastructure failure
Nuclear Power Plant Accidents
Oil or Natural Gas Well Accidents
Transportation (Bus, Airplane, Train)

Human-Related Hazards
Terrorism
Civil Disturbance
Nuclear Attack
Public Health Emergencies

The initial list of potential hazards was originally provided at a public meeting in August of 2004 as part of the original development of the Plan. This list again was presented at the June 26, 2014 kick-off meeting. Although input on historic hazards was again received, no additional hazard categories were identified. This list was again adopted by the as the official list of hazards for Shiawassee County by the LAC.

Using the list of identified hazards, a hazard matrix was developed so that the hazards could be assessed on the impact each hazard had on the community. These hazards were then prioritized based on the calculated level of impact. The hazard matrix for Shiawassee County used the following six (6) variables:

1. Potential for Causing Causalities- Has this hazard ever occurred in the past, or could it happen in the future?

2. Capacity to Cause Physical Damages and Economic Affect – Has this hazard ever caused physical damage? What was the associated cost in property and lives?

3. Likelihood of Occurrence - How often has this hazard happened in the past and what is the future potential for this to reoccur?

4. Inability of Hazard Impacts to be Mitigated – What can Shiawassee County do to reduce the hazard's effects the next time it happens?

5. Unavailability of Warning Systems – With the current system in place, what extent can Shiawassee County warn residents of this hazard?

6. Unpredictability of Hazard and Seasonal Risk – To what extent can this hazard be foreseen? Does this hazard occur more frequently at a certain time of year over another time of year?

7. Size of Affected Area and Population - How many residents have been affected by this hazard in the past, or could be affected by it in the future?

8. Environmental Impact – To what extent does this hazard have the potential to affect natural features?

A scoring system was developed to create a hazard matrix. It was deemed important by the LAC to develop a system that was intuitive to fill out and that allowed easy factoring of each variable. Based on these criteria, the following scoring system was developed:

1. Potential for Causing Causalities
   A ranking of 1-5 (5 = Great Potential, 1 = Little to No Potential)

2. Capacity to Cause Physical Damages and Economic Affect
   A ranking of 1-5 (5= High Potential for Damages and Repair Costs, 1 = Low Potential)

3. Likelihood of Occurrence
   A ranking of 1-5 (5 = Very Likely, 1 = Not Likely)

4. Inability of Hazard Impacts to be Mitigated
   A ranking of 1-5 (5 = No Ability to Mitigate Hazard, 1 = Has Ability to Reduce or Mitigate Hazard)

5. Unavailability of Warning Systems
   A ranking of 1-5 (5 = No Established Warning System, 1 = Readily Available for Use)

6. Unpredictability of Hazard and Seasonal Risk
   A ranking of 1-5 (5 = Highly Unpredictable with Greatly Increased Likelihood in a given season, 1 = Predictable with Little Seasonal effect on Occurrence)

7. Size of Affected Area and Population
   A ranking of 1-5 (5 = Large Area and Population Effected, 1 = Little to no Area and Population Effected)

8. Environmental Impact
   A ranking of 1-5 (5 = High Environmental Impact, 1 = Little to no Environmental Impact)

At the November 6th and December 16th, 2015 meeting of the LAC, the committee members reviewed information regarding the frequency and general costs associated with the identified hazards in the County. After discussing the information, the LAC scored the hazards based on the eight (8) variables mentioned above. The matrix required that the members enter scores in the range of 1 to 5 and the final rankings where determined by factoring each of the variables according to its level of importance in determining the level of impact for each hazard. The following factors were used to calculate rank:

1. Potential for Causing Causalities (20% Weight)

2. Capacity to Cause Physical Damages and Economic Affect (20% Weight)

3. Likelihood of Occurrence (20% Weight)

4. Inability of Hazard Impacts to be Mitigated (10% Weight)

5. Unavailability of Warning Systems (10% Weight)

6. Unpredictability of Hazard and Seasonal Risk (10% Weight)

7. Size of Affected Area and Population (5% Weight)

8. Environmental Impact (5% Weight)

Out of this process, the hazard matrix was developed. Factors were applied to the raw scores and the hazards were given a ranking. The official hazard rankings for Shiawassee County as developed out of this process are found below with the matrix following:

1. Snow
2. Riverine Flooding
3. Inclement Weather (Thunderstorms, Hail, Lightning)
4. Dam Failure
5. Structure Fires
6. Tornadoes/Straight-Line Winds
7. Infrastructure failure
8. Extreme Temperatures
9. Hazardous Material Incidents (Transportation)
10. Public Health Emergencies
11. Drought
12. Oil or Natural Gas Well Accidents
13. Transportation (Bus, Airplane, Train)
14. Hazardous Material Incidents (Fixed Sites)
15. Wildfires
16. Terrorism
17. Civil Disturbance
18. Nuclear Attack
19. Scrap Tire Fires
20. Nuclear Power Plant Accidents
21. Earthquakes
22. Subsidence

Hazard Assessment Rating Table

Hazard:	Potential for causing casualties (20%)	Capacity to cause phys damages & economic affect (20%)	Likelihood of Occurrence (20%)	Inability of hazard to be mitigated (10%)	Unavailability of warning systems (10%)	Unpredictability of hazard and seasonal risk (10%)	Size of affected area and population (5%)	Environmental impact (5%)	Total rating: sum of all columns (100%)
Severe winds	3	5	5	4	3	3	5	2	3.95
Tornadoes	4	4	2	4	3	4	2	2	3.30
Flooding	1	5	4	4	3	3	2	2	3.20
Snow storms	1	3	5	4	2	3	5	1	3.00
Nuclear attack	5	4	1	1	3	1	4	4	2.90
Ice and sleet storms	1	4	3	4	2	3	5	2	2.85
Extreme cold	3	2	3	4	2	3	5	1	2.80
Lightning	3	3	3	2	2	2	5	2	2.75
Hail	1	4	2	3	3	3	5	2	2.65
Hazardous materials incident (fixed site)	3	4	1	2	3	3	1	3	2.60
Hazardous materials incident (transport)	3	4	1	2	3	3	1	3	2.60
Public health emergencies	5	2	1	2	2	2	4	1	2.45
Extreme heat	2	1	3	4	2	3	5	1	2.40
Drought	1	4	1	4	2	2	5	3	2.40
Structural fires	3	4	1	2	2	3	1	1	2.40
Transportation accidents	4	2	2	2	2	3	1	1	2.40
Wildfires	3	3	1	2	2	2	2	5	2.35
Fog	2	1	2	4	3	3	5	1	2.30
Oil and gas pipelines	2	3	1	2	3	3	1	3	2.20
Terrorism and similar activities	3	3	1	1	2	4	1	1	2.20
Invasive species	1	2	1	3	2	1	5	5	1.90
Nuclear power plant	1	2	1	2	3	3	1	5	1.90
Civil disturbances	2	3	1	2	2	2	1	1	1.90
Catastrophic incidents	1	2	1	2	3	4	1	2	1.85
Dam failures	1	2	1	2	3	4	1	1	1.80
Earthquakes	1	1	1	2	3	4	5	1	1.80
Subsidence	1	1	1	2	3	4	1	1	1.60
Celestial impacts	1	1	1	2	3	4	1	1	1.60
Scrap tire fires	1	2	1	1	2	3	1	2	1.55
Infrastructure failures	1	2	2	1	2	1	1	1	1.50
Oil and gas wells	1	1	1	1	2	2	1	1	1.20
Energy emergencies	1	1	1	1	1	1	3	1	1.10
For each hazard listed in the left column, fill in a rating from 1 to 5. (1 = least threat, 3 = moderate threat, 5 = greatest threat)									

Vulnerability Assessment

A vulnerability assessment provides a quantitative estimate of the persons and property in the County that are susceptible to each hazard. A basic method of determining vulnerability is to compare the susceptible area of the County with locations of population, infrastructure and structures to see what kind of overlap will result. The overlap between the area where the hazard may happen, and the affected people and property, is the vulnerable area. Urban and rural areas of the county that experience the same hazard may have different types of damage, and different costs may be assessed accordingly. Also, some hazards, such as snowstorms, may be experienced by the whole county at once. Other hazards, such as riverine flooding, will be very localized, determined by the presence of a nearby waterway.

Vulnerability assessments provide information that measures the threats associated with each hazard. Measures would include data such as how many injuries occurred, how many buildings were flooded, how many crops were damaged, the cost of clean-up afterwards and so on. The vulnerability assessments (based on past history) also give the county an idea of what it can reasonably expect to experience when another hazard of that type occurs. Since the vulnerability assessments give a monetary cost to the hazards, they can be used for cost-benefit comparisons.

These comparisons are helpful in justifying the expense of mitigation projects, land use restrictions and other policy decisions. However, it is important to remember that the vulnerability assessments are based on a series of assumptions and estimates, and they should be used as a guide only. Actual hazard events may cause greater losses than what has been estimated in the vulnerability assessments. Also, there may be additional costs associated with a hazard event that have not been included in the assessments, as the costs presented are not exhaustive.

This section has been updated from the previous 2007 edition of the Shiawassee County Hazard Mitigation Plan. Many hazards tend to share a great deal in common with each other causing there to be a general overlap between some hazards. Many of these sections have been extensively rewritten to add additional information from review and research more recently conducted. The result of these changes is meant to be a document that is much more comprehensive, up-to-date, and valid than has appeared in the previous plan, while also being easier to use.

The following hazards were analyzed and vulnerability assessed. Some of the hazards were grouped into broader categories, but detailed further in the description of the hazard. For example, snow and ice events are combined under “Severe Winter Weather”, but specifically addressed under the broader category.

1 TORNADO/STRAIGHT LINE WIND

TORNADO

Hazard Description

Tornadoes are rapidly rotating columns of air that form most often in some severe thunderstorms during Michigan's warm months. Tornadoes are high-profile hazards that can cause catastrophic damage to either a limited or an extensive area. A tornado can have winds in excess of 300 miles per hour and can have widths over one mile. The deaths and injuries associated with tornadoes have declined since the 1950s, thanks to advances in severe weather forecasting and technology improvements, but tornadoes can still effect large numbers of people and large expanses of area. Although tornado deaths have decreased, tornado damages have increased in recent years due to increased population growth and development.

Tornadoes in Michigan are most frequent in the spring and early summer when warm, moist air collides with cold air to generate severe thunderstorms. Michigan lies at the northeastern edge of the nation's primary tornado belt, which extends from Texas and Oklahoma through Missouri, Illinois, Indiana and Ohio. Most of a tornado's destructive force is exerted by the powerful winds that knock down walls and lift roofs from buildings in the storm's path. The violently rotating winds then carry debris aloft that can be blown through the air as dangerous missiles, which provides the other mechanism by which tornadoes can cause such severe destruction.

The typical length of a tornado path is approximately 16 miles, but tracks much longer than that. Tracks greater than 200 miles have been reported. Tornado path widths are generally less than one-quarter mile wide. Typically, tornadoes last only a few minutes on the ground, but those few minutes can result in tremendous damage and devastation. Historically, tornadoes have resulted in tremendous loss of life, with the mean national annual death toll being approximately 60 persons and approximately 1500 injured. Property damage costs from tornadoes averages approximately $400,000,000 every year.

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 damaged 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. Tornadoes are classified as EF0 through EF5, based on wind speed and damage levels.

The Enhanced Fujita Scale of Tornado Intensity			
EF-Scale Number	**Intensity Descriptor**	**Wind Speed (mph)**	**Type/Intensity of Damage**
EF0	Gale tornado	65-85	Light damage. Some damage to chimneys; breaks branches off trees; pushes over shallow-rooted trees; damages boards.
EF1	Weak tornado	86-110	Moderate damage. The lower limit is the beginning of hurricane wind speed; peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos pushed off the roads; attached garages may be destroyed.
EF2	Strong tornado	111-135	Considerable damage. Roofs torn off frame houses; mobile homes demolished; boxcars pushed over; large trees snapped or uprooted; light object missiles generated.
EF3	Severe tornado	136-165	Severe damage. Roof and some walls torn off well-constructed houses; trains overturned; most trees in forest uprooted; heavy cars lifted off ground and thrown.
EF4	Devastating tornado	166-200	Devastating damage. Well-constructed houses leveled; structures with weak foundations blown off some distance; cars thrown and large missiles generated.
EF5	Incredible tornado	Over 200	Incredible damage. Strong frame houses lifted off foundations and carried considerable distances to disintegrate; automobile-sized missiles fly through the air in excess of 100 yards; trees debarked; steel reinforced concrete structures badly damaged; incredible phenomena will occur.

The major health hazard from tornadoes is physical injury from flying debris or being in a collapsed structure. Within a structure, flying debris or missiles are generally stopped by interior walls. However, if a structure has no partitions, any glass, brick or other debris blown into the interior is life threatening. Following a tornado, damaged buildings are a potential health hazard due to instability, electrical system damage, and gas leaks. Sewage and water lines may also be damaged.

Although tornadoes strike at random, making all buildings vulnerable, three types of structures are more likely to suffer damage include mobile homes, homes on crawlspaces (more susceptible to lift), and buildings with large spans, such as airplane hangars, gymnasiums and factories.

Structures within the direct path of a tornado are often reduced to rubble. However, structures adjacent to the tornadoes path are often severely damaged by high winds flowing into the tornado. It is here, adjacent to the tornado's path where the building type and construction techniques are critical to the structures survival.

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

- The failure for many residential structures occurred where the framing was attached to the foundation or when nails were the primary connectors between the roofing and the walls. A home in Kansas was lifted from its foundation where the addition of nuts to the bolts anchoring the wood framing to the foundation may have been all that was needed to have kept this from happening.

- Roof geometry also played a significant role in a building's performance.

- Failure of garage doors, commercial overhead doors, residential entry doors or large windows caused a significant number of catastrophic building failures.

- Manufactured homes that rested on permanent foundations were found to perform better than those that had not.

Shiawassee County Perspective

Tornadoes are the most like thunderstorm hazards due to the widespread damage, loss of life and injuries. Since 1951, 20 tornadoes have been confirmed in Shiawassee County.

The strongest tornado in Shiawassee County occurred on April 11, 1965. This tornado was categorized as an F4 (out of 5) on the Fujita scale. The tornado moved from near DeWitt in Clinton County to near Bennington in Shiawassee

County. No one was killed or injured in Shiawassee County as a result of this tornado, but one death and 8 injuries resulted in Clinton County. Damage was estimated at between $50,000 and $500,000, with a total of 8 houses destroyed in the tornado's path. This tornado was part of the Palm Sunday outbreak which resulted in 256 deaths and over 1,500 injuries across Iowa, Indiana, Illinois, Ohio, and Michigan. All other tornadoes in Shiawassee County since 1950 have been categorized as F0, F1, or F2.

Eight persons were injured in a short-lived tornado that occurred early in the morning on August 19, 1978. This tornado occurred just west of Perry, traveling about 2 miles. The tornado was an F2, with some mobile homes being destroyed. In addition, though only categorized as an F1, the tornado on June 2, 1971 resulted in 3 injuries in Shiawassee County as it moved along a path that extended from near Owosso to just southeast of Flint. Damage was reported to a school, 5 houses, and 2 barns along the tornado's path.

One of the most damaging tornadoes in Shiawassee County since 1950 occurred on April 21, 1976. This tornado, categorized as an F2, destroyed a factory and a house as it moved from 2 miles east of Shaftsburg to 5 miles southwest of Owosso. Damage was estimated at over $500,000. One (1) person was reported to be injured.

Shiawassee County has no county-wide siren warning system. The previous Plan noted that personnel activated warning systems in Owosso and other cities and villages throughout Shiawassee County were available but delayed and lacking in timeliness. The County now participates with CodeRED. CodeRED is a reverse 911 system and is utilized to announce tornado warnings for those who have signed up to receive the announcements. There are currently twelve (12) installed early warning sirens. See Appendix 2, Page ___ for a map of sirens. Working off of estimated siren ranges, approximately 28,848 (37.5%) of the population is covered by a siren, leaving (62.5%) of the population outside the estimated range of a siren.

Shiawassee County Tornados					
#	**Location**	**Date**	**Magnitude**	**Injuries**	**Property Damage**
1	Shiawassee Co.	5/12/1956	F1	1	$ 250,000
2	Shiawassee Co.	9/21/1957	F2	0	$ 3,000
3	Shiawassee Co.	4/11/1965	F4	0	$ 250,000
4	Shiawassee Co.	4/16/1967	F2	1	$ 250,000

5	Shiawassee Co.	6/2/1971	F1	3	$ 250,000
6	Shiawassee Co.	8/1/1972	F1	0	$ -
7	Shiawassee Co.	6/3/1973	F0	0	$ 3,000
8	Shiawassee Co.	8/29/1975	F2	0	$ 25,000
9	Shiawassee Co.	4/21/1976	F2	1	$ 2,500,000
10	Shiawassee Co.	4/21/1976	F1	0	$ 25,000
11	Shiawassee Co.	4/2/1977	F1	1	$ 25,000
12	Shiawassee Co.	8/19/1978	F2	8	$ 250,000
13	Shiawassee Co.	6/10/1984	F1	0	$ -
14	Shiawassee Co.	8/30/1984	F1	0	$ 3,000
15	Shiawassee Co.	4/28/1986	F2	0	$ 2,500,000
16	Shiawassee Co.	11/27/1989	F1	0	$ 25,000
17	Shiawassee Co.	8/17/1991	F0	0	$ -
18	Shiawassee Co.	8/17/1991	F1	0	$ 3,000
19	Shiawassee Co.	8/17/1991	F0	0	$ -
20	Bennington	5/21/2001	F0	0	$ -
21	Bennington	5/13/2004	F0	0	$ -
22	Owosso	5/22/2004	F0	0	$ -
23	Juddville	8/24/2007	F0	0	$ 50,000
24	Perry	10/18/2007	F1	1	$ 400,000
25	Shaftsburg	5/29/2011	F1	0	$ 25,000
26	Shaftsburg	5/28/2013	F0	0	$ 30,000
27	Morrice	5/28/2013	F0	0	$ 50,000
28	Bancroft	5/28/2013	F1	0	$ 100,000
29	Durand	6/15/2015	F0	0	$ 10,000

Tornado Vulnerability Assessment

Costs associated with tornadoes include deaths, injuries, loss of infrastructure, damage to property, temporary housing, use of emergency personnel and clean-up afterwards. For the period from 1956 to 2015, Shiawassee County had 29 tornado events, giving the County approximately 50% chance of having a tornado per year. The previous Plan indicated a 40% chance of a tornado occurring per year.

The estimated average cost of a tornado in Shiawassee County is expected to be approximately $250,000. A tornado is anticipated to occur every other year in Shiawassee County. As cost and data are collected in the future, the Plan will be updated to reflect up to date projections and estimated cost of damage due to tornados.

STRAIGHT-LINE WINDS

Hazard Description

Severe winds, or straight-line winds, sometimes occur during severe 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, may be confused with a tornado occurrence. Severe winds have the potential to cause loss of life from breaking and falling trees, property damage, and flying debris, but tend not to cause as many deaths as tornados do. However, the property damage from straight-line winds can be more widespread than a tornado. 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, with hundreds of thousands of customers affected, are common during straight-line wind events.

Severe winds spawned by thunderstorms or other storm events have had devastating effects on Michigan in terms of loss of life, injuries and property damage. According to data compiled by the National Weather Service for the period 1970-1996, Michigan experienced over 8,300 severe wind events (not including tornadoes), which resulted in 98 deaths and millions of dollars in damage. It is important to note that the high number of severe wind events is due, in part, to the fact that the data was compiled by county, thus, multi-county storms are counted more than once. Severe wind events are characterized by wind velocities of 58 miles per hour or greater, with gusts sometimes exceeding 74 miles per hour (hurricane velocity).

Wind Speed Description

0 MPH	Smoke rises vertically
1-3 MPH	The direction of the wind is shown by smoke but not wind vanes.
4-7 MPH	Wind is felt on the face, leaves rustle, wind vanes move.
8-12 MPH	Leaves and small twigs are in motion, small flags are extended.
13-18 MPH	Dust and loose paper is raised, small branches move.

19-24 MPH	Small leafy trees sway, crested wavelets form on lakes & ponds.
25-31 MPH	Large branches are in motion, whistling is heard on power lines.
32-38 MPH	Whole trees in motion, inconvenience in walking against wind.
39-46 MPH	Twigs break off trees, difficult to walk against the wind.
47-54 MPH	Minor structural damage such as chimneys and shingles.
55-72 MPH	Damage to chimneys and antennas, shallow rooted trees uprooted.
73-113 MPH	Roof surfaces peel, windows break, moving cars pushed off road.
113-157 MPH	Roofs, weak buildings, mobile homes destroyed, large trees uprooted.

Shiawassee County Perspective

Straight-line winds are commonly mistaken as tornadoes. Downed power lines and debris are common concerns of this type of hazard. High winds are fairly common in Shiawassee County. There have been 230 severe wind events in Shiawassee County from 1996 to 2013 causing $5,025,000 in total property damage and $30,000 in total crop damage. During this time frame Shiawassee has reported zero injuries or deaths caused by severe winds whereas Michigan as a whole has reported 261 injuries and 34 deaths caused by severe winds.

2 FLOODING

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, rooftops and through man-made channels and pipes. Some developments have also encroached into flood plain areas and thus impeded the carrying capacity of drainage area.

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.

Flood prone areas are found throughout the state, as every lake, river, stream and county drain has a floodplain. The type of development that exists within the floodplain will determine whether or not flooding will cause damage. The Michigan Department of Environmental Quality estimates that about 6% of Michigan's land is flood prone, including about 200,000 buildings. The southern half of the Lower Peninsula contains the areas with the most flood damage potential.

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.

From 1972-2014, Michigan experienced sixteen (16) flood disasters that resulted in either a Presidential Major Disaster Declaration or a Governor's Disaster Declaration. These flood disasters have caused hundreds of millions of dollars in damage to homes, businesses, personal property and agriculture.

The following terminology is used when describing floods:

> The term **Minor Flooding** is used to indicate minimal or no property damage. However, some public inconvenience is possible.
>
> The term **Moderate Flooding** is used to indicate the inundation of secondary roads. Transfer to higher elevation may be necessary to save property. Some evacuation may be required.
>
> The term **Major Flooding** is used to indicate extensive inundation and property damage, usually characterized by the evacuation of people and livestock, and the closure of both primary and secondary roads.

The following two (2) issues are particular to addressing flooding has a hazard:

> **Bridges**
> A key evacuation and safety concern is when roads and bridges go under water. Generally, the larger the road, the more likely it will not flood, but this is not always the case. Approximately 105 bridges and culverts in Shiawassee County are located in area known to be in the floodplain. Some of these may be underwater during a base flood.
>
> A bridge does not have to be under water to be damaged or to cut off an evacuation route. In some cases the bridge may be above flood stage, but the access road may be flooded. In other cases, the bridge or culvert can be washed out. This is especially dangerous if a person drives on a flooded road and assumes that the bridge is still there.
>
> **Health**
> There are generally three (3) types of health hazards accompany floods. The first comes from the water itself. Floodwaters carry whatever was on the ground that the upstream runoff picked up, including dirt, oil, animal waste, and lawn, farm

and industrial chemicals. Pastures and areas where cattle and hogs are kept can contribute polluted waters to the receiving streams. Flood waters saturate the ground which leads to infiltration into sanitary sewer lines. When wastewater treatment plants are flooded, there is nowhere for the sewage to flow. Infiltration and lack of treatment lead to overloaded sewer lines which back up into low lying areas and some homes. Even though diluted by flood waters, raw sewage can be a breeding ground for bacteria, such as e coli, and other disease causing agents.

The second type of health problem comes after the water is gone. Stagnant pools become breeding grounds for mosquitoes, and wet areas of a building that have not been cleaned breed mold and mildew. A building that is not thoroughly and properly cleaned becomes a health hazard, especially for small children and the elderly. When heating ducts in a forced-air system are not properly cleaned after inundation. When the furnace or air conditioner is turned on, the sediments left in the ducts are circulated throughout the building and breathed in by the occupants.

The third problem is the long-term psychological impact of having been through a flood and seeing one's home damaged and irreplaceable keepsakes destroyed. The cost and labor needed to repair a flood-damaged home puts a severe strain on people, especially the unprepared and uninsured. There is also a long-term problem for those who know that their homes can be flooded again. The resulting stress on floodplain residents takes its toll in the form of aggravated physical and mental health problems.

Shiawassee County Perspective

Shiawassee's primary flooding source is the Shiawassee River. The flooding is not restricted to the Shiawassee River whereas smaller rivers and lakes also contribute to flooding. Riverine flooding is a common occurrence in Shiawassee County. During the past 22 years, there have been 12 major floods. There are an estimated 1,500 structures within the floodplain, of which an estimated 800 are in the City of Owosso. With the median value of a Shiawassee County home being $95,900.00, a worst-case flood scenario could jeopardize $14,385,000.00 worth of homes. With the new mapping potential created under this Plan update, the County will be better situated in the future to address potential loss in flood prone areas.

There are 2 repetitive loss locations; the average total damage paid in claims (building & contents) is $25,390.00. As cost and data are collected in the future, the plan will be updated to include up to date projections and estimated cost of damage due to reverine flooding.

Shiawassee County Floods		
Date	**Type**	**Property Damage**
2/19/1994	Flood/Flash Flood	$ 50,000
6/26/1994	Flood	$ -
7/7/1994	Flood	$ -
5/21/1996	Flood	$ -
2/21/1997	Flood	$ -
2/27/1997	Flood	$ -
5/19/2000	Flood	$ -
2/9/2001	Flood	$ 20,000
6/30/2004	Flood	$
6/27/2007	Flash Flood	$ 1,000
6/19/2009	Flash Flood	$ -
5/4/2012	Flash Flood	$ 1,100,000

Shiawassee County has experienced at least four (4) significant flood events since 1994. In 2004, Shiawassee County was one of the counties affected by the May flood which caused a total of $100 million in damage in the affected areas. The other flood events were more localized to Shiawassee County. Based on historic data, Shiawassee County has an 18% chance in any given year to have a significant flood event.

There are several different definitions of a "repetitive loss property." This Plan uses the Community Rating System's definition, in part because data is readily available: A repetitive loss property is one which has received two (2) flood insurance claim payments of at least $1,000 each since 1978.

There are several FEMA programs that encourage communities to identify the causes of their repetitive losses and develop a plan to mitigate the losses. The primary program is the National Flood Insurance Program ("NFIP"). There are 256 NFIP policies in Shiawassee County with a total coverage total of $31,491,300.

The following depicts communities where NFIP policies are in place:

Community	Policies	Coverage
Burns Township	5	$949,400.00
Village of Byron	3	$675,800.00
Caledonia Township	57	$8,206,800.00
City of Corunna	23	$3,315,700.00

Hazelton Township	3	$544,700.00
New Haven Township	3	$665,000.00
Owosso Township	4	$961,500.00
City of Owosso	147	$13,969,400.00
Shiawassee Township	4	$665,000.00
Vernon Township	1	$106,000.00
Village of Vernon	6	$1,432,000.00
Shiawassee County	**256**	**$31,491,300.00**

The following table depicts claims and total payments for claims:

Community	Total Losses	Closed Losses	Open Losses	CWOP Losses	Total Payments
Caledonia Township	14	8	0	6	$30,950.32
City of Corunna	4	1	0	3	$300.00
Owosso Township	1	1	0	0	$6,580.77
City of Owosso	36	17	0	19	$58,727.27
Shiawassee County	**55**	**27**	**0**	**28**	**$96,558.36**

In the 1980s the City of Owosso initiated a voluntary acquisition and relocation program using various community and privately-generated funds to reduce repetitive losses. They used Small Cities Block Grants and private investment to relocate forty (40) homes out of the floodplain, revitalize downtown development and develop a park along the Shiawassee River.

Riverine Flooding Vulnerability Assessment

Costs associated with flooding include deaths, injuries, loss of infrastructure, damage to property, temporary housing, use of emergency personnel and clean-up afterwards. Available damage costs for past floods in Shiawassee County were used to calculate the average annual cost of a flood. (Due to the wide area of impact that many floods have, this cost may include damage estimates from surrounding areas.) There have only been two reported cases of damage in the last ten years of floods totaling $70,000 with an average of $35,000 per event. Because property damage estimates were not available for most flood events, information is not sufficient to determine the true amount of property damage that floods in Shiawassee County have caused.

When data becomes available, estimates of the amount of residential flood damage that could occur in Shiawassee County floodplains, staff could use some basic FEMA techniques. These techniques included finding the replacement values of the structures, and estimating damages by equating flood depths with appropriate percentages of that

replacement value. For the purposes of this flooding scenario, staff estimated that approximately one-quarter (375) of the 1,500 homes in the floodplain were damaged by 7' of flood water during the 100-year flood event. Flood Damage Estimation Tables adapted from the Flood Insurance Administration were used to estimate a damage percentage for different types of structures.

Flood Damage Estimation **(Numbers are damages as a percentage of the structure's replacement value)**						
Depth of Flooding in Feet	1 story, no basement	2 story, no basement	Split-level, no basement	1 or 2 story with basement	Split-level with basement	Mobile Home
About 1' flooding at surface	14%	9%	9%	15%	16%	44%
About 2' flooding on ground floor	22%	13%	13%	20%	19%	63%
About 3' flooding on ground floor	27%	18%	25%	23%	22%	73%
About 4' flooding on ground floor	29%	20%	27%	28%	27%	78%
About 5' flooding on ground floor	30%	22%	28%	33%	32%	80%
About 6' flooding on ground floor	40%	24%	33%	38%	35%	81%
About 7' flooding on ground floor	43%	26%	34%	44%	36%	82%

Note: This table is adapted from Flood Insurance Administration guidelines, based on historical averages from observed flood damages. Since replacement value may exceed the current market value of a structure, damages greater than 50% of the replacement value can be considered a total loss of the structure, unless special historic or service functions require that additional expenses be undertaken to repair and preserve it.

3 SEVERE WINTER WEATHER HAZARDS

Hazard Description

Severe winter weather hazards include snowstorms, blizzards, and ice and sleet storms. As a mid-western state, Michigan is vulnerable to all of these winter hazards. Most of the severe winter weather events that occur in Michigan have their origin in Canadian and Arctic cold fronts that move across the state from the west or northwest. Michigan is susceptible to moderate snowfall and extreme cold.

A period of rapid accumulation of snow often accompanied by high winds, cold temperatures and low visibility. As a result of being surrounded by the Great Lakes, Michigan experiences large differences in snowfall over relatively short distances. The annual mean accumulation ranges from 30 to 170 inches of snow. In Lower Michigan, the highest snowfall accumulations occur near Lake Michigan and in the higher elevations of northern Lower Michigan.

Snowstorms can be very dangerous for a community over a period of days or weeks. Heavy snows can shut down communities for several days if snow is persistent and cannot be cleared in a timely fashion. Roof failures may occur as the weight of the snow and area of snow cause damage to homes and buildings.

Blizzards are the most severe 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.

Ice storms coat roads, trees, power lines, and buildings with thick, heavy, and slick surfaces. Ice storms are the result of cold rain that freezes on contact with the surface, therefore coating exposed objects with ice. 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. Massive traffic accidents and power outages from downed tree limbs and utility lines are common when an ice storm occurs. Ice storms are accompanied by snowfall, in which the ice is camouflaged and covered up by snow, creating treacherous transportation conditions.

The economic impact of snowstorms, blizzards and ice storms can be estimated by totaling the damage to structures and personal property, the cost of materials and labor required to repair damaged utilities, the cost of labor and materials required to apply salt to roads, the cost of labor and equipment to plow roads, costs associated with persons

injured or fatally wounded as a result of storm conditions, and profit loss due to business closure.

Significant Incidents

There have been forty (40) snow storms in Shiawassee County from 1993 to 2016. The blizzard of January 1977 found Shiawassee County involved in a Governor's Declaration. This however, did not exceed the December 1976 snowfall totals of 28.5 inches. That record was exceeded in the storm of December 2000, when a local State of Emergency was declared and Federal assistance was granted. Over 30 inches of snow fell over a 7-day period. Power outages and a shortage of heating oil were the greatest concerns because of the high risk of fires. Resources are in place to address snowstorms.

Major ice storms are not uncommon in Shiawassee County and occur at least once a year. There have been 29 Snow and Ice storms in Shiawassee County since 1993. The ice storm in April 2003 caused an estimated $161,100,000 in damages and the 2013 ice storm caused $3,000,000 in damage.

SHIAWASSEE COUNTY SNOW, BLIZZARD AND ICE STORMS						
#	**Location**	**Date**	**Type**	**Deaths**	**Injuries**	**Property Damage**
1	Shiawassee Co.	1/12/1993	Heavy Snow	0	0	$ 50,000
2	Shiawassee Co.	1/27/1994	Heavy Snow/freezing Rain	0	0	$ 5,000,000
3	Shiawassee Co.	2/7/1994	Snow	0	0	$ -
4	Shiawassee Co.	12/6/1994	Heavy Snow	0	0	$ -
5	Shiawassee Co.	1/20/1995	Heavy Snow	0	0	$ -
6	Shiawassee Co.	3/6/1995	Ice Storm	0	0	$ -
7	Shiawassee Co.	12/13/1995	Ice Storm	0	0	$ -
8	Shiawassee Co.	1/9/1997	Heavy Snow	0	0	$ -
9	Shiawassee Co.	3/13/1997	Ice Storm	0	0	$ 19,000,000
10	Shiawassee Co.	10/26/1997	Heavy Snow	0	0	$ -
11	Shiawassee Co.	12/10/1997	Heavy Snow	0	0	$ -
12	Shiawassee Co.	1/2/1999	Heavy Snow	0	0	$ 50,000
13	Shiawassee Co.	1/12/1999	Heavy Snow	0	0	$ -
14	Shiawassee Co.	1/12/1999	Snow	0	3	$ 1,800,000
15	Shiawassee Co.	3/5/1999	Heavy Snow	0	0	$ -
16	Shiawassee Co.	2/18/2000	Heavy Snow	0	0	$ -
17	Shiawassee Co.	10/7/2000	Snow	0	0	$ -
18	Shiawassee Co.	12/11/2000	Heavy Snow	0	1	$ 1,100,000
19	Shiawassee Co.	12/13/2000	Snow	0	0	$ 25,000
20	Shiawassee Co.	12/17/2000	Heavy Snow	0	0	$ 560,000

21	Shiawassee Co.	1/30/2002	Winter Storm	0	0	$ -
22	Shiawassee Co.	2/25/2002	Winter Storm	0	0	$ -
23	Shiawassee Co.	3/4/2003	Heavy Snow	0	0	$ -
24	Shiawassee Co.	4/3/2003	Ice Storm	1	2	$161,100,000
25	Shiawassee Co.	1/14/2004	Heavy Snow	0	0	$ -
26	Shiawassee Co.	1/26/2004	Winter Storm	0	0	$ -
27	Shiawassee Co.	12/9/2005	Heavy Snow	0	0	$ -
28	Shiawassee Co.	12/15/2005	Heavy Snow	0	0	$ -
29	Shiawassee Co.	12/1/2006	Ice Storm	0	0	$ -
30	Shiawassee Co.	1/14/2007	Ice Storm	0	0	$ -
31	Shiawassee Co.	2/1/2008	Heavy Storm	0	0	$ -
32	Shiawassee Co.	2/12/2008	Heavy Snow	0	0	$ -
33	Shiawassee Co.	2/9/2010	Heavy Snow	0	0	$ -
34	Shiawassee Co.	2/20/2011	Heavy Snow	0	0	$ -
35	Shiawassee Co.	11/29/2011	Heavy Snow	0	0	$ -
36	Shiawassee Co.	12/21/2013	Ice Storm	0	0	$ 3,000,000
37	Shiawassee Co.	1/5/2014	Heavy Snow	0	0	$ -
38	Shiawassee Co.	2/1/2015	Heavy Snow	0	0	$ -
39	Shiawassee Co.	11/21/2015	Heavy Snow	0	0	$ -
40	Shiawassee Co.	2/24/2016	Heavy Snow	0	0	$ -

Severe Winter Weather Vulnerability Assessment

The vulnerability calculation for severe winter weather hazards events takes into account many factors described in the hazard description section including property damage, injuries, lost wages, and costs associated with improving road conditions. The variables identified in the calculation were derived from historic event information and a 2003 Salt Institute study detailing the costs associated with severe winter weather hazards events. The vulnerability determination concludes that Shiawassee County will average 2.7 snow and ice storm events a year resulting in an annual cost of $11,335,239. As cost and data is collected in the future, the Plan can be updated to include better projections of estimated cost of damage due to severe winter weather.

What is the Probability of an Event Occurring Each Year	Amount of County land Impacted	Cost (Part	Expected Annual Cost of Damage
2.7	100	$ 4,198,23	$ 11,335,239

Probability: This is determined by adding the number of events between 1993 – 2003 and dividing it by the number of years studied. Amount of County Land Impacted: Percent of land in the County affected by the incident per occurrence. Cost: This is the total cost of each incident calculated in Part B. Expected Annual Damage: This is calculated by multiplying all of the above factors.

Part B - Breakdown of Costs	
Activation of Emergency Management	$ 25,000
Response (plowing, trees)	$ 575,661
Infrastructure failure (i.e. Road closure, car delay)	$ 322,300
Wages Salaries Lost	$ 1,462,318
State/Local Taxes Lost	$ 77,392
Federal Taxes Lost	$ 114,099
Retail Sales Lost	$ 632,406
Minor Injuries $1,560 per person (6)	$ 9,360
Major Injuries $15,600 per person (2)	$ 31,200
Death $2,710,000 per person (0.35) car accident or physical exertion	$ 948,500
Total:	$ 4,198,237

Activation of Emergency Management - temporary shelter, activation/running EOC, evacuation, rescue operations

Response (plowing, trees) - Based on 1727 miles x $333.33 per mile cost - Oakland Co. Road Commission factored for Shiawassee County

Infrastructure failure (i.e. Road closure, car delay) - Based on 1 hr delay of morning traffic on I-69 - 10,000 cars x $32.23 cost of delays - FEMA

Wages Salaries Lost - 2003 Salt Institute Study factored for Shiawassee Co. Population

State/Local Taxes Lost - 2003 Salt Institute Study factored for Shiawassee Co. Population

Federal Taxes Lost - 2003 Salt Institute Study factored for Shiawassee Co. Population

Retail Sales Lost - 2003 Salt Institute Study factored for Shiawassee Co. Population

Minor Injuries $1,560 per person - FEMA

Major Injuries $15,600 per person - FEMA

Death $2,710,000 per person - FEMA

4 EXTREME TEMPERATURES

Hazard Description

Prolonged periods of very high or very low temperatures, often accompanied by other extreme meteorological conditions.

Temperature extremes are broken down into two categories: extreme heat and extreme cold. Both extremes can last for weeks, without any advance warning and in the middle of a seemingly normal weather pattern. Although they differ in their initiating conditions, the two hazards share a commonality in that they both tend to have a special impact on the most vulnerable segments of the population – the elderly, young children and infants, impoverished individuals and persons who are poor in health.

Shiawassee County Perspective

Shiawassee County is susceptible to both extreme heat and extreme cold. The County experienced several consecutive days of 90°+ temperatures in the summer of 2003. Conditions frequently involve great changes in temperature by as much at 30-40° within a 24-hour period. However, the Great Lakes appear to influence this weather phenomenon, as far as prolonged extremes. There have been nine recorded incidences of extreme heat or cold since 1995 that have caused over 250 injuries.

Shiawassee County Extreme Temperature Events						
#	**Location**	**Date**	**Type**	**Deaths**	**Injuries**	**Property Damage**
1	Shiawassee Co.	12/9/1995	Cold Wave	3	0	$ -
2	Shiawassee Co.	2/1/1996	Extreme Cold	1	0	$ -
3	Shiawassee Co.	1/17/1997	Extreme Cold	2	0	$ -
4	Shiawassee Co.	2/11/1999	Record Warmth	0	0	$ -
5	Shiawassee Co.	7/4/1999	Excessive Heat	0	52	$ -
6	Shiawassee Co.	3/8/2000	Record Warmth	0	0	$ -
7	Shiawassee Co.	12/21/2000	Extreme Cold	0	0	$ 475,000
8	Shiawassee Co.	8/6/2001	Excessive Heat	1	200	$ -
9	Shiawassee Co.	1/10/2003	Extreme Cold/wind Chill	0	0	$ -
10	Shiawassee Co.	1/14/2009	Extreme Cold/Wind Chill	0	0	$ -
11	Shiawassee Co.	7/17/2011	Extreme Cold/Wind Chill	0	0	$ -
12	Shiawassee Co.	2/14/2015	Extreme Cold/Wind Chill	0	0	$ -
13	Shiawassee Co.	2/19/2015	Extreme Cold/Wind Chill	0	0	$ -
14	Shiawassee Co.	2/23/2015	Extreme Cold/Wind Chill	0	0	$ -

5 INCLEMENT WEATHER

Hazard Description

Inclement weather is ranked as the third hazard, and the county is susceptible to this hazard all year long. Inclement weather includes a) thunderstorms, b) lightning, c) hail, and d) fog. These weather hazards are all combined under the "inclement weather" category because of their connectivity. For example, thunderstorms can produce lightning, severe winds or hail.

Severe Thunderstorms

Severe thunderstorms are weather systems accompanied by strong winds (at least 56mph), lightning, heavy rain (that could cause flash flooding), hail (at least ¾" diameter) or tornadoes.

Severe thunderstorms can occur at any time in Michigan, although they are most frequent during the warm spring and summer months from May through September. The potential thunderstorm threat is often measured by the number of "thunderstorm days", which are defined as days in which thunderstorms are observed. The National Weather Service (NWS) in Michigan has further refined that statewide average figure and found that the southern two tiers of counties of the Lower Peninsula (roughly the area south of Interstate 94) is subject to 40-60 thunderstorm days per year. The Lower Peninsula, in general, is subject to approximately 40 thunderstorm days per year, while the Upper Peninsula average is closer to 30 thunderstorm days per year.

Thunderstorms form when a shallow layer of warm, moist air is overrun by a deeper layer of cool, dry air. Cumulonimbus clouds, frequently called "thunderheads", are formed in these conditions. These clouds are often enormous (up to six miles or more across and 40,000 to 50,000 feet high) and may contain tremendous amounts of water and energy. That energy is often released in the form of high winds, excessive rains, lightning and possibly hail and tornadoes.

Thunderstorms are typically short-lived (often lasting no more than 30-40 minutes) and fast moving (30-50 miles per hour). Strong frontal systems, however, may spawn one squall line after another composed of many individual thunderstorm cells. The following sections address, in greater detail, these specific thunderstorm hazards: 1) lightning; 2) hail; 3) severe winds; 4) tornadoes. Thunderstorms can also result in riverine flooding, which is addressed in another section.

Shiawassee County Perspective

There are several thunderstorms that occur in Shiawassee County every year, and each of these storms tends to generate several hazards. Since 2000, the National Weather Service has issued 12 thunderstorm or severe thunderstorm warnings in Shiawassee County. On August 22, 2000, strong winds produced by a thunderstorm blew down electrical lines, resulting in a fire in the City of Owosso.

Shiawassee County averages 30-40 thunderstorms a year of varying magnitudes. Approximately 2.4 storms per year are severe enough to cause damage. Severe thunderstorm events cause, on average, approximately $299,583 in damage for the affected area. Even though a single thunderstorm affects multiple counties, the bulk of the damage is typically localized where the storm reached its peak. Given the frequency (2.4 severe storms on average) and severity ($299,583) of thunderstorms in the Shiawassee County area, staff estimates that Shiawassee County should plan for $718,999 in damage annually related to inclement weather events. As cost and data are collected in the fulture, the plan will be updated to reflect up to date projections and estimated cost of damage due to thunderstorms.

Shiawassee County Thunderstorms and High Winds							
#	Location	Date	Type	KNT	Miles/Hour	Injuries	Property Damage
1	Shiawassee Co.	12/3/1955	Thunderstorm Winds	0	0	0	$ -
2	Shiawassee Co.	7/4/1957	Thunderstorm Winds	0	0	0	$ -
3	Shiawassee Co.	5/1/1967	Thunderstorm Winds	0	0	0	$ -
4	Shiawassee Co.	6/16/1967	Thunderstorm Winds	0	0	0	$ -
5	Shiawassee Co.	4/23/1968	Thunderstorm Winds	0	0	0	$ -
6	Shiawassee Co.	6/23/1968	Thunderstorm Winds	0	0	0	$ -
7	Shiawassee Co.	8/16/1968	Thunderstorm Winds	0	0	0	$ -
8	Shiawassee Co.	4/29/1970	Thunderstorm Winds	0	0	0	$ -
9	Shiawassee Co.	6/7/1971	Thunderstorm Winds	0	0	0	$ -
10	Shiawassee Co.	5/14/1974	Thunderstorm Winds	0	0	0	$ -
11	Shiawassee Co.	6/15/1975	Thunderstorm Winds	0	0	0	$ -
12	Shiawassee Co.	6/15/1975	Thunderstorm Winds	0	0	0	$ -
13	Shiawassee Co.	3/20/1976	Thunderstorm Winds	0	0	0	$ -
14	Shiawassee Co.	3/30/1976	Thunderstorm Winds	0	0	0	$ -
15	Shiawassee Co.	7/29/1980	Thunderstorm Winds	0	0	0	$ -
16	Shiawassee Co.	7/5/1985	Thunderstorm Winds	0	0	0	$ -
17	Shiawassee Co.	5/14/1987	Thunderstorm Winds	56	64	0	$ -
18	Shiawassee Co.	7/20/1987	Thunderstorm Winds	0	0	0	$ -
19	Shiawassee Co.	8/5/1988	Thunderstorm Winds	0	0	0	$ -
20	Shiawassee Co.	8/16/1988	Thunderstorm Winds	0	0	0	$ -
21	Shiawassee Co.	3/14/1989	Thunderstorm Winds	54	62	0	$ -
22	Shiawassee Co.	5/25/1989	Thunderstorm Winds	0	0	0	$ -
23	Shiawassee Co.	6/26/1989	Thunderstorm Winds	68	78	0	$ -
24	Shiawassee Co.	7/25/1989	Thunderstorm Winds	0	0	0	$ -
25	Shiawassee Co.	11/27/1989	Thunderstorm Winds	0	0	0	$ -
26	Shiawassee Co.	1/25/1990	Thunderstorm Winds	0	0	0	$ -
27	Shiawassee Co.	9/6/1990	Thunderstorm Winds	0	0	0	$ -
28	Shiawassee Co.	9/6/1990	Thunderstorm Winds	0	0	0	$ -
29	Shiawassee Co.	9/14/1990	Thunderstorm Winds	52	60	0	$ -
30	Shiawassee Co.	9/14/1990	Thunderstorm Winds	52	60	0	$ -
31	Shiawassee Co.	3/27/1991	Thunderstorm Winds	70	81	0	$ -
32	Shiawassee Co.	3/27/1991	Thunderstorm Winds	70	81	0	$ -
33	Shiawassee Co.	6/15/1991	Thunderstorm Winds	0	0	0	$ -
34	Shiawassee Co.	7/3/1991	Thunderstorm Winds	61	70	0	$ -
35	Shiawassee Co.	7/6/1991	Thunderstorm Winds	61	70	0	$ -
36	Shiawassee Co.	7/7/1991	Thunderstorm Winds	0	0	0	$ -
37	Shiawassee Co.	7/7/1991	Thunderstorm Winds	0	0	0	$ -
38	Shiawassee Co.	7/7/1991	Thunderstorm Winds	0	0	0	$ -
39	Shiawassee Co.	5/17/1992	Thunderstorm Winds	59	68	0	$ -
40	Shiawassee Co.	6/17/1992	Thunderstorm Winds	0	0	0	$ -

41	Shiawassee Co.	10/8/1992	Thunderstorm Winds	0	0	0	$	-
42	Perry	6/28/1994	Thunderstorm Winds	0	0	0	$	-
43	Bancroft	6/28/1994	Thunderstorm Winds	0	0	0	$	1,000
44	Byron	7/6/1994	Thunderstorm Winds	0	0	0	$	-
45	Owosso	7/20/1994	Thunderstorm Winds	0	0	0	$	-
46	Owosso	7/4/1995	Thunderstorm Winds	0	0	0	$	-
47	Shiawassee Co.	7/13/1995	Thunderstorm Winds	0	0	0	$	200,000
48	Shiawassee Co.	3/25/1996	High Wind	50	58	0	$	65,000
49	Owosso	7/2/1996	Thunderstorm Winds	50	58	0	$	-
50	Morrice	7/18/1996	Thunderstorm Winds	60	69	0	$	-
51	Shiawassee Co.	8/7/1996	Thunderstorm Winds	70	81	0	$	-
52	Shiawassee Co.	8/7/1996	Thunderstorm Winds	70	81	0	$	-
53	Shiawassee Co.	10/30/1996	High Wind	60	69	0	$	90,000
54	Shiawassee Co.	2/27/1997	High Wind	55	63	0	$	20,000
55	Shiawassee Co.	4/6/1997	High Wind	70	81	1	$	1,200,000
56	Owosso	7/14/1997	Thunderstorm Wind/Hail	50	58	0	$	-
57	Owosso	4/16/1998	Thunderstorm Winds	52	60	0	$	-
58	Henderson	5/31/1998	Thunderstorm Winds	70	81	0	$	630,000
59	Laingsburg	5/31/1998	Thunderstorm Winds	77	89	0	$	120,000
60	Laingsburg	5/31/1998	Thunderstorm Winds	70	81	0	$	100,000
61	New Lothrop	5/31/1998	Thunderstorm Winds	65	75	0	$	60,000
62	Corunna	5/31/1998	Thunderstorm Winds	65	75	0	$	60,000
63	Bancroft	5/31/1998	Thunderstorm Winds	60	69	0	$	30,000
64	Shiawassee Co.	6/2/1998	High Wind	35	40	0	$	-
65	Owosso	6/21/1998	Thunderstorm Winds	52	60	0	$	2,000
66	Owosso	6/25/1998	Thunderstorm Winds	52	60	0	$	-
67	Byron	6/25/1998	Thunderstorm Winds	52	60	0	$	-
68	Carland	7/21/1998	Thunderstorm Winds	55	63	0	$	9,000
69	Owosso	11/10/1998	Thunderstorm Winds	52	60	0	$	5,000
70	Shiawassee Co.	11/10/1998	High Wind	61	70	0	$	1,100,000
71	Perry	11/10/1998	Thunderstorm Winds	52	60	0	$	8,000
72	Shiawassee Co.	1/17/1999	Thunderstorm	0	0	0	$	-
73	Owosso	5/17/1999	Thunderstorm Winds	61	70	0	$	10,000
74	Byron	6/28/1999	Thunderstorm Winds	52	60	0	$	4,000
75	Owosso	7/23/1999	Thunderstorm Winds	52	60	0	$	8,000
76	Durand	6/1/2000	Thunderstorm Winds	52	60	0	$	6,000
77	Bancroft	7/28/2000	Thunderstorm Winds	52	60	0	$	5,000
78	Owosso	8/22/2000	Thunderstorm Winds	50	58	0	$	5,000
79	Shiawassee Co.	2/25/2001	Thunderstorm Winds	52	60	0	$	35,000
80	Owosso	4/23/2001	Thunderstorm Winds	52	60	0	$	6,000
81	Carland	7/29/2001	Thunderstorm Winds	60	69	0	$	-
82	Owosso	7/29/2001	Thunderstorm Winds	60	69	0	$	-
83	Owosso	7/29/2001	Thunderstorm Winds	50	58	0	$	-
84	Perry	7/29/2001	Thunderstorm Winds	50	58	0	$	-
85	Corunna	9/7/2001	Thunderstorm Winds	55	63	0	$	-
86	Owosso	9/8/2001	Thunderstorm Winds	50	58	0	$	-
87	Owosso	9/8/2001	Thunderstorm Winds	55	63	0	$	-
88	Shiawassee Co.	2/1/2002	High Wind	40	46	1	$	30,000
89	Shiawassee Co.	3/9/2002	High Wind	61	70	2	$	780,000
90	New Lothrop	5/31/2002	Thunderstorm Winds	55	63	0	$	-
91	Corunna	6/25/2002	Thunderstorm Winds	50	58	0	$	-
92	Laingsburg	9/10/2002	Thunderstorm Winds	52	60	0	$	15,000
93	Morrice	9/10/2002	Thunderstorm Winds	52	60	0	$	50,000
94	Perry	9/10/2002	Thunderstorm Winds	55	63	0	$	-
95	Perry	5/5/2003	Thunderstorm Winds	50	58	0	$	-
96	Bancroft	6/8/2003	Thunderstorm Winds	50	58	0	$	-
97	Byron	6/8/2003	Thunderstorm Winds	50	58	0	$	-

98	Perry	7/4/2003	Thunderstorm Winds	50	58	0	$	-
99	Owosso	7/4/2003	Thunderstorm Winds	52	60	0	$	-
100	Corunna	7/4/2003	Thunderstorm Winds	52	60	0	$	-
101	Laingsburg	8/1/2003	Thunderstorm Winds	52	60	0	$	-
102	Shiawassee Co.	11/12/2003	High Wind	76	87	0	$	21,000,000
103	Perry	5/5/2003	High Wind			0	$	-
104	Bancroft	6/8/2003	Thunderstorm Winds			0	$	-
105	Byron	6/8/2003	Thunderstorm Winds			0	$	-
106	Perry	7/4/2003	Thunderstorm Winds			0	$	-
107	Owosso	7/4/2003	Thunderstorm Winds			0	$	-
108	Corunna	7/4/2003	Thunderstorm Winds			0	$	-
109	Laingsburg	8/1/2003	Thunderstorm Winds			0	$	-
110	Vernon	5/21/2004	Thunderstorm Winds			0	$	-
111	Vernon	5/23/2004	Thunderstorm Winds			0	$	-
112	New Lothrop	6/9/2004	Thunderstorm Winds			0	$	-
113	Owosso	7/13/2004	Thunderstorm Winds			0	$	-
114	Henderson	6/5/2005	Thunderstorm Winds			0	$	-
115	Morrice	6/8/2005	Thunderstorm Winds			0	$	-
116	Juddville	6/14/2005	Thunderstorm Winds			0	$	-
117	Henderson	6/28/2005	Thunderstorm Winds			0	$	-
118	Byron	7/18/2005	Thunderstorm Winds			0	$	-
119	Owosso	9/22/2005	Thunderstorm Winds			0	$	-
120	Juddville	9/22/2005	Thunderstorm Winds			0	$	-
121	Shiawassee Co.	11/15/2005	High Wind			0	$ 450,000	
122	Perry	5/25/2006	Thunderstorm Winds			0	$	-
123	Vernon	6/19/2006	Thunderstorm Winds			0	$	-
124	Shiawassee Co.	7/17/2006	Thunderstorm Winds			0	$	-
125	Owosso	7/30/2006	Thunderstorm Winds			0	$	-
126	Corunna	7/30/2006	Thunderstorm Winds			0	$	-
127	Bancroft	8/2/2006	Thunderstorm Winds			0	$	-
128	Perry	5/15/2007	Thunderstorm Winds			0	$ 4,000	
129	Perry	5/15/2007	Thunderstorm Winds			0	$	-
130	Byron	5/15/2007	Thunderstorm Winds			0	$ 25,000	
131	Vernon	5/15/2007	Thunderstorm Winds			0	$ 15,000	
132	Vernon	6/2/2007	Thunderstorm Winds			0	$ 3,000	
133	Henderson	6/27/2007	Thunderstorm Winds			0	$	-
134	New Lothrop	7/10/2007	Thunderstorm Winds			0	$	-
135	Owosso	7/10/2007	Thunderstorm Winds			0	$ 2,000	
136	Juddville	7/10/2007	Thunderstorm Winds			0	$ 2,000	
137	New Lothrop	7/18/2007	Thunderstorm Winds			0	$	-
138	Laingsburg	7/19/2007	Thunderstorm Winds			0	$	-
139	Owosso	7/19/2007	Thunderstorm Winds			0	$	-
140	New Lothrop	7/26/2007	Thunderstorm Winds			0	$	-
141	Juddville	7/26/2007	Thunderstorm Winds			0	$	-
142	Corunna	8/22/2007	Thunderstorm Winds			0	$	-
143	Owosso	8/24/2007	Thunderstorm Winds			0	$	-
144	Owosso	8/24/2007	Thunderstorm Winds			0	$	-
145	Owosso	8/24/2007	Thunderstorm Winds			0	$ 3,000	
146	Juddville	8/29/2007	Thunderstorm Winds			0	$ 3,000	
147	Vernon	9/25/2007	Thunderstorm Winds			0	$	-
148	Bancroft	10/18/2007	Thunderstorm Winds			0	$	-
149	Corunna	5/17/2008	Thunderstorm Winds			0	$	-
150	Henderson	6/6/2008	Thunderstorm Winds			0	$	-
151	Perry	7/16/2008	Thunderstorm Winds			0	$ 500	
152	Pittsburg	4/25/2009	Thunderstorm Winds			0	$	-
153	New Lothrop	7/15/2010	Thunderstorm Winds			0	$ 25,000	
154	Shiawassee Co.	9/7/2010	High Wind			0	$ 5,000	

155	Perry	5/29/2011	Thunderstorm Winds			0	$ 10,000	
156	Byron	5/29/2011	Thunderstorm Winds			0	$	-
157	Byron	5/29/2011	Thunderstorm Winds			0	$	-
158	Morrice	6/21/2011	Thunderstorm Winds			0	$ 10,000	
159	Byron	6/22/2011	Thunderstorm Winds			0	$	-
160	Shiawassee Co.	10/15/2011	High Wind			0	$ 2,000	
161	Owosso	5/3/2012	Thunderstorm Winds			0	$ 3,000	
162	Laingsburg	6/18/2012	Thunderstorm Winds			0	$	-
163	Corunna	7/5/2012	Thunderstorm Winds			0	$ 50,000	
164	Burton	5/20/2013	Thunderstorm Winds			0	$ 4,000	
165	Shaftsburg	5/28/2013	Thunderstorm Winds			0	$	-
166	New Lothrop	8/7/2013	Thunderstorm Winds			0	$	-
167	Perry	11/17/2013	Thunderstorm Winds			0	$	-
168	Morrice	11/17/2013	Thunderstorm Winds			0	$	-
169	Perry	4/12/2014	Thunderstorm Winds			0	$	-
170	Durand	4/12/2014	Thunderstorm Winds			0	$	-
171	Byron	4/12/2014	Thunderstorm Winds			0	$	-
172	Shaftsburg	6/18/2014	Thunderstorm Winds			0	$	-
173	Bennington	6/18/2014	Thunderstorm Winds			0	$	-
174	Bancroft	8/19/2014	Thunderstorm Winds			0	$	-
175	Burton	7/14/2015	Thunderstorm Winds			0	$	-
176	Vernon	7/14/2015	Thunderstorm Winds			0	$	-

LIGHTNING

Hazard Description

The discharge of electricity from within a thunderstorm. Lightning is a random and unpredictable product of a thunderstorm's tremendous energy. Lightning strikes when a thunderstorm's electrical potential (the difference between its positive and negative charges) becomes great enough to overcome the resistance of the surrounding air. Lightning strikes can generate current levels of 30,000 to 40,000 amperes, with air temperatures often superheated to higher than 50,000 degrees Fahrenheit (hotter than the surface of the sun) and speeds approaching one-third the speed of light.

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 not uncommon for a single thunderstorm to produce hundreds or even thousands of lightning strikes. However, to the majority of the general 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.

Lightning deaths are usually caused by the electrical force shocking the heart into cardiac arrest or throwing the heartbeat out of its usual rhythm. Lightning can also cut off breathing by paralyzing the chest muscles or damaging the respiratory center in the brain stem. It takes only about one-hundredth of an ampere of electric current to stop the human heartbeat or send it into ventricular fibrillation. Lightning can also cause severe skin burns that can lead to death if complications from infection set in. Statistics compiled by the National Oceanic and Atmospheric Administration ("NOAA") 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:

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 aftereffects, such as memory and attention deficits, sleep disturbance, fatigue, dizziness and numbness.

Lightning-Related Property Losses: In terms of property losses from lightning, statistics vary widely, according to sources. The Insurance Information Institute (a national clearinghouse of insurance industry information) estimates that lightning damage amounts to nearly five (5%) of all paid insurance claims, with residential claims alone exceeding $1 billion. Information from insurance companies shows one homeowner's damage claim for every 57 lightning strikes. The NLSI estimates that lightning causes more than 26,000 fires annually, with damage to property exceeding $5-6 billion. Electric utility companies across the country estimate as much as $1 billion per year in damaged equipment and lost revenue from lightning. The Federal Aviation Administration (FAA) reports approximately $2 billion per year in airline industry operating costs and passenger delays from lightning. Because lightning-related damage information is compiled by so many different sources, using widely varying collection methods and criteria, it is difficult to determine the collective damage for the U.S. from lightning. However, suffice it to say that annual lightning-related property damages are conservatively estimated at several billion dollars per year, and those losses are expected to continue to grow as the use of computers and other lightning-sensitive electronic components becomes more prevalent.

Shiawassee County Perspective

Lightning is another product of thunderstorms and a common occurrence in Shiawassee County. Approximately three years ago, a young boy was struck by lightning in Perry. There have been 4 recorded lighting storms that have caused significant damage.

Shiawassee County Lightning Storms				
#	**Location**	**Date**	**Injuries**	**Property Damage**
1	Corunna	8/9/1998	0	$ 75,000
2	Perry	9/21/2001	1	$ -
3	Morrice	9/10/2002	0	$ 75,000
4	Carland	5/20/2004	0	$ -
5	Vernon	11/9/2005	0	$ 50,000
6	Bancroft	3/26/2007	0	$ 25,000

HAIL

Hazard Description

A condition where atmospheric water particles from thunderstorms form into rounded or irregular lumps of ice, that fall to the earth. Hail is another product of the strong thunderstorms that frequently move across the state. As one of these thunderstorms passes over, hail usually falls near the center of the storm, along with the heaviest rain. Sometimes, strong winds occurring at high altitudes in the thunderstorm can blow the hailstones away from the storm center, causing an unexpected hazard at places that otherwise might not appear threatened. Most hailstones range in size from a pea to a golf ball, but hailstones larger than baseballs have occurred with the most severe thunderstorms. Hail is formed by thunderstorms 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. Large hail is a characteristic of severe thunderstorms and it may precede the occurrence of a tornado.

Hail can be especially damaging to crops, home roofs, and automobiles. Approximately $1 billion in damages occurs annually across the United States. In Michigan, there is usually at least one intense hailstorm per year that causes significant damages.

Hail Size Estimation

Size	Description
1/4 inch	Pea size
1/2 inch	Marble size
3/4 inch	Dime size

1 inch	Quarter size
1 3/4 inch	Golf ball size
2 3/4 inch	Baseball size

Shiawassee County Perspective

Occasionally, thunderstorms will produce various-size hail. On 7-14-2000, nickel-size hail was reported along M-13 in Hazelton and Venice Townships. There have been 28 recorded hail storms since 1967.

Shiawassee County Hail Storms			
#	**Location**	**Date**	**Mag**
1	Shiawassee Co.	7/30/1967	1.50 in.
2	Shiawassee Co.	6/11/1970	1.50 in.
3	Shiawassee Co.	6/14/1970	1.50 in.
4	Shiawassee Co.	7/29/1980	1.00 in.
5	Shiawassee Co.	5/14/1987	1.75 in.
6	Shiawassee Co.	9/6/1990	0.75 in.
7	Shiawassee Co.	7/3/1991	1.75 in.
8	Shiawassee Co.	5/2/1992	0.75 in.
9	Shiawassee Co.	5/2/1992	0.75 in.
10	Owosso	4/12/1994	1.75 in.
11	Perry	4/12/1994	1.75 in.
12	Bancroft	5/25/1994	1.00 in.
13	Carland	6/28/1994	0.75 in.
14	Perry	6/28/1994	1.00 in.
15	Corunna	1/18/1996	1.00 in.
16	Owosso	4/12/1996	0.75 in.
17	Laingsburg	6/23/1997	1.75 in.
18	Owosso	7/14/1997	50 kts.
19	Owosso	5/31/1998	0.75 in.
20	Durand	7/24/1999	0.75 in.
21	Perry	7/14/2000	1.00 in.
22	Juddville	7/14/2000	0.75 in.
23	Bennington	7/29/2001	1.00 in.
24	Henderson	6/17/2002	0.75 in.

25	Owosso	6/25/2002	1.75 in.
26	Perry	9/19/2002	0.88 in.
27	Corunna	3/20/2003	0.75 in.
28	Morrice	8/21/2003	0.88 in.
29	Owosso	5/17/2004	1.00 in.
30	Vernon	5/23/2004	1.00 in.
31	New Lothrop	6/23/2004	0.75 in.
32	Perry	7/16/2004	1.00 in.
33	Bennington	8/2/2004	0.75 in.
34	Henderson	6/5/2005	0.75 in.
35	Bancroft	4/22/2006	1.75 in.
36	Owosso	6/28/2006	0.75 in.
37	Perry	6/2/2007	0.88 in.
38	Henderson	6/2/2007	1.00 in.
39	Henderson	6/27/2007	0.88 in.
40	New Lothrop	7/26/2007	0.75 in.
41	Juddville	7/26/2007	1.00 in.
42	New Lothrop	7/26/2007	1.00 in.
43	Durand	7/26/2007	1.75 in.
44	New Haven	4/11/2008	0.88 in.
45	New Lothrop	4/11/2008	1.75 in.
46	Henderson	6/6/2008	0.75 in.
47	Bennington	6/8/2008	0.88 in.
48	Byron	5/13/2011	0.88 in.
49	Laingsburg	6/22/2011	0.88 in.
50	Perry	11/17/2013	0.75 in.

FOG

Hazard Description

Fog is condensed water vapor in cloudlike masses lying close to the ground and limiting visibility. 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. It must be noted, however, that freezing fog (a hazard for which the National Weather Service does issue special statements) can cause direct harm by causing slickness on roadways and thus leading to serious transportation accidents.

Shiawassee County Perspective

Fog has played a contributing role in several multi-vehicle accidents over the past several years. While statistics suggest that highway accidents and fatalities, in general, have fallen, that trend is not evident with respect to accidents and fatalities caused by fog. 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. Property damage can be significant for vehicles, although real property and structures are usually unaffected.

Inclement Weather Vulnerability Assessment

Inclement weather includes a) thunderstorms, b) lightning, c) hail, and d) severe winds. These weather hazards are all combined under the "inclement weather" category because of their connectivity. Costs associated with inclement weather include deaths, injuries, loss of power, damage to property, and clean-up afterwards. Available damage costs for past events in Shiawassee County were used to calculate the average cost of an inclement weather event. See the Vulnerability Assessment Chart #3 below.

According to the Federal Emergency Management Agency (FEMA), a death is estimated at $2,710,000, major injuries are estimated at $15,600, and minor injuries are $1,560. Using the historic data below, the cost of five injuries (it was estimated that one injury was major and four minor) totaled $21,840. Added to the property damages of $25,804,000, the total figure becomes $25,825,840 for the 34 recorded events. Based on these damage figures, the estimated average cost of a thunderstorm event in Shiawassee County is expected to be $759,583.53 per event. As cost and data are collected in the future, the plan will be updated to reflect up to date projections and estimated cost of damage due to inclement weather

Shiawassee County Inclement Weather			
Date	**Deaths**	**Injuries**	**Property Damage**
6/28/1994	0	0	$ 1,000
7/13/1995	0	0	$ 200,000
3/25/1996	0	0	$ 65,000
10/30/1996	0	0	$ 90,000
2/27/1997	0	0	$ 20,000
4/6/1997	0	1 (major @ $15,600) = $15,600	$ 1,200,000
5/31/1998	0	0	$ 630,000
5/31/1998	0	0	$ 120,000
5/31/1998	0	0	$ 100,000
5/31/1998	0	0	$ 60,000
5/31/1998	0	0	$ 60,000
5/31/1998	0	0	$ 30,000
6/21/1998	0	0	$ 2,000
7/21/1998	0	0	$ 9,000
11/10/1998	0	0	$ 5,000
11/10/1998	0	0	$ 1,100,000
11/10/1998	0	0	$ 8,000
5/17/1999	0	0	$ 10,000
6/28/1999	0	0	$ 4,000
7/23/1999	0	0	$ 8,000
6/1/2000	0	0	$ 6,000
7/28/2000	0	0	$ 5,000
8/22/2000	0	0	$ 5,000
2/25/2001	0	0	$ 35,000
4/23/2001	0	0	$ 6,000
2/1/2002	0	1(minor @ $1,560) = $1,560	$ 30,000
3/9/2002	0	2 (minor @ $1,560) = $3,120	$ 780,000
9/10/2002	0	0	$ 15,000
9/10/2002	0	0	$ 50,000
11/12/2003	0	0	$ 21,000,000
8/9/1998	0	0	$ 75,000
9/21/2001	0	1(minor @ $1,560) = $1,560	$ -
9/10/2002	0	0	$ 75,000
11/15/2005	0	0	$ 450,000
5/15/2007	0	0	$ 44,000
6/2/2007	0	0	$ 3,000
7/10/2007	0	0	$ 4,000
8/24/2007	0	0	$ 3,000

8/29/2007	0	0	$ 3,000
7/16/2008	0	0	$ 500
7/15/2010	0	0	$ 25,000
9/7/2010	0	0	$ 5,000
5/29/2011	0	0	$ 10,000
6/21/2011	0	0	$ 10,000
10/15/2011	0	0	$ 2,000
5/3/2012	0	0	$ 3,000
7/5/2012	0	0	$ 50,000
5/20/2013	0	0	$ 4,000
Totals	**$0**	**$ 21,840.00**	**$ 26,420,500.00**
Grand Total		**$ 26,442,340.00**	
Estimated Per Event		**$ $550,427**	

6 HAZARDOUS MATERIALS

Hazard Description (Transportation)

An uncontrolled release of hazardous materials during transport, capable of posing a risk to life, health, safety, property or the environment. 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. 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. Being surrounded by the Great Lakes, one of the most dangerous hazardous material transportation accident scenarios that could occur in Michigan would be a spill or release of oil, petroleum or other harmful materials into one of the lakes from a marine cargo vessel.

Such an incident, if it involved a large quantity of material, could cause environmental contamination of unprecedented proportions. Fortunately, the Great Lakes states, working in partnership with oil and petroleum companies and other private industries, have taken significant steps to ensure that a spill of significant magnitude is not likely to occur on the Great Lakes.

Heating fuel and motor fuel account for approximately 98% of all the hazardous materials that are being transported on today's roadways. The remaining 2% includes all other hazardous materials. Available estimates from the Michigan State Police indicate that about 100 loads of propane go over I-69 daily during the winter season. In the warmer months, this amount declines. However, large quantities of anhydrous ammonia are transported during the warmer months. Anhydrous ammonia is sprayed on farm

fields, and is also used for air conditioning and refrigeration purposes. This would also be an extremely dangerous hazardous material if a release occurred during transportation.

Shiawassee County Perspective

Shiawassee County has had a number of small-scale hazardous material transportation incidents that have required local response by Shiawassee County fire departments. Cleanup has been contracted with companies such as Young's Environment and DeBarr. In 2003, a decontamination tent system was purchased with Homeland Security Grant funds and in February, 2004, 11 fire personnel completed Hazmat Whopper Technician Training. Since April 2005, 22 fire personnel have been trained for the hazmat team. Two major sources of concern in Shiawassee County are the I-69 corridor that has a very high volume of truck traffic traveling from the Port Huron, Michigan and Sarnia, Ontario, Canada area. Many of these vehicles transport hazardous materials and leaks have been discovered on occasion. The other source of concern is the railroad. Trains traveling on tracks running through several cities, villages and townships carry hazardous substances. Several years ago, a railcar caught fire in the Morrice/Perry area, requiring evacuation. As recently as December 2003, a minor leak from a railcar was discovered within the City of Durand. It was repaired without incident or evacuation. In February 2005, there was a train derailment in Bancroft causing a propane tank explosion. In November 2006, a semi-tanker rolled over in Rush Township, causing an evacuation of a 2 mile radius due to the release of styrene monomer.

7 PUBLIC HEALTH EMERGENCIES

Hazard Description

Prolonged periods of very high or very low temperatures, often accompanied by other extreme meteorological conditions. Public health emergencies can take many forms—disease epidemics, large-scale incidents of food or water contamination, extended periods without adequate water and sewer services, harmful exposure to chemical, radiological or biological agents and large-scale infestations of disease-carrying insects or rodents, to name just a few. Public health emergencies can occur as primary events by themselves, or they may be secondary events to another disaster or emergency such as a 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 hazard would be the intentional release of a radiological, chemical or biological agent to adversely impact a large number of people. Such a release would most likely be an act of sabotage aimed at the government or a specific organization or segment of the population. Fortunately to date, Michigan has not yet experienced such a release aimed at mass destruction. However, it is probably only a matter of time before an incident of that nature and magnitude does occur. If and when it does, the public health implications, under the right set of circumstances, could be staggering.

Shiawassee County Perspective

Shiawassee County Public Health Officials have done a fine job of overseeing the heath needs in the county. There have been flu outbreaks, measles, TB, hepatitis A and meningitis cases over the years. The health system has been activated to monitor and reduce any major outbreaks. Recently, the Health Department has assigned a nurse to conduct surveillance of these varying medical outbreaks and to put in motion the necessary steps to keep any cases to a minimum. Today, additional pressure is put on public health to mitigate and prepare for a number of serious hazards, due to the possibility of terrorist activity. The threat of a hazard does exist.

8 DROUGHT

Hazard Description

A water shortage caused by a deficiency of rainfall, generally lasting for an extended period of time. Drought is the consequence of a natural reduction in the amount of precipitation received over an extended period of time, usually a season or more in length. Drought is a normal part of the climate in Michigan and virtually all other climates around the world, including areas with high and low average rainfall. Drought differs from normal arid conditions found in low rainfall areas, because aridity is a permanent characteristic of that type of climate. Drought is the consequence of a natural reduction in the amount of precipitation 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 multifaceted nature of the hazard makes it difficult to define a drought and assess when and where one is likely to occur.

Drought differs from other natural hazards in several ways. First, it is difficult to determine the exact beginning and end of a drought, since its effects may accumulate slowly and linger even after the event is generally thought of as being over. Second, the lack of a clear-cut definition of drought often makes it difficult to determine whether one actually exists, and if it does exist, its degree of severity. Third, drought impacts are often less obvious than other natural hazards and they are typically spread over a much larger geographic area. Fourth, due primarily to the aforementioned reasons, most communities do not have any contingency plans in place for addressing drought. This lack of pre-planning can greatly hinder a community's response capability when a drought does occur.

Droughts can cause many severe impacts on communities and regions, including: 1) water shortages for human consumption, industrial, business and agricultural uses, power generation, recreation and navigation; 2) a drop in the quantity and quality of agricultural crops; 3) decline of water quality in lakes, streams and other natural bodies of water; 4) malnourishment of wildlife and livestock; 5) increase in wildfires and wildfire-related losses to timber, homes and other property; 6) declines in tourism in areas dependent on water-related activities; 7) declines in land values due to physical damage from the drought conditions and/or decreased economic or functional use of the property; 8) reduced tax revenue due to income losses in agriculture, retail, tourism and other economic sectors; 9) increases in insect infestations, plant disease, and wind erosion; 10) possible loss of human life due to food shortages, extreme heat, fire and other health-related problems such as diminished sewage flows and increased pollutant concentrations in surface water.

Shiawassee County Perspective

Droughts occur occasionally in Michigan and Shiawassee County is no exception. The potential for significant crop loss is a concern. In June of 2002, Shiawassee County was one of 33 Michigan counties designated as natural disaster areas due to drought.

Shiawassee County Droughts			
#	**Location**	**Date**	**Crop Damage**
1	Shiawassee Co.	7/1/2001	$ 150,000,000
2	Shiawassee Co.	9/1/2002	$ -

9 STRUCTURAL FIRE

Hazard Description

The collapse or failure of an impoundment resulting in downstream flooding. 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. According to some sources, structural fires cause more loss of life and property damage than all types of natural disasters combined. Direct property losses due to fire exceed $9 billion per year, and much of that figure is the result of structural fire.

Even though the United States has made great strides in lessening deaths and injuries caused by other types of disasters, structural fires is a worse problem in this country than in many other industrialized countries (even those with a more densely-developed population pattern). Information from the United States Centers for Disease Control (CDC) indicate that fire-associated mortality rates in the United States are approximately 2-3 times greater than those in many other developed countries.

Structural fires are a common occurrence in Shiawassee County. The winter months are more prone to fire, due to the use of alternate heat sources, in addition to furnaces that have not been properly maintained. Major fires in recent years include the Colonel's Manufacturing facility, Owosso Township and the Kona Villa Apartments in the City of Owosso. In January of 2004, a residential fire that occurred in the city of Durand resulted in the death of an elderly woman.

Below is a list of major fires in Shiawassee County since 1970:

Sept. 24, 1970	Economy Mills (Unknown Loss) - City of Owosso
Nov. 10, 1970	Carpart Corp. Warehouse (Loss estimated at $100,000) - City of Owosso
Oct. 30, 1972	American Record Pressing Co. (Unknown Loss) - City of Owosso
June 16, 1977	Westown Freight Depot (Unknown Loss) – City of Owosso
June 13, 1978	Raycliff Foundry (Unknown Loss) and 3 Grand Trunk Locomotives - City of Owosso

Jan. 11, 1981	Gittleman's Store - Oakes-Coons Insurance (Unknown Monetary Loss, Fireman Elmer Hodge died) - City of Owosso
March 18, 1982	Selleck Insurance/Melco Decorating (Unknown Monetary Loss, Owosso Barber, Joseph Radon dies) - City of Owosso
May 1, 1985	Valley Lumber Co. Owosso Fire
June 1, 1993	Colonel's Bumpers Owosso (Loss-$30,000,000-reputed to be largest $ loss in State) 120 firemen from 12 area Departments
2001	The Flat Iron Building, Corner of Washington and Water Street, Owosso
2002	Corunna Post #15 Michigan State Police
April 2005	Vangurde Warehouse Fire, Owosso
September 2005	House Explosion, Caledonia Township
January 2006	City of Owosso: Capital Bowling Alley
February 2007	City of Owosso: Major downtown fire destroys historic 1926 Lebowski Theater
June 3, 2013	Arson fire in Village of Byron destroys three (3) downtown historic buildings.

Structure Fires Vulnerability Determination

Over a four-year period (2000-2003) Shiawassee County averaged 255 fires per year and $2,259,981 of damage per year. Each year at least 15% of the fires in the County are confirmed to be arson, or are suspected to be arson fires. Arson is estimated to cause an average of $1,063,008 in damage annually in Shiawassee County. As cost and data are collected in the future, the plan will be updated to reflect up to date projections and estimated cost of damage due to structural fires.

Shiawassee County Fires- Historical Data					
Year	2000	2001	2002	2003	Average
Total Fires	228	236	243	315	255.5
Total loss ($)	$4,155,470	$1,254,334	$1,971,500	$2,058,220	$2,359,881.00
Arson Fires	21	11	18	23	18.25

Suspected Arson Fires	18	26	14	12	17.5
Loss ($) from arson/suspected arson fires	$2,484,800	$512,384	$959,700	$295,150	$1,063,008.50
% of fires arson or suspected arson	17%	16%	13%	12%	15%
% of loss ($) from arson or suspected arson fires	60%	41%	49%	14%	41%

Year	Shiawassee Structure Fires	Civilian Deaths	Civilian Injuries	Total $ Loss
2004	79	0	0	$1,269,350
2005	74	0	1	$2,515,777
2006	62	0	0	$1,015,350
2007	93	2	6	$36,189,200
2008	66	0	0	$2,870,440
2009	51	0	1	$2,062,470
2010	59	0	0	$701,600
2011	64	0	1	$1,591,205
2012	39	1	1	$211,400
2013	34	0	0	$402,200
2014	43	2	0	$1,130,170
2015	45	0	2	$2,448,200

10 TRANSPORTATION ACCIDENTS

Hazard Description

A crash or accident involving an air, land or water-based commercial passenger carrier.

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

Land Transportation Accidents: A land transportation accident in Michigan could involve a commercial intercity passenger bus, a local public transit bus, a school bus, or an intercity passenger train. Although these modes of land transportation have a good safety record, accidents do occur. Typically, bus accidents are caused by the bus slipping off the roadway in inclement weather or colliding with another vehicle. 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.

Shiawassee County Perspective

The Shiawassee County is served by many means of transportation. The County is in the flight path of Bishop International Airport of Flint, Capitol City Airport of Lansing and MBS Airport of Freeland. The Owosso Airport has increased its activity in recent years, due to larger aircraft for both recreational and commercial flights.

Land transportation accidents are very common across Shiawassee County due to being traversed by one (1) interstate and three (3) state highways. The I - 69 corridors supports a very high volume of truck traffic on a daily basis. Trains cross our county every hour of every day, with occasional derailments and crossing grade crashes. The chance of accidents occurring is significant.

11 WILDFIRES

Hazard Description

An uncontrolled fire in grasslands, brush lands or forested areas. Forests cover approximately 49% (18.2 million acres) of Michigan's total land area. These vast forests provide Michigan with the largest state-owned forest system in the United States. In addition, Michigan has the fifth largest timberland acreage, with 4.2 million acres of softwoods and 13.1 million acres of hardwoods. That vast forest cover is a boon for both industry and recreation. However, it also makes many areas of Michigan highly vulnerable to wildfires.

Although Michigan's landscape has been shaped by wildfire, the nature and scope of the wildfire threat has changed. Michigan's landscape has changed substantially over the last several decades due to wilderness development, and so the potential danger from wildfires has become more severe. Increased development in and around rural forested areas (a 60% increase in the number of rural homes during the 1980's) has increased the potential for loss of life and property from wildfires. There are simply not enough fire suppression forces available in rural areas to protect every structure from wildfire.

Contrary to popular belief, lightning strikes are not the primary cause of wildfires in Michigan. Today, only about 7% of all wildfires in Michigan are caused by lightning strikes, the rest are caused by human activity. Outdoor burning is the leading cause of wildfires in Michigan. Most Michigan wildfires occur close to where people live and recreate, which puts both people and property at risk. The immediate danger from wildfires is the destruction of timber, property, wildlife and injury or loss of life to persons who live in the affected area or who are using recreational facilities in the area.

According to 2011 MDNR information, the leading causes of wildfires from 2001 to 2010 were:

1. Debris burning (32%)
2. Equipment (17%)
3. Miscellaneous (11%)
4. Unknown (10%)
5. Campfires (9%)
6. Lightning (7%)
7. Incendiary activity (5%)
8. Children (5%)
9. Railroads (3%)
10. Smoking (3%)

Shiawassee County Perspective:

Wildfires do occur in Shiawassee County, especially due to an uncontrolled burning during dry conditions. Seventy wildfires have occurred in Shiawassee County from 1981 to 1996, which is one of the higher numbers in south central Michigan. This is an average of 4.4 serious wildfire events per year.

12 OIL AND NATURAL GAS WELL/PIPELINE ACCIDENTS

Hazard Description

A water shortage caused by a deficiency of rainfall, generally lasting for an extended period of time. Oil and natural gas are produced from fields scattered across 63 counties in the Lower Peninsula. From 1927 to 2009 there have been approximately 56,525 oil and natural gas wells 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 6 trillion cubic feet of gas.

The petroleum and natural gas industry is 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 (H_2S) 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 H_2S 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˚ 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.

Petroleum and natural gas pipelines can leak or fracture and cause property damage, environmental contamination, injuries, and even loss of life. Most accidents in Michigan result from damage caused by construction or digging activities. Pipelines are actually the safest means of transporting the needed materials of petroleum and natural gas, but the threat of fires, explosions, ruptures, and spills nevertheless exists. There is also the danger of hydrogen sulfide release. Accidents usually have a limited impact and are handled by the pipeline emergency crews and local responders, but are worth noting in this analysis due to the potential damages and injuries that could result either from direct effects or secondary impacts from lost fuels.

Physiological Response to H_2S	
10 ppm	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.

Source: American National Standards Institute, Standard: 237.2-1972

Shiawassee County Perspective

There are no oil or natural gas wells in Shiawassee County, but there are some pipelines that run through the county (two companies: Buckeye Pipeline and Michcon).

13 TERRORISM/CRIMINAL ACTIVITY

Introduction

Terrorism is defined as "…activities that involve violent…or life-threatening acts…that are a violation of the criminal laws of the United States or of any State and…appear to be intended (i) to intimidate or coerce a 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. Sect. 2331

Hazard Description

Terrorism is the use of violence by individuals or groups to achieve political goals by creating fear. The political motives of terrorism distinguish it from ordinary crime. Terrorism is carried out for a cause; not for financial gain, personal revenge, or a desire for fame. The United States is threatened not only by international terrorists, but also by home-grown domestic terrorist groups including racist, ecological, anti-abortion, and anti-government terrorists.

A wide range of techniques can be used by terrorists, including bombings, shootings, arson, and hijacking. Regardless of the specific tactics used, terrorists seek the greatest possible media exposure. The goal of terrorists is to frighten as many people as possible, not necessarily to cause the greatest damage possible. Media coverage allows terrorists to affect a much larger population than those who are directly attacked.

Non-terrorist criminal activity may resemble terrorism, but lacks a political objective. Emergency management is typically not concerned with routine, individual crimes, but does need to prepare for crimes that impact large portions of the population. Such attacks may require resources not available to local law enforcement agencies. Crimes of this sort include mass shootings, random sniper attacks, sabotage of infrastructure, and cyber-attacks. The types of criminal attacks considered in this section are those that resemble terrorism or that may cause widespread immediate disruption to society.

Equally alarming is the rapid increase in the scope and magnitude of sabotage/terrorism methods and threats, which now include: 1) nuclear, chemical and biological weapons; 2) information warfare; 3) ethnic/religious/gender intimidation (hate crimes); 4) state and local militia groups that advocate the overthrow of the U.S. Government; 5) eco-extremism, designed to destroy or disrupt specific research or resource-related activities; 6) widespread and organized narcotics (and other contraband) smuggling and distribution organizations. Just as the methods and potential instigators have increased, so too have the potential targets of sabotage/terrorism. As recent events across the country have shown, virtually any public facility or infrastructure, or place of public assembly can be

considered a target of sabotage. In addition, certain types of businesses engaged in controversial activities are also potential targets. With the advent of the information age and growth in the number of computer "hackers", computer systems (especially those of government agencies, large businesses, financial institutions, health care facilities and colleges/universities) are potential targets as well.

One of the primary common denominators of most saboteurs is their general desire for organizational recognition, but not necessarily individual recognition. They often seek publicity for their "cause" or specific agenda, but they go to great lengths to avoid individual detection by law enforcement agencies. (The exception to this might be individuals and organizations involved in narcotics or other contraband smuggling and distribution, who seek to keep their clandestine operations out of public and law enforcement scrutiny.) Another commonality is that innocent people are usually the ones who suffer the most as a result of these criminal acts.

Shiawassee County Perspective

Shiawassee County is a rural community that has several government buildings in several areas of Corunna. In addition to county government buildings, there are numerous local government buildings, churches and athletic facilities and events that accommodate a large number of people. Events in recent years (Columbine and September 11th) have shown that acts of terrorism can occur, due to domestic or international terrorism. Also, one of the most historically damaging acts of domestic terrorism took place in 1927 in Bath Township, which lies just west of Shiawassee County.

The fire services in Shiawassee County have limited resources and training to deal with a serious WMD/Terrorist incident. The County fire services are improving this capability, but it will take several more years to be able to adequately respond without the immediate need for outside assistance. Currently, any hazardous or biological incident would require the use outside resources.

The County has a hazmat team capable of entering a “hot” zone. The fire services’ current policy is to identify a hazardous situation, seal off the area, and call for the county hazmat team.

14 NUCLEAR POWER PLANT ACCIDENTS/ATTACKS

Hazard Description

Though the construction and operation of nuclear power plants are closely monitored and regulated by the Nuclear Regulatory Commission (NRC), accidents at these plants are considered a possibility and appropriate on-site and off-site emergency planning is conducted. An accident could result in the release of potentially dangerous levels of radioactive materials into the environment that could affect the health and safety of the public living near the nuclear power plant. A nuclear power plant accident might involve both a release of airborne radioactive materials and radioactive contaminants of the environment around the plant. The degree and area of environmental contamination could vary greatly, depending on the type and amount of radioactivity and weather conditions. Response to a nuclear power plant accident requires specialized personnel who have been trained to handle radioactive materials safely, who have specialized equipment to detect and monitor radiation and who are trained in personal radiation exposure control.

Shiawassee County Perspective

Nuclear power plant accidents are not considered a threat in Shiawassee County, due to the fact that none exist in the county. The closest one is over 100 miles away from Owosso. It is the Fermi 2 Nuclear Power Station located in Newport, Michigan. There are also two other nuclear power plant facilities operating in Michigan. These are the Cook Nuclear Plant which is located north of Bridgman along Lake Michigan, and the Palisades Nuclear Plant near South Haven. Michigan's fourth nuclear facility, Big Rock Point, was located near Charlevoix, but stopped generating electricity in 1997. The facility was scheduled to be turned into a "Greenfield" area in 2004

Hazard Description

A hostile action taken against the United States which involves nuclear weapons an results in destruction of property and/or loss of life. 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.

World events in recent years have greatly changed the nature of the nuclear attack threat against the United States. The breakup of and establishment of democratic forms of

government in the former Soviet Union and other Soviet-Bloc nations in Eastern Europe has essentially ended the "Cold War" that shaped and influenced world politics since the late 1940's. That tremendous turn of events has, for all intents and purposes, reduced the need for the United States and former Soviet states to maintain huge stockpiles of nuclear weapons.

The reduction in nuclear weapons stockpiles that has occurred over the past few years in both countries has diminished the threat of a full-scale, massive nuclear attack that would threaten the very existence of the world as we know it. However, while the threat of attack is diminished, it is still a possibility due to the large number of nuclear weapons still in existence in present-day Russia and throughout the rest of the world. Even though an International Nuclear Non-Proliferation Treaty is in place, several countries are thought to be actively pursuing the development of nuclear weapons. In addition, internal instability and strife within Russia and some of its neighboring countries could cause the region to fall back under its previous form of government, which could potentially revive a larger-scale nuclear attack threat. Both Russian and U.S. nuclear weapons systems remain on high alert, which increases the risk of an accidental nuclear launch that could spawn a nuclear counterattack. Given the state of Russia's aging nuclear technical systems, that scenario is not out of the realm of possibility.

Although the nature and scope of an attack at this time would likely be reduced from previous possibilities, the potential impact on the country would still be devastating. Despite the fact that it is based on a fully-armed and functional Soviet Union as an adversary, Federal Emergency Management Agency (FEMA) Attack Planning Guidance provided in the document Nuclear Attack Planning Base 1990 (NAPB-90) remains the basis for the population protection strategy adopted for Michigan.

This strategy is incorporated in the Michigan Emergency Management Plan (MEMP) and most local Emergency Operations Plans (EOPs). The NAPB report identifies potential aiming points or target areas throughout the United States. These targets were categorized into seven classifications: 1) commercial power plants; 2) chemical facilities; 3) counterforce military installations; 4) other military bases; 5) military support industries; 6) refineries; 7) political targets. The potential size, or yield, and the height of burst were postulated for each target. The State of Michigan has 25 target areas. In addition, four target areas near the Ohio and Indiana borders directly affect Michigan jurisdictions. The NAPB report was an attempt by FEMA to develop a risk assessment of a potential attack upon the United States. Targets were identified using specific criteria, part of which involved the target's importance to counterattack measures. For this reason, not all chemical facilities, for example, are included. Further, designation as a target area does

not imply that all targets will be affected equally. The NAPB-90 planning base is, by design, a worst-case nuclear attack scenario.

The United States is vulnerable to a number of national security threats from external, hostile forces. National security threats include nuclear attack, chemical and biological warfare, and terrorism. The potential for damage resulting from a national security emergency ranges from the relatively localized damage caused by a terrorist attack using weapons of mass destruction, to the catastrophic devastation that could be expected following a full-scale nuclear attack. This section focuses on the nuclear attack threat. Information on terrorism and other hostile acts of sabotage or destruction using both nuclear and non-nuclear weapons are addressed in the sabotage/terrorism section.

Shiawassee County Perspective

Although very remote, this hazard cannot be overlooked. The end of the Cold War reduced the threat from the Soviet Union, however, in recent years, the concern has moved to other nations, such as North Korea and other smaller nations, who are developing nuclear capabilities.

15 CIVIL DISTURBANCES

Hazard Description

Collective behavior that results in a significant level of lawbreaking, perceived threat to public order, or disruption of essential functions and quality of life. 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 disturbances 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 first type, protest, usually contains some level of formal organization or shared discontent that allows goal-oriented activities to be collectively pursued. 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 second type, 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.

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 in not sufficiently similar to allow their collective concerns or efforts to coalesce in a relatively organized manner.

The fourth type, 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 j, 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.

Shiawassee County Perspective

Although there are no recent civil disturbance cases recorded in Shiawassee County, it cannot be discounted. In 1893, a local resident was murdered. The suspect was later arrested near Detroit. Authorities returned the suspect to the Shiawassee County Jail in Corunna. A large gathering of angry citizens gathered in downtown Corunna. They eventually stormed the jail and overpowered law enforcement personnel. The murder suspect was beaten, dragged through the city, and finally hanged. The following investigation resulted in no one being charged or convicted of this prisoner's death. The chance of a civil disturbance in Shiawassee County is improbable. A more recent event occurred approximately 30 years ago as a result of the death of an inmate at the county jail, who committed suicide. A demonstration occurred, although no injuries or damage resulted. Around 1980, a one-day strike at a local factory required outside assistance to handle. During a major event, assistance would be sought from the Michigan State Police and/or National Guard.

16 CATATOPHIC INCIDENTS (NATIONAL EMERGENCIES)

Hazard Description

An impact or threatened impact from a meteorite, asteroid, comet, satellite, space vehicle, space debris, solar storms, or similar phenomena that may cause physical damages or other disruptions. Since 2000, the nation has been affected by disastrous events that have caused various states, including Michigan, to undertake significant actions to respond to, assist, or help accommodate the impact of events that took place well outside their borders. Mutual aid agreements are in place between states to provide one another with supplemental resources and capabilities to respond to and recover from a disastrous event. It is also possible that certain types of events outside of U.S. territory may require coordinated response, as well.

The National Response Framework involves a recognition of, and reaction to, events of national significance. This was observed during the terrorist events of September 11, 2001 along with the federal government, all states went into a mode of heightened alert and exchanged various information and resources in a coordinated manner. More recently, Hurricanes Katrina and Rita caused such disruption in the southern states that nation-wide assistance and coordination was needed. Not only were resources deployed to the disaster areas themselves, but distant states such as Michigan also needed to accommodate large numbers of evacuees who were temporarily displaced from their homes, jobs, businesses, and even families. Some evacuees even chose to permanently change their residence to new homes in other communities across the U.S.

In some disaster scenarios, even if Michigan experiences some direct impacts, it may turn out that much greater effects in other states or nations (e.g. Canada) may require extensive additional actions to be taken by Michigan government and personnel. In recognition of these extra tasks, a Catastrophic Incident hazard is now identified, in addition to the many hazards that are known to potentially have a direct impact within Michigan.

FEMA has (in its Catastrophic Incident Annex of November 2008) defined the nature of the catastrophic disaster situation. It "will result in large numbers of casualties and/or displaced persons, possibly in the tens to hundreds of thousands… The nature and scope of a catastrophic incident will immediately overwhelm State, tribal, and local response capabilities and require immediate Federal support… A catastrophic incident will have significant international dimensions, including impacts on the health and welfare of border community populations, cross-border trade, transit, law enforcement coordination, and others."

Special aspects that may be part of catastrophic incidents include the possibility of occurrence without warning, the occurrence of multiple incidents over a wide-ranging area (or even without any clearly defined incident site), may involve large-scale evacuations (whether organized or self-directed), may cause widespread homelessness and displacement (either temporary or permanent), may overwhelm existing health-care systems, and may produce severe environmental impacts that exceed governmental abilities to achieve a timely recovery.

Shiawassee County Perspective

National Emergency events would call for the coordination of emergency responders (and associated personnel) between states, and even from across the nation or between nations (e.g. Canada, or its Ontario province). The most direct impact of a national emergency upon responders would be dealing with the logistics of interstate mutual aid (or even its international equivalents). In an event such as the 9/11 terrorist events, or the 2005 Hurricane events, numerous response personnel may have to juggle their time, resources, and efforts involving activities that assist other states or jurisdictions with disaster response and recovery, while simultaneously ensuring that their own state's (or local jurisdictions') preparedness and response needs are also adequately cared for. An additional potential impact may arise from events that occur in one's home jurisdiction after various aid has been granted to some other area—various staff, equipment, expertise, and funds may suddenly be needed "back at home" in the midst of complicated and important response or recovery operations abroad. Extra complexity would also be entailed in the tracking of expenses and the paperwork involved in reimbursement procedures, which might ordinarily be used on activities that are of clearer importance to the home jurisdiction's own emergency needs. One of the effects of national emergencies that does have an impact upon a state's own circumstances, even when not directly impacted by the national emergency event itself, is the potential need to deal with evacuees coming from an affected area, who would need food, shelter, and other types of assistance in living their lives under conditions of displacement and even duress. Such evacuees would tend to have numerous financial and material needs, since the emergency event may have caused severe material hardships for them (or at least temporarily denied them access to their homes and wealth). In addition, various disaster and emergency events tend to cause emotional, social, and psychological hardships as well as material and economic ones, since various trauma may have been experienced during the emergency events (including the loss of family and friends). The uncertainties and stresses of relocations, job loss, etc. would often require social and psychological support structures to be sought (and often provided by the host community) in order to restore a degree of security to the evacuees conditions and lifestyle. As a part of long-term recovery, such evacuees would ideally be able to restore their lifestyles to some sort of

normalcy, perhaps even including successful relocation back to their original homes and the resumption of their previous, ordinary life circumstances.

Depending upon the type of event under consideration, environmental impacts upon Shiawassee County may vary widely, or may not directly be felt at all. A super-volcanic eruption, even in the Western United States, could deposit large amounts of volcanic ash across the state. Although superficially similar in appearance to a snowfall event, in some ways, such material would not be collected or dissipated as easily as snow. A major earthquake, tsunami, hurricane, meteorite, nuclear, or terrorist event that causes a wave of immigration into the state (even if only on a temporary basis) may require various forms of development and land use that, under the need to provide emergency services to many people, could be environmentally damaging by the inability to speedily undertake such actions in accordance with long-term comprehensive development plans.

Examples of Major Catastrophic Incidents include:

- Major warfare, such as World War II
- Great Blackouts, such as those of 1965 and 2003
- Anticipated or threatened infrastructure breakdowns (such as "Y2K")
- Major terrorist incidents or threats, such as 9/11 and the subsequent anthrax events
- Catastrophic hurricane impacts, as seen in 2005 with hurricanes Katrina and Rita (with many displaced evacuees and a state emergency declaration in Michigan)

17 SCRAP TIRE FIRES

Hazard Description

A large fire that burns scrap tires being stored for recycling or re-use. With the disposal of an estimated 290 million vehicle tires annually in the United States, management of scrap tires has become a major economic and environmental issue. Michigan generates approximately 10 million scrap tires each year. Although responsible means of storage and disposal have become more common, tire dumps of the last forty years still present environmental and safety hazards that will last into the foreseeable future.

In addition, scrap tires are breeding grounds for mosquitoes, which can reproduce at 4,000 times their natural rate in a scrap tire disposal site. From an emergency management perspective, the most serious problem that scrap tire disposal sites pose is that they can be a tremendous fire hazard if not properly designed and managed.

Shiawassee County Perspective

The event of a major tire fire would result in a severe emergency scenario. An inventory of scrap tire disposal sites in 2009 listed Shiawassee County at having one site and approximately 1,000 tires. An official MDEQ count in 2004 listed 105,500 tires in Shiawassee County. The large amount of scrap tires was of great concern to Shiawassee County residents, and has since greatly declined.

18 INFRASTRUCTURE/DAM FAILURES

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, communication, 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 mitigation action is not taken. When the water or wastewater 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 mitigation 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. (Note: Refer to the Dam Failures and Petroleum and Natural Gas Pipeline Accidents sections for more information on those particular types of infrastructure failures.)

Shiawassee County Perspective

Infrastructure failures are common in Shiawassee County. The most common infrastructure failure is loss of power. In 2003, a power outage shut down government operations in the City of Corunna and the county government for several hours. These incidents occur in all types of weather and are a concern for our special-needs population, the elderly, handicapped and adult foster care homes.

DAM FAILURE

Hazard Description

The collapse or failure of an impoundment resulting in downstream flooding. 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 poor operation, lack of maintenance and repair, and vandalism. Such failures can be catastrophic because they occur unexpectedly, with no time for evacuation. The Michigan Department of

Environmental Quality (MDEQ) has documented approximately 287 dam failures in Michigan since 1888.

Dams are made to hold back large amounts of water. If they fail or are overtopped, they can produce a dangerous flood situation because of the high velocities and large volumes of water released. A break in a dam can occur with little or no warning on clear days when people are not expecting rain, much less a flood. Breaching often occurs within hours after the first visible signs of dam failure, leaving little time for evacuation.

Dam failures are usually caused by either structural problems with the dam or by hydrologic problems. Structural problems include seepage, erosion, cracking, sliding and overturning that are a result of the age of the dam or lack of maintenance. Hydrologic problems typically occur when there is excessive runoff due to heavy precipitation. A dam failure can occur if the dam has to impound (hold back) more water than it was designed to, or if the spillway capacity is inadequate for the amount of water needing to pass downstream.

A dam can suffer a partial failure or a complete failure, but the energy of the water stored behind even a small dam can cause loss of life and great property damage when it impacts downstream. The following factors influence the impact of a dam failure:

Level of failure (partial or complete)

Rapidity of failure (sudden or gradual)

Amount of water released

Nature of the development or infrastructure located downstream.

Shiawassee County Perspective

A 1998 State of Michigan Potential Dam Hazards study, conducted by the Michigan Department of Environmental Quality, lists Shiawassee County as having two dams noted as significant hazards. In 2001, a project was undertaken to clear debris from the dam located on the Shiawassee River in the ShiaTown/Shiawassee Township area, due to a near-breach of the dam. Another on-going project is along the Mistingay Creek Inter-County Drains, located in the northeastern part of the county, primarily Hazelton Township and the Village of New Lothrop. An Emergency Action Plan is currently being updated to including both Shiawassee County and Saginaw County because the Mistingay Creek continues into Saginaw County and affects several townships. This is an original impoundment flood control structure. The dam located in the City of Corunna is

also in poor condition and is currently under consideration to either repair or remove. The dam in Byron is also in need of repair.

Shiawassee County has a total of 16 dams. Fourteen (14) of the dams have been classified as having a low hazard potential, and 2 of the dams have been classified as having significant hazard potential. The hazard classifications assess potential damage if the dam were to fail, rather than assessing the structural condition of the dam. With 2 dams classified as having significant hazard potential, and the reality of an aging infrastructure, dam failure is a significant hazard in Shiawassee County. Please see Appendices, Page ___ for a map of dam locations in the County.

As noted in Section 1, the Shia Dam is currently in the process of being removed and developed in accordance with the Shiawassee County Parks and Recreation Plan. The Plan is in the process of being drafted with the Shia Dam a primary activity where funding will be sought from the Michigan Department of Natural Resources.

Dam Failures Vulnerability Assessment

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).

There have not been any dam failures in Shiawassee County to use as historic data. Assuming there were a dam failure, costs associated would include deaths, injuries, loss of power, and damage to property, floods, temporary housing, use of emergency personnel, infrastructure failure and clean-up afterwards. According to the Federal Emergency Management Agency (FEMA), a death is estimated at $2,710,000, major injuries are estimated at $15,600, and minor injuries are $1,560. The biggest impact of a dam failure would be the Owosso Dam in the City of Owosso and the Corunna Dam in the City of Corunna. These dams are located on the Shiawassee River and would cause the most damage due to the population density and number of structures in the radius of the dams.

The Corunna dam, which has a significant hazard ranking, would impact park areas if it failed, but also multi-family housing, an airport, a train rail yard, approximately 1100 residential structures and the Downtown Owosso area. The failure of this dam would most likely cause millions in damages to the area.

COUNTY	High Hazard	Significant Hazard	Total	COUNTY	High Hazard	Significant Hazard	Total
Alcona	1	2	3	Kalkaska	1		1
Alger	1		1	Kent	3	7	10
Allegan	6	2	8	Lake		1	1
Alpena	2		2	Shiawassee		7	7
Antrim	2		2	Leelanau	2	1	3
Arenac		1	1	Lenawee	3	5	8
Baraga	2		2	Livingston	3	10	13
Barry		4	4	Macomb	2	2	4
Benzie		2	2	Manistee	2		2
Berrien	3	2	5	Marquette	10	7	17
Branch		2	2	Mason	2		2
Calhoun		4	4	Mecosta	1	3	4
Cass	3	2	5	Menominee	5	2	7
Charlevoix		3	3	Midland	1		1
Cheboygan	9	1	10	Missaukee		2	2
Chippewa		1	1	Monroe		2	2
Clare	3	1	4	Montcalm		2	2
Clinton		2	2	Montmorency		2	2
Delta	1	1	2	Muskegon	1	2	3
Dickinson	2	3	5	Newaygo	3	1	4
Eaton	2		2	Oakland	8	19	27
Emmet		3	3	Oceana	2	2	4
Genesee	3	7	10	Ogemaw		4	4
Gladwin	6	3	9	Ontonagon	2	3	5
Gogebic		1	1	Osceola		3	3
Grant Traverse	4	4	8	Oscoda	1		1
Gratiot		3	3	Ottawa		1	1
Hillsdale		6	6	Roscommon	1	3	4
Houghton		3	3	Saginaw	1		1
Ingham	2		2	St. Joseph	6	2	8
Ionia	1	1	2	Schoolcraft	1	2	3
Alcona	4	1	5	Shiawassee		2	2
Iron	3	2	5	Van Buren	1	2	3
Isabella	1	4	5	Washtenaw	8	7	15
Jackson	1	6	7	Wayne	7	2	9
Kalamazoo	7	4	11	Wexford		3	3

Source: Michigan Department of Environmental Quality, Land and Water Management Division

19 EARTHQUAKES/SUBSIDENCE

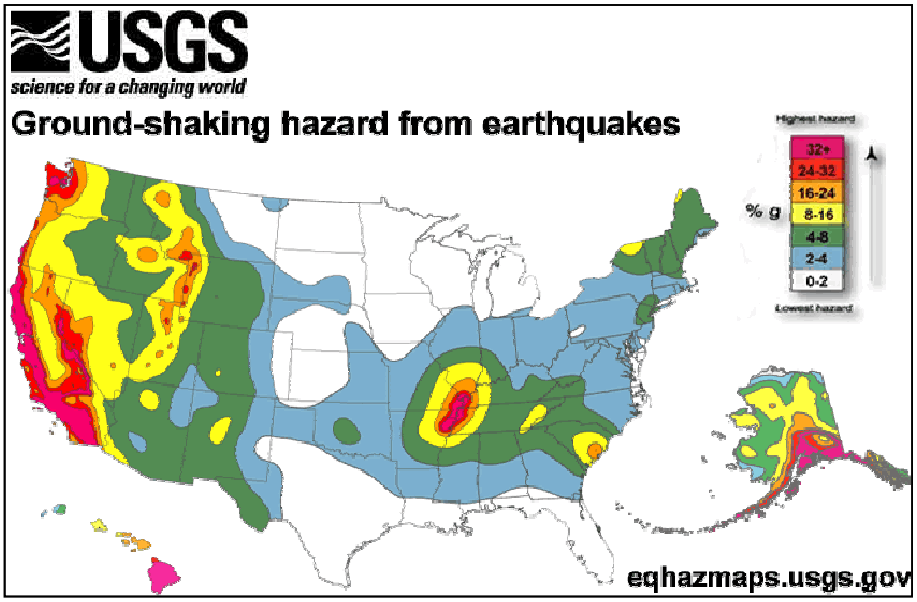
Hazard Description

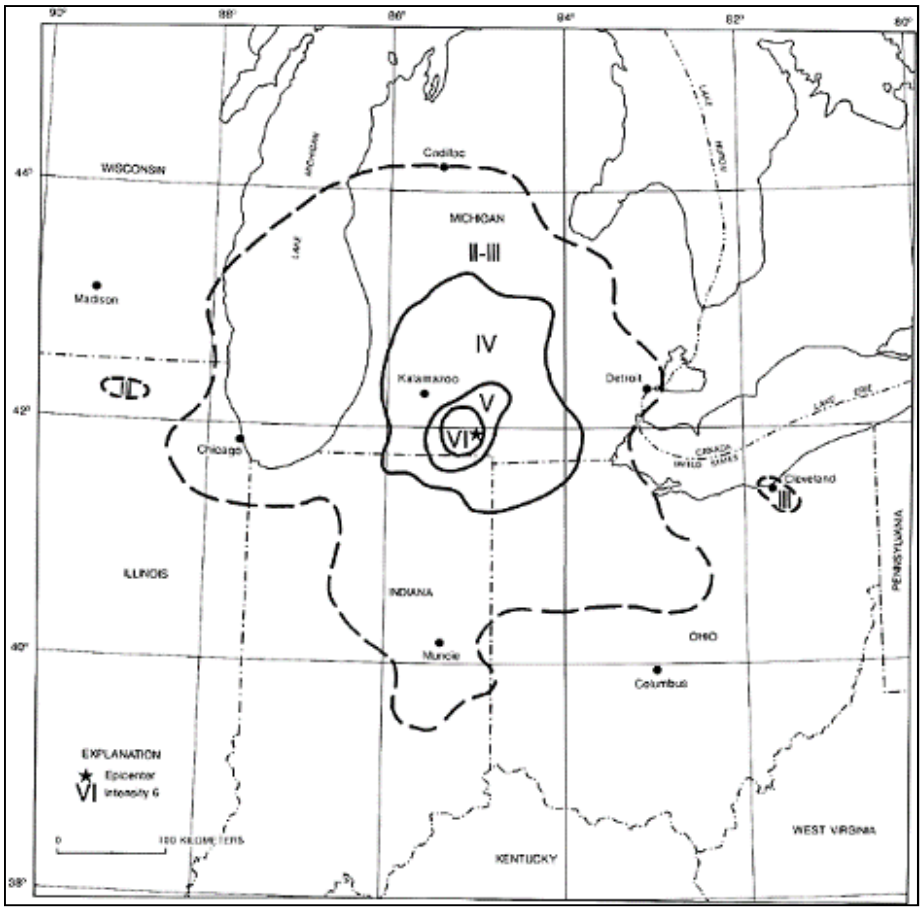
A shaking or trembling of the crust of the earth caused by the breaking and shifting of rock beneath the surface. Earthquakes range in intensity from slight tremors to great shocks. They may last from a few seconds to several minutes, or come as a series of tremors over a period of several days. The 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 emergency situations such as fires and hazardous material spills, thereby compounding the situation.

No severely destructive earthquake has ever been documented in Michigan. However, several damaging earthquakes have been felt since the late 1700s. 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.

U. S. Geological Survey Earthquake Hazard Map for the United States showing earthquake ground accelerations (horizontal) that have a 10 percent probability of being exceeded in the next 50 years for a firm rock site condition. This map is based on seismicity and fault-slip rates and takes into account the frequency of occurrence of earthquakes of various magnitudes. Locally, hazard may be greater that shown, because site geology may amplify ground motions.


USGS
science for a changing world
Ground-shaking hazard from earthquakes
Highest hazard
32+
24-32
16-24
8-16
4-8
2-4
0-2
Lowest hazard
% g
eqhazmaps.usgs.gov


WISCONSIN
Cadillac
MICHIGAN
II-III
IV
V
VI
Madison
Kalamazoo
Detroit
Chicago
Cleveland
ILLINOIS
INDIANA
OHIO
PENNSYLVANIA
Muncie
Columbus
EXPLANATION
Epicenter
Intensity 6
KENTUCKY
WEST VIRGINIA

Shiawassee County Perspective

Earthquakes are not considered a threat in Shiawassee County because the nearest recorded fault line is no closer than the lower third of the state, and there is no record of an earthquake in Shiawassee County. Although, in recent years, attention has been focused on the New Madrid Seismic Zone. This zone extends from approximately Cairo, Illinois through New Madrid, Missouri to Marked Tree, Arkansas. This is significant because scientists predict that a catastrophic earthquake (between 6.0 and 7.6 on the Richter Scale) will occur within the zone sometime during the next few decades. Michigan may be somewhat affected by such and earthquake. Michigan is only ranked number 36 out of 50 states on the Top Earthquake States List, with only 2 earthquakes from 1974 to 2003. (Alaska came in first with 12,053 earthquakes.) On August 9, 1947, an earthquake did hit a large area of south-central Michigan, affecting a total area of about 50,000 square miles, including points north to Muskegon and Saginaw. On May 2, 2015 a 4.2 magnitude was centered south of Galesburg, Michigan. The tremors were felt in Shiawassee County.

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. The National Research Council estimate of annual damage from various types of subsidence is outlined in the table below:

Land Subsidence: Estimated Annual National Damage

Type of Subsidence	Annual Damage ($)
Drainage of organic soils	40,000,000
Underground fluid withdrawal	35,000,000
Underground mining	30,000,000
Natural compaction	10,000,000
Sinkholes	10,000,000

Hydro compaction (collapsible soils)	N/A
TOTAL:	$125,000,000

Source: National Research Council; Multi-Hazard Identification and Risk Assessment, Federal Emergency Management Agency

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 who 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.

Water-Related Subsidence: Compaction of soils in some aquifer systems can accompany excessive ground-water pumping and cause subsidence. Excessive pumping of such aquifer systems has resulted in permanent subsidence and related ground failures. In some systems, when large amounts of water are pumped, the subsoil compacts, thus reducing in size and number the open pore spaces in the soil that previously held water. This can result in permanent reduction in the total storage capacity of the aquifer system. More of 80% of the identified subsidence in the United States is a consequence of human impact on subsurface water. Three distinct processes account for most of the water-related subsidence: compaction of aquifer systems, drainage and subsequent oxidation of organic soils, and dissolution and collapse of susceptible rocks. An increasing number of urban subsidence events have resulted from infrastructure failures, such as water main breaks, which cause road

surfaces to collapse. Construction-related incidents have also occurred in Michigan.

Shiawassee County Perspective

This hazard is not considered a serious threat, although Shiawassee County is home to several mining operations from several years ago. Articles were reported in the local newspapers of these mining operations in Caledonia and New Haven Townships.

20 CELESTIAL IMPACT

Hazard Description

An impact or threatened impact from a meteorite, asteroid, comet, satellite, space vehicle, space debris, solar storms, or similar phenomena that may cause physical damages or other disruptions. The celestial impact hazard primarily concerns the effects of large forces (from objects or energy) upon the Earth or its atmosphere. Most such forces are extraterrestrial in origin – meteors (which burn up in the atmosphere) or meteorites (which impact physically upon the ground) that were originally asteroids or comets from elsewhere in the solar system. It must be noted that even in cases where no meteorite actually strikes the ground, the explosive energies from the meteor's impact upon the many layers of the atmosphere can create an intense heat and blast area, along with very strong winds, and can release more energy than even the largest nuclear bombs. Massive or fast moving bodies that impact upon either the ground, the oceans, or the atmosphere can cause widespread destruction and disruption of both human and natural systems, including secondary hazards such as earthquakes, volcanoes, tsunamis, and severe winds, although events of the magnitude are extremely rare.

Shiawassee County Perspective

About 40,000 to 60,000 tons of extraterrestrial material falls onto the Earth each year, but most of it is mere dust. Larger materials fall during regular cycles called meteor showers, but again most of it is small enough to harmlessly burn up (through ablation) as it hits the Earth's atmosphere at high speeds (typically about 67,000 mph). During meteor showers, the material is typically leftover debris from comets that had crossed the Earth's orbit, and most such material is very small and harmless to us. Material that does survive ablation to strike the Earth's surface lands in random locations, and since 70% of the Earth's surface is water, these meteorites mostly go unnoticed by ordinary people. The risk to Michigan is calculable in general terms, by considering the proportion of the Earth's total surface area that is occupied by Michigan's land area. This is approximately 2.9 x 10-4, or 0.00029 percent and even less for Shiawassee County. The frequency of global impact events can then be multiplied by this factor to estimate the frequency of impact events directly upon Michigan's land area. This results in the following estimates, on average, for different sizes of impacts upon Michigan's land itself:

About 1 to 5 impacts per year that are larger than 100g (golf-ball size) – This may kill an individual that is struck, but since most space is not occupied by a person at any particular moment, such a thing is exceptionally rare, and there have only been a couple of confirmed meteorite injuries worldwide. Instead, such incidents are more likely to simply cause limited property damage to a car or home, although their appearance in the sky can appear impressive and be accompanied by a sonic boom. (Example: the Washtenaw County strike of 1997)

About one impact per century involving an object of more than 100kg (220 pounds), and about one impact every 1700 years involving an object of more than 1000kg (about 2200 pounds) – These types of events would result in loud sounds and bright flare-ups in the sky, leaving a field of fragments strewn across an area that is miles across, but actual damages are likely to be only moderate unless a dense urban area or critical facility happens to be struck. (Example: the Park Forest, IL event of 2003.)

About one impact every 350,000 years involving an object of more than 100,000kg (about 220,000 pounds) – This is the type of impact that resembles an atomic blast, exploding brightly in the sky and producing a very strong blast wave and severe winds that would cause extensive building damages and collapse at ground level, and would flatten forest lands. (Example: the Tunguska, USSR event of 1908.)

Although that last type of event is so rare that it need not be of general concern for Michigan, the probability of such an event affecting some part of the U.S. and potentially causing a national emergency is a bit larger, but still remote. It is most probable that the next such event will occur elsewhere in the world (on the order of about 1 event per century) and, although potentially devastating to that area, Michigan's role would probably only involve the voluntary donation of humanitarian aid to the disaster area.

21 ENERGY EMERGENCIES

Hazard Description

An impact or threatened impact from a meteorite, asteroid, comet, satellite, space vehicle, space debris, solar storms, or similar phenomena that may cause physical damages or other disruptions. An adequate energy supply is critical to Shiawassee's economic and social well-being. The American economy and lifestyle is dependent on an uninterrupted, reliable, and relatively inexpensive supply of energy that includes gasoline to fuel vehicles, and electricity, natural gas, fuel oil, and propane to operate homes, businesses, and public buildings. Energy emergencies became a serious national issue in the 1970s, when two major "energy crises" exposed America's increasing vulnerability to long term energy disruptions.

There are three types of energy emergencies. The first and most frequent type of energy emergency involves physical damages to energy production or distribution facilities, caused by severe storms, tornadoes, floods, earthquakes, or sabotage. Michigan has experienced a number of these short-term energy disruptions in recent history, mostly due to high winds associated with severe thunderstorms, or damage caused by ice storms. While there have been only a few incidents of sabotaged energy systems in this country, networks supporting terrorist activity exist throughout the world and the possibility of more frequent incidents in the United States is always present. This category of energy emergency also covers short-term disruptions caused by human error, accidents of equipment failure.

The second type of energy emergency involves a sharp, sudden escalation in energy prices, usually resulting from a curtailment of oil supplies. Since 2001, energy costs for the average U.S. household have more than doubled, and sharply escalating gasoline prices have strained the budgets of lower and middle class families.

The third type of energy emergency is sudden surge in energy demand caused by national security emergency involving mobilization of U.S. defense forces. National defense, in a time of crisis, will demand an increase in energy. Although the regulated natural gas and electric utilities have approved state and federal priority allocation systems that are in place, regulatory changes to introduce competition into natural gas and electric markets have not fully addressed how such shortages might be managed once these markets are fully opened.

Shiawassee County Perspective

Shiawassee County has experienced numerous and severe electrical power outages, caused mostly by severe weather such as windstorms and ice and sleet storms.

Energy emergencies could cause the public, including small business owners and self-employed persons, to experience significant financial impacts from higher prices or limited/curtailed energy supplies. Business and commuting costs would be likely to increase temporarily. Persons with special medical needs may have difficulty traveling or otherwise having those needs met.

Energy emergencies may potentially affect response capabilities, through limitations or shortfalls in resources, and in the amount of expense associated with the use of such resources. A good example could be a shortage of fuel that is needed to operate fire trucks. The budgets of involved agencies may become overburdened. Resources may need to be carefully shared between agencies, or supplemented with special state or federal assistance.

Principal air emissions involve substances that could cause a negative impact on the environment, such as particulate matter, sulfur oxides, nitrogen oxides, hydrocarbons, and carbon monoxide. Each of these pollutants varies in its emission rate and potential opportunities for reduction. Fossil fuel consumption is closely linked to greenhouse gas emissions and therefore climate change. The burning of fossil fuels results in the conversion of carbon to carbon dioxide, which contributes to the atmospheric greenhouse effect and global warming. Nuclear power plants generate radioactive by-products that can be harmful to the environment and must therefore be carefully stored in selected locations.

22 INVASIVE SPECIES

Hazard Description

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. An invasive species is defined as a species that is (1) non-native (alien) to the ecosystem under consideration and (2) whose introduction causes or is likely to cause economic or environmental harm, or harm to human health. Invasive species can be plants, animals, and other organisms (e.g. microbes). Human actions are the primary consideration here as a means of invasive species' introduction (thus distinguishing the situation from natural shifts in the distribution of species). Nationally, the current environmental, economic, and health costs of invasive species were estimated as exceeding the costs of all other natural disasters combined.

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. New environments may affect rates of reproduction, susceptibility to disease, and other features that affect a species' success. Consequently, a plant or animal that causes little damage to agriculture or natural ecosystems in one area may cause significant problems in another. Certain non-native species are very successful in their new habitats because they out-compete native plants or animals and have no natural controls (predators, diseases, etc.) in the new area. At least 200 well-known, high-impact, non-native species presently occur in the United States. They range from the European gypsy moth and emerald ash borer to crabgrass, dandelions, and German cockroaches, annually costing well over a billion dollars to control. Some even pose human health risks. Others, like the zebra mussel, threaten widespread disruption of ecosystems and the displacement or loss of native plants and animals.

Shiawassee County Perspective

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. There are many examples of decreased biodiversity in such areas. One of the primary threats to biodiversity is the spread of humanity into what were once isolated areas, with land clearance and habitation putting significant pressure on local species. Agriculture, livestock, and fishing can also

introduce changes to local populations of indigenous species and may result in a previously innocuous native species becoming a pest, due to a reduction of natural predators. This threat intensifies the need for scientists, managers, and stakeholders to cooperate to build better systems to prevent invasion, improve early detection of invaders, track established invaders, and to coordinate containment, control, and effective habitat restoration.

Although invasive species, in most cases, primarily cause environmental damage and degradation, there are situations in which serious threats to public health, safety, and well-being can occur due to animal disease or plant/animal infestations. For example, certain diseases could wipe out large segments of an animal population, creating a potentially serious public health emergency and the need to properly (and rapidly) dispose of the dead animal carcasses.

Similarly, a widespread insect infestation, such as that of the Emerald Ash Borer, can create serious public safety threats (especially in densely populated urban areas) due to dead and dying trees being fire prone (because of their dry, brittle nature) or to partial/total collapse due to high winds or ice/snow accumulation. The falling trees or limbs can also bring down power lines, cause damage to public and private structures, and cause injuries or even death.

SECTION 5- MITIGATION STRATEGIES

INTRODUCTION

Mitigation strategies reduce or eliminate the amount of harm that could be caused in the future by a hazard. There are five (5) basic hazard mitigation approaches that should be taken generally into account when discussing mitigation.

1. Modify the Hazard- This approach removes or eliminates the hazard, such as widening a stream to improve water flow and stop flooding, or stream corridor restoration to prevent increased soil erosion. Other modifications of the hazard could include watershed management and wetland restoration and preservation.

2. Segregating the Hazard- This approach keeps the hazard away from people, and can include many of the other mechanisms, such as regulatory requirements preventing development in certain areas or government action to purchase areas to prevent locating within a hazard area.

3. Preventing or Eliminating Development- This approach keeps people away from the hazard. Government administrative or regulatory actions or processes that influence the way property and structures are developed and built. Actions under this approach can include public activities to reduce hazard losses through planning and zoning, building codes, capital improvement programs, open space preservation, and storm water management regulations.

4. Altering Design or Construction- This approach involves actions and solutions that involve engineering and construction of structures to reduce the impact of hazards. for at-risk structures, such as elevating buildings above the flood level. Such an approach could involve the engineering of structures such as dams, levees, floodwalls, seawalls, and retaining walls. It could also include elevation of existing at-risk structures above flood levels or modification of structures during a rehabilitation phase.

5. Early Warning and Public Education- This approach keeps the public informed of potential hazards. Such actions are intended to inform and educate citizens, elected officials, and property owners about the hazards and potential ways to mitigate them and can include outreach projects, real estate disclosure, hazard information centers, and school-age to adult education programs.

Some of hazard mitigation strategies may take place during the response or recovery phases of a disaster, not just before an event (since no sooner does one event end than another one may begin, and therefore anything that is done is always potentially in advance of some future hazard event). That is, a "pure" hazard mitigation and vulnerability assessment strategy is an effort to prevent hazard impacts, or to take advance, proactive steps toward the long-term reduction of the impacts of hazards on a community.

As part of the development of the original Plan and this update to the Plan, local units of governments and agencies associated with hazard mitigation or emergency response were requested to submit hazard mitigation projects. As part of the original Plan, the Village of Lennon, City of Durand, City of Owosso, City of Perry, and Township of Owosso submitted projects to be included into the Plan. These requests were evaluated and these projects and included in the original Plan to assist is developing mitigation strategies (actions) that can be implemented to help mitigate hazards. As part of the Plan update, local units of governments and agencies involved in hazard mitigation, emergency response or public safety were contacted to participate in the plan update process, including the open house.

The following charts identify specific mitigation actions for general hazard categories, their suggested implementing agency, a proposed timeline for implementation and relative priority level. Please review the following concerning the charts and information contained within:

Relative Priority Levels

Top: Mitigation actions for hazards that pose the greatest threat and likelihood of affecting the community and that are eligible for federal FEMA Hazard Mitigation funding.

High: Mitigation actions for hazards that pose the greatest threat and likelihood of affecting the community.

Medium: Mitigation actions for hazards that pose a moderate threat and likelihood of affecting the community.

Low: Mitigation actions for hazards that pose the least threat and likelihood of affecting the community.

Responsible Jurisdictions, Department, Agencies, Etc.

County refers to Shiawassee County Commissions and Departments and other agencies such as the County Road and Drain Commission

County Emergency Management refers to the Shiawassee County Office of Emergency Management/Homeland Security

Local refers to a local unit of government besides the County.

Local ERA are local emergency response agencies (police, fire, medical, etc.)

Local DPW refers to the local department of public works.

State refers to various state agencies such as MDOT and the DNR.

Federal refers to federal agencies.

Utilities refer to private utilities such as power and phone companies.

Potential Funding Source

Local-	Jurisdiction Sponsored (Property Tax, Millage, Etc.)
State-	State Sponsored
Federal-	Federal Sponsored

Federal and State funds can also be administered to local units through various grants and assistance from the following sources:

HMGP-	Hazard Mitigation Grant Program
HSGP-	Homeland Security Grant Program
FMAP-	Flood Mitigation Assistance Program
PDMP-	Pre-Disaster Mitigation Program

**For detailed information on these four hazard mitigation funding sources applied to projects in this plan, please refer to Appendix B: Project Applications—Hazard Mitigation Project Grant Program*

Page Intentionally Left Blank

Mitigation Actions & Implementation Strategies Severe Winter Weather	Priority	Responsible Agency	Funding Sources	Application	Progress	Goal Status
1. Enhance storm warning system/distribution of NOAA radios	Top	County Emergency Management, County, Local, Local ERA	Federal, State & Local	County-wide	Initiated	Long-term
2. Marketing & Public Outreach for general public to sign-up for CodeRED	Top	County Emergency Management, County and Local	Local	County-wide	Initiated	Short-term
3. Establish warming stations/centers/shelters	Top	County Emergency Mgmt., Local, and Local ERA	Federal, State & Local	County-wide	Identified	Long-term
4. Tree trimming program/Support and encourage public utilities programs.	High	State, County, Local DPW	Local	County-wide	Identified	Short-term
5. Encourage/support elderly assistance programs	High	County, Local and State	Local	County-wide	Identified	Short-term
6. Monitor for repetitive hazard areas (drifting/black ice)/Implement signage or other notification measures upon warning/Implement fencing & preventive measures	High	County Emergency Management, County and Local ERA	State & Local	County-wide	Identified	Short-term
7. Promote general & specialized training for all emergency responders	High	All	Federal, State & Local	County-wide	Initiated	Short-term
8. Encourage work places, schools, offices, retail, factories, hospitals, etc. to develop emergency plans.	High	All	Federal, State & Local	County-wide	Initiated	Short-term
9. Develop and implement GIS system to assist in preparedness, development of mitigations strategies, and response.	High	All	Federal, State & Local	County-wide	Initiated	Short-term
10. Public education for disaster preparedness/Encourage programs such as “Do1Thing”	High	All	Federal, State & Local	County-wide	Initiated	Short-term

11. Continually monitor/update disaster response plan	High	County Emergency Management, County	Federal, State & Local	County-wide	Ongoing	Short-term

Mitigation Actions & Implementation Strategies Riverene Flooding	Priority	Responsible Agency	Funding Sources	Application	Progress	Goal Status
1. Promote NFIP programs/FEMA programs/Other programs that prevent or fund removal of improvements in floodplain areas.	Top	All	Federal, State and Local	Flood Zones	Ongoing	Short-term
2. Amend land use and zoning regulations to prohibit development in the flood plain/Support other development regulations, such as soil erosion & sedimentation regulations, storm water run-off controls, etc. in development review	Top	County Emergency Management, County, and Local	Local	Flood Zones	Initiated	Mid-term
3. Identify structures in the flood plain/Monitor for repetitive loss areas	Top	County Emergency Management, County, State and Local	Federal, State and Local	Flood Zones	Initiated	Short-term
4. Mitigation assistance program for structures in the flood plain.	Top	County Emergency Management, County, and Local	Federal, State and Local	Flood Zones	Initiated	Long-term
5. Implement River flood control measures	High	Federal, State, County and Local	Federal, State and Local	Flood Zones	Initiated	Long-term
6. Marketing & public outreach for general public to sign-up for CodeRED	High	County and Local	State and Local	County-wide	Initiated	Short-term
7. Promote general & specialized training for all emergency responders	High	All	Federal, State and Local	County-wide	Initiated	Short-term
8. Encourage work places, schools, offices, retail, factories, hospitals, etc. to develop emergency plans.	High	All	Federal, State and Local	County-wide	Initiated	Short-term

9. Develop and implement GIS system to assist in preparedness, development of mitigations strategies, and response.	High	All	Federal, State and Local	County-wide	Initiated	Short-term
10. Public education for disaster preparedness/Encourage programs such as “Do1Thing”	High	All	Federal, State and Local	County-wide	Initiated	Short-term
11. Continually monitor/update disaster response plan	High	County Emergency Management, County	Federal, State and Local	County-wide	Ongoing	Short-term

Mitigation Actions & Implementation Strategies Inclement Weather/Fog/Thunderstorms	Priority	Responsible Agency	Funding Sources	Application	Progress	Goal Status
1. Enhance storm warning system/distribution of NOAA radios	Top	County Emergency Management, Local, Local ERA	Federal, State, Local	County-wide	Ongoing	Long-term
2. Marketing & Public Outreach for general public to sign-up for CodeRED	Top	County Emergency Management, State, Local, Local ERA	Federal, State, Local	County-wide	Initiated	Long-term
3. Weather spotter training	Top	County Emergency Management, and Local ERA	Federal, State, Local	County-wide	Ongoing	Short-term
4. Encourage/support elderly assistance programs	High	State, County and Local	Federal, State, Local	County-wide	Initiated	Short-term
5. Tree trimming program/Support and encourage public utilities programs.	High	County, Local DPW, and Utility	State and Local	County-wide	Ongoing	Short-term
6. Promote general & specialized training for all emergency responders	High	All	Federal, State, Local	County-wide	Initiated	Short-term
7. Encourage work places, schools, offices, retail, factories, hospitals, etc. to develop emergency plans.	High	All	Federal, State, Local	County-wide	Initiated	Short-term
8. Develop and implement GIS system to assist in preparedness, development of mitigations strategies, and response.	High	All	Federal, State, Local	County-wide	Initiated	Short-term
9. Public education for disaster preparedness/Encourage programs such as “Do1Thing”	High	All	Federal, State, Local	County-wide	Initiated	Short-term
10. Continually monitor/update disaster response plan	High	All	Federal, State, Local	County-wide	Ongoing	Short-term

Mitigation Actions & Implementation Strategies Dam Failures	Priority	Responsible Agency	Funding Sources	Application	Progress	Goal Status
1. Identify and assess dam integrities	Top	County Emergency Management, County, Federal, State and Local	Federal, State, Local	Site Locations	Ongoing as needed	Mid-term
2. Repair of dams where appropriate	Top	County Emergency Management, County, Federal, State and Local	Federal, State, Local	Site Locations	Ongoing as needed	Long-term
3. Identify areas potentially affected by hazard	Top	County Emergency Management, County, Federal, State and Local	Federal, State, Local	Site Locations	Ongoing as needed	Mid-term
4. Promote general & specialized training for all emergency responders	High	All	Federal, State, Local	County-wide	Initiated	Short-term
5. Encourage work places, schools, offices, retail, factories, hospitals, etc. to develop emergency plans.	High	All	Federal, State, Local	County-wide	Initiated	Short-term
6. Develop and implement GIS system to assist in preparedness, development of mitigations strategies, and response.	High	All	Federal, State, Local	County-wide	Initiated	Short-term
7. Public education for disaster preparedness/Encourage programs such as “Do1Thing”	High	All	Federal, State, Local	County-wide	Initiated	Short-term
8. Continually monitor/update disaster response plan	High	All	Misc.	County-wide	Ongoing	Short-term

Mitigation Actions & Implementation Strategies Structural Fires	Priority	Responsible Agency	Funding Sources	Application	Progress	Goal Status
1. Enhance emergency response and 911 system	Top	County Emergency Management, Local and Local ERA	Federal, State, Local	County-wide	Ongoing	Long-term
2. Update firefighting and emergency response equipment & procedures	Top	Local and Local ERA	State, Local	County-wide	Ongoing	Mid-term
3. Promote proper enforcement of buildings, trades and fire codes.	High	County and Local ERA	State, Local	County-wide	Ongoing	Short-term
4. Develop public education, landlord/tenant education, and school programs on fire safety, including specific items such as stoves, heaters, fireworks, fireplaces, importance of pulling permits, etc.	High	County Emergency Management, Local and Local ERA	Local	County-wide	Initiated	Short-term
5. Increase volunteer recruitment/ Promote general & specialized training for all emergency responders	High	County Emergency Management and Local ERA	Federal, State, Local	County-wide	Ongoing	Short-term
6. Develop regulations to promote accessibility to properties and in and around structures.	High	County and Local	State, Local	County-wide	Ongoing	Mid-term
7. Develop water supply sources and systems, and multi-jurisdictional access to water systems	High	County, Local and Local ERA	Local	County-wide	Ongoing	Short-term
8. Maintain auto and mutual aid agreements	High	County, Local and Local ERA	Local	County-wide	Ongoing	Short-term
9 Encourage work places, schools, offices, retail, factories, hospitals, etc. to develop emergency plans.	High	All	Federal, State, Local	County-wide	Initiated	Short-term
10. Develop and implement GIS system to assist in preparedness, development of mitigations strategies, and response.	High	All	Federal, State, Local	County-wide	Initiated	Short-term

11. Public education for disaster preparedness/Encourage programs such as “Do1Thing”	High	All	Federal, State, Local	County-wide	Initiated	Short-term
12. Continually monitor/update disaster response plan	High	All	Misc.	County-wide	Ongoing	Short-term

Mitigation Actions & Implementation Strategies Tornadoes	Priority	Responsible Agency	Funding Sources	Application	Progress	Goal Status
1. Provision for accessible shelters/home sheltering education	Top	County Emergency Management, Local, Local ERA	Federal, State, Local	County-wide	Ongoing	Long-term
2. Enhance storm warning system/distribution of NOAA radios	Top	County Emergency Management, Local, Local ERA	Federal, State, Local	County-wide	Ongoing	Long-term
3. Marketing & Public Outreach for general public to sign-up for CodeRED	Top	County Emergency Management and Local	State, Local	County-wide	Ongoing	Short-term
4. Weather spotter training	High	County Emergency Management and Local ERA	State, Local	County-wide	Ongoing	Short-term
5. Enforce building codes, especially concerning prospering anchoring structures/Educate general public on building codes/engineering techniques.	High	County, Local and Local ERA	State, Local	County-wide	Ongoing	Short-term
6. Promote general & specialized training for all emergency responders	High	All	Federal, State, Local	County-wide	Ongoing	Short-term
7. Encourage work places, schools, offices, retail, factories, hospitals, etc. to develop emergency plans.	High	All	Federal, State, Local	County-wide	Initiated	Short-term
8. Develop and implement GIS system to assist in preparedness, development of mitigations strategies, and response.	High	All	Federal, State, Local	County-wide	Initiated	Short-term
9. Public education for disaster preparedness/Encourage programs such as “Do1Thing”	High	All	Federal, State, Local	County-wide	Initiated	Short-term
10. Continually monitor/update disaster response plan	High	All	Misc.	County-wide	Ongoing	Short-term

Mitigation Actions & Implementation Strategies Infrastructure Failures	Priority	Responsible Agency	Funding Sources	Application	Progress	Goal Status
1. Encourage and support infrastructure assessment/maintenance/enhancement/repair/replacement programs	Top	County Road Commission, Local, Local DPW and Utility	Federal, State, Local	County-wide	Ongoing	Short-term
2. Review and develop strategies to identify and employ generators for back-up power at critical facilities	Top	Local and Local ERA	State, Local	County-wide	Ongoing	Long-term
3. Review and develop strategies to ensure redundancies in infrastructure systems	High	Local and ERA	State, Local	Local	Ongoing	Mid-term
4. Promote general & specialized training for all emergency responders	High	All	Federal, State, Local	County-wide	Ongoing	Short-term
5. Encourage work places, schools, offices, retail, factories, hospitals, etc. to develop emergency plans.	High	All	Federal, State, Local	County-wide	Initiated	Short-term
6. Develop and implement GIS system to assist in preparedness, development of mitigations strategies, and response.	High	All	Federal, State, Local	County-wide	Initiated	Short-term
7. Public education for disaster preparedness/Encourage programs such as “Do1Thing”	High	All	Federal, State, Local	County-wide	Initiated	Short-term
8. Continually monitor/update disaster response plan	High	All	Misc.	County-wide	Ongoing	Short-term

Mitigation Actions & Implementation Strategies Extreme Temperatures	Priority	Responsible Agency	Funding Sources	Application	Progress	Goal Status
1. Establish warming or cooling stations/centers/shelters	Top	County Emergency Management, Local, and Local ERA	State, Local	County-wide	Ongoing	Long-term
2. Encourage/support elderly assistance programs	High	County, Local and State	State, Local	County-wide	Ongoing	Short-term
3. Promote general & specialized training for all emergency responders	High	All	Federal, State, Local	County-wide	Ongoing	Short-term
4. Encourage work places, schools, offices, retail, factories, hospitals, etc. to develop emergency plans.	High	All	Federal, State, Local	County-wide	Initiated	Short-term
5. Develop and implement GIS system to assist in preparedness, development of mitigations strategies, and response.	High	All	Federal, State, Local	County-wide	Initiated	Short-term
6. Public education for disaster preparedness/Encourage programs such as “Do1Thing”	High	All	Federal, State, Local	County-wide	Initiated	Short-term
7. Continually monitor/update disaster response plan	High	All	Misc.	County-wide	Ongoing	Short-term

Mitigation Actions & Implementation Strategies Hazardous Materials Incidents (Transportation)	Priority	Responsible Agency	Funding Sources	Application	Progress	Goal Status
1. Enhance emergency response system	Top	County Emergency Management, Local and Local ERA	Federal, State, Local	County-wide	Ongoing	Long-term
2. Update hazard material incident emergency response equipment & procedures	Top	Local and Local ERA	Federal, State, Local	County-wide	Ongoing	Mid-term
3. Promote general & specialized training for all emergency responders	High	All	Federal, State, Local	County-wide	Ongoing	Short-term
4. Encourage work places, schools, offices, retail, factories, hospitals, etc. to develop emergency plans.	High	All	Federal, State, Local	County-wide	Initiated	Short-term
5. Develop and implement GIS system to assist in preparedness, development of mitigations strategies, and response.	High	All	Federal, State, Local	County-wide	Initiated	Short-term
6. Public education for disaster preparedness/Encourage programs such as “Do1Thing”	High	All	Federal, State, Local	County-wide	Initiated	Short-term
7. Continually monitor/update disaster response plan	High	All	Misc.	County-wide	Ongoing	Short-term

Mitigation Actions & Implementation Strategies Public Health Emergencies	Priority	Responsible Agency	Funding Sources	Application	Progress	Goal Status
1.Programs for the general public health and safety, such as immunization programs	Medium	County Health Department, Local, Local ERA, State and Federal	Federal, State, Local	County-wide	Ongoing	Short-term
2. Promote general & specialized training for public health officers, staff and emergency responders	High	All	Federal, State, Local	County-wide	Ongoing	Short-term
3. Encourage work places, schools, offices, retail, factories, hospitals, etc. to develop emergency plans.	High	All	Federal, State, Local	County-wide	Initiated	Short-term
4. Develop and implement GIS system to assist in preparedness, development of mitigations strategies, and response.	High	All	Federal, State, Local	County-wide	Initiated	Short-term
5. Public education for disaster preparedness/Encourage programs such as “Do1Thing”	High	All	Federal, State, Local	County-wide	Initiated	Short-term
6. Continually monitor/update disaster response plan	High	All	Misc.	County-wide	Ongoing	Short-term

Mitigation Actions & Implementation Strategies Drought	Priority	Responsible Agency	Funding Sources	Application	Progress	Goal Status
1. Promote and educate water rationing program for drought conditions	Medium	All	Federal, State, Local	County-wide	Ongoing	Short-term
2. Promote and educate public concerning water conservation program	Medium	All	Federal, State, Local	County-wide	Ongoing	Short-term
3. Promote general & specialized training for all emergency responders	High	All	Federal, State, Local	County-wide	Ongoing	Short-term
4. Encourage work places, schools, offices, retail, factories, hospitals, etc. to develop emergency plans.	High	All	Federal, State, Local	County-wide	Initiated	Short-term
5. Develop and implement GIS system to assist in preparedness, development of mitigations strategies, and response.	High	All	Federal, State, Local	County-wide	Initiated	Short-term
6. Public education for disaster preparedness/Encourage programs such as “Do1Thing”	High	All	Federal, State, Local	County-wide	Initiated	Short-term
7. Update local disaster response plan	High	All	Misc.	County-wide	Ongoing	Short-term

Mitigation Actions & Implementation Strategies Oil and Natural Gas Pipeline/Well Accidents	Priority	Responsible Agency	Funding Sources	Application	Progress	Goal Status
1. Update firefighting and emergency response equipment & procedures	Top	Local and Local ERA	State, Local	County-wide	Ongoing	Mid-term
2. Encourage and support infrastructure assessment/maintenance/enhancement/repair/replacement programs	Top	County Road Commission, Local, Local DPW and Utility	Federal, State, Local	County-wide	Ongoing	Short-term
3. Enforce operator compliance with industry safety regulations and standards	Medium	County Emergency Management and Local ERA	State, Local	County-wide	Ongoing	Short-term
4. Develop contingency plans for general public and work protection, including emergency rescue and evacuation plans.	Medium	County Emergency Management and Local ERA	Federal, State, Local	County-wide	Ongoing	Long-term
5. Update inventory of oil and natural gas wells	Medium	County, State DEQ and Local	Federal, State, Local	County-wide	Ongoing	Mid-term
6. Promote general & specialized training for all emergency responders	High	All	Federal, State, Local	County-wide	Ongoing	Short-term
7. Encourage work places, schools, offices, retail, factories, hospitals, etc. to develop emergency plans.	High	All	Federal, State, Local	County-wide	Initiated	Short-term
8. Develop and implement GIS system to assist in preparedness, development of mitigations strategies, and response.	High	All	Federal, State, Local	County-wide	Initiated	Short-term
9. Public education for disaster preparedness/Encourage programs such as “Do1Thing”	High	All	Federal, State, Local	County-wide	Initiated	Short-term
10. Update local disaster response plan	High	All	Misc.	County-wide	Ongoing	Short-term

Mitigation Actions & Implementation Strategies Transportation Accidents	Priority	Responsible Agency	Funding Sources	Application	Progress	Goal Status
1. Provide training, planning, and preparedness for mass-casualty incidents involving all modes of public transportation.	Medium	County Emergency Management and Local ERA	Federal, State, Local	County-wide	Ongoing	Mid-term
2. Encourage long-term planning that provides more for reduced congestion of arterial roads.	Medium	County Emergency Management and Local ERA	Federal, State, Local	County-wide	Ongoing	Short-term
4. Meet with local and regional industries to determine type of products transported over local roadways, highways and railways for use by local emergency responders	Medium	County Emergency Management and Local ERA	State, Local	County-wide	Ongoing	Short-term
5. Promote general & specialized training for all emergency responders	High	All	Federal, State, Local	County-wide	Ongoing	Short-term
6. Encourage work places, schools, offices, retail, factories, hospitals, etc. to develop emergency plans.	High	All	Federal, State, Local	County-wide	Initiated	Short-term
7. Develop and implement GIS system to assist in preparedness, development of mitigations strategies, and response.	High	All	Federal, State, Local	County-wide	Initiated	Short-term
8. Public education for disaster preparedness/Encourage programs such as “Do1Thing”	High	All	Federal, State, Local	County-wide	Initiated	Short-term
9. Update local disaster response plan	High	All	State, Local	County-wide	Ongoing	Short-term

Mitigation Actions & Implementation Strategies Hazardous Materials Incidents (Fixed Site)	Priority	Responsible Agency	Funding Sources	Application	Progress	Goal Status
1. Enhance emergency response 911 system	Top	County Emergency Management, Local and Local ERA	Federal, State, Local	County-wide	Ongoing	Long-term
2. Update hazard material incident emergency response equipment & procedures	Top	Local and Local ERA	Federal, State, Local	County-wide	Ongoing	Mid-term
3. Update hazardous material site inventory	Medium	County Emergency Management, Local, Local ERA and State	Federal, State, Local	County-wide	Ongoing	Short-term
4. Promote general & specialized training for all emergency responders	High	All	Federal, State, Local	County-wide	Ongoing	Short-term
5. Encourage work places, schools, offices, retail, factories, hospitals, etc. to develop emergency plans.	High	All	Federal, State, Local	County-wide	Initiated	Short-term
6. Develop and implement GIS system to assist in preparedness, development of mitigations strategies, and response.	High	All	Federal, State, Local	County-wide	Initiated	Short-term
7. Public education for disaster preparedness/Encourage programs such as “Do1Thing”	High	All	Federal, State, Local	County-wide	Initiated	Short-term
8. Update local disaster response plan	High	All	State, Local	County-wide	Ongoing	Short-term

Mitigation Actions & Implementation Strategies Wildfires	Priority	Responsible Agency	Funding Sources	Application	Progress	Goal Status
1. Update firefighting and emergency response equipment & procedures	Top	Local and Local ERA	Local	County-wide	Ongoing	Mid-term
2. Develop public education and school programs on fire safety, including specific items such as fireworks, open burning, importance of pulling permits, etc.	High	County Emergency Management, Local and Local ERA	Federal, State, Local	County-wide	Ongoing	Short-term
3. Alert system for burn with caution, or burning bans	Medium	County Emergency Management, State and Local	State, Local	County-wide	Ongoing	Short-term
4. Promote general & specialized training for all emergency responders	High	All	Federal, State, Local	County-wide	Ongoing	Short-term
5. Encourage work places, schools, offices, retail, factories, hospitals, etc. to develop emergency plans.	High	All	Federal, State, Local	County-wide	Initiated	Short-term
6. Develop and implement GIS system to assist in preparedness, development of mitigations strategies, and response.	High	All	Federal, State, Local	County-wide	Initiated	Short-term
7. Public education for disaster preparedness/Encourage programs such as “Do1Thing”	High	All	Federal, State, Local	County-wide	Initiated	Short-term
8. Update local disaster response plan	High	All	State, Local	County-wide	Ongoing	Short-term

Mitigation Actions & Implementation Strategies Terrorism and Similar Activities	Priority	Responsible Agency	Funding Sources	Application	Progress	Goal Status
1. Prepare vulnerability studies, training, and emergency response plans for critical infrastructure	Medium	County Road Commission, Local, Local DPW, State and Utility	Federal, State, Local	County-wide	Ongoing	Mid-term
2. Develop public education and school programs on terrorism and similar activities, including specific items such as lock downs, response, etc.	High	County Emergency Management, Local and Local ERA	Federal, State, Local	County-wide	Ongoing	Short-term
3. Promote general & specialized training for all emergency responders	High	All	Federal, State, Local	County-wide	Ongoing	Short-term
4. Encourage work places, schools, offices, retail, factories, hospitals, etc. to develop emergency plans.	High	All	Federal, State, Local	County-wide	Initiated	Short-term
5. Develop and implement GIS system to assist in preparedness, development of mitigations strategies, and response.	High	All	Federal, State, Local	County-wide	Initiated	Short-term
6. Public education for disaster preparedness/Encourage programs such as “Do1Thing”	High	All	Federal, State, Local	County-wide	Initiated	Short-term
7. Update local disaster response plan	High	All	State, Local	County-wide	Ongoing	Short-term

Mitigation Actions & Implementation Strategies Civil Disturbances	Priority	Responsible Agency	Funding Sources	Application	Progress	Goal Status
1. Promote general & specialized training for all emergency responders	High	All	Federal, State, Local	County-wide	Ongoing	Short-term
2. Encourage work places, schools, offices, retail, factories, hospitals, etc. to develop emergency plans.	High	All	Federal, State, Local	County-wide	Initiated	Short-term
3. Develop and implement GIS system to assist in preparedness, development of mitigations strategies, and response.	High	All	Federal, State, Local	County-wide	Initiated	Short-term
4. Public education for disaster preparedness/Encourage programs such as “Do1Thing”	High	All	Federal, State, Local	County-wide	Initiated	Short-term
5. Update local disaster response plan	High	All	State, Local	County-wide	Ongoing	Short-term

Mitigation Actions & Implementation Strategies Nuclear Attack/Accident	Priority	Responsible Agency	Funding Sources	Application	Progress	Goal Status
1. Promote general & specialized training for all emergency responders	High	All	Federal, State, Local	County-wide	Ongoing	Short-term
2. Encourage work places, schools, offices, retail, factories, hospitals, etc. to develop emergency plans.	High	All	Federal, State, Local	County-wide	Initiated	Short-term
3. Develop and implement GIS system to assist in preparedness, development of mitigations strategies, and response.	High	All	Federal, State, Local	County-wide	Initiated	Short-term
4. Public education for disaster preparedness/Encourage programs such as “Do1Thing”	High	All	Federal, State, Local	County-wide	Initiated	Short-term
5. Update local disaster response plan	High	All	State, Local	County-wide	Ongoing	Short-term

Mitigation Actions & Implementation Strategies Scrap Tire Fires	Priority	Responsible Agency	Funding Sources	Application	Progress	Goal Status
1. Inventory scrap tire storage facilities	Low	County Emergency Management, Local and State	State, Local	County-wide	Ongoing	Mid-term
2. Promote and enforce rules and regulations to prevent the accumulation of tires/Encourage collection events for tires	Mid	County, Local, and State	Local	County-wide	Ongoing	Mid-term
3. Promote general & specialized training for all emergency responders	High	All	Federal, State, Local	County-wide	Ongoing	Short-term
4. Encourage work places, schools, offices, retail, factories, hospitals, etc. to develop emergency plans.	High	All	Federal, State, Local	County-wide	Initiated	Short-term
5. Develop and implement GIS system to assist in preparedness, development of mitigations strategies, and response.	High	All	Federal, State, Local	County-wide	Initiated	Short-term
6. Public education for disaster preparedness/Encourage programs such as “Do1Thing”	High	All	Federal, State, Local	County-wide	Initiated	Short-term
7. Update local disaster response plan	High	All	State, Local	County-wide	Ongoing	Short-term

Mitigation Actions & Implementation Strategies Earthquakes	Priority	Responsible Agency	Funding Sources	Application	Progress	Goal Status
1. Enforce building codes, especially concerning prospering anchoring structures/Educate general public on building codes/engineering techniques.	High	County, Local and Local ERA	State, Local	County-wide	Ongoing	Short-term
2. Promote general & specialized training for all emergency responders	High	All	Federal, State, Local	County-wide	Ongoing	Short-term
3. Encourage work places, schools, offices, retail, factories, hospitals, etc. to develop emergency plans.	High	All	Federal, State, Local	County-wide	Initiated	Short-term
4. Develop and implement GIS system to assist in preparedness, development of mitigations strategies, and response.	High	All	Federal, State, Local	County-wide	Initiated	Short-term
5. Public education for disaster preparedness/Encourage programs such as “Do1Thing”	High	All	Federal, State, Local	County-wide	Initiated	Short-term
6. Update local disaster response plan	High	All	State, Local	County-wide	Ongoing	Short-term

Mitigation Actions & Implementation Strategies Subsidence	Priority	Responsible Agency	Funding Sources	Application	Progress	Goal Status
1. Identify potential subsidence locations	Low	County Emergency Management and Local	Federal, State, Local	County-wide	Initiated	Mid-term
2. Restrict development in potential subsidence locations	Low	County Planning Commission and Local	Local	County-wide	Need to Commence	Short-term
3. Promote general & specialized training for all emergency responders	High	All	Federal, State, Local	County-wide	Ongoing	Short-term
4. Encourage work places, schools, offices, retail, factories, hospitals, etc. to develop emergency plans.	High	All	Federal, State, Local	County-wide	Initiated	Short-term
5. Develop and implement GIS system to assist in preparedness, development of mitigations strategies, and response.	High	All	Federal, State, Local	County-wide	Initiated	Short-term
6. Public education for disaster preparedness/Encourage programs such as “Do1Thing”	High	All	Federal, State, Local	County-wide	Initiated	Short-term
7. Update local disaster response plan	High	All	State, Local	County-wide	Ongoing	Short-term

Mitigation Actions & Implementation Strategies Invasive Species	Priority	Responsible Agency	Funding Sources	Application	Progress	Goal Status
1. Develop public education, landlord/tenant education, and school programs on fire safety, including specific items such as stoves, heaters, fireworks, fireplaces, importance of pulling permits, etc.	High	County Emergency Management, Local and Local ERA	Federal, State, Local	County-wide	Initiated	Short-term
2. Develop eradication or prevention programs to arrest the spread of invasive species	Low	County Emergency Management, Local, Local ERA and County	Federal, State, Local	County-wide	Initiated	Mid-term
3. Promote general & specialized training for all emergency responders	High	All	Federal, State, Local	County-wide	Ongoing	Short-term
4. Encourage work places, schools, offices, retail, factories, hospitals, etc. to develop emergency plans.	High	All	Federal, State, Local	County-wide	Initiated	Short-term
5. Develop and implement GIS system to assist in preparedness, development of mitigations strategies, and response.	High	All	Federal, State, Local	County-wide	Initiated	Short-term
6. Public education for disaster preparedness/Encourage programs such as “Do1Thing”	High	All	Federal, State, Local	County-wide	Initiated	Short-term
7. Update local disaster response plan	High	All	State, Local	County-wide	Ongoing	Short-term

Mitigation Actions & Implementation Strategies Celestial Impacts	Priority	Responsible Agency	Funding Sources	Application	Progress	Goal Status
1. Promote general & specialized training for all emergency responders	High	All	Federal, State, Local	County-wide	Ongoing	Short-term
2. Encourage work places, schools, offices, retail, factories, hospitals, etc. to develop emergency plans.	High	All	Federal, State, Local	County-wide	Initiated	Short-term
3. Develop and implement GIS system to assist in preparedness, development of mitigations strategies, and response.	High	All	Federal, State, Local	County-wide	Initiated	Short-term
4. Public education for disaster preparedness/Encourage programs such as “Do1Thing”	High	All	Federal, State, Local	County-wide	Initiated	Short-term
5. Update local disaster response plan	High	All	State, Local	County-wide	Ongoing	Short-term

Mitigation Actions & Implementation Strategies Catastrophic Incidents	Priority	Responsible Agency	Funding Sources	Application	Progress	Goal Status
1. Promote general & specialized training for all emergency responders	High	All	Federal, State, Local	County-wide	Ongoing	Short-term
2. Encourage work places, schools, offices, retail, factories, hospitals, etc. to develop emergency plans.	High	All	Federal, State, Local	County-wide	Initiated	Short-term
3. Develop and implement GIS system to assist in preparedness, development of mitigations strategies, and response.	High	All	Federal, State, Local	County-wide	Initiated	Short-term
4. Public education for disaster preparedness/Encourage programs such as “Do1Thing”	High	All	Federal, State, Local	County-wide	Initiated	Short-term
5. Update local disaster response plan	High	All	State, Local	County-wide	Ongoing	Short-term

Mitigation Actions & Implementation Strategies Energy Emergencies	Priority	Responsible Agency	Funding Sources	Application	Progress	Goal Status
1. Promote general & specialized training for all emergency responders	High	All	Federal, State, Local	County-wide	Ongoing	Short-term
2. Encourage work places, schools, offices, retail, factories, hospitals, etc. to develop emergency plans.	High	All	Federal, State, Local	County-wide	Initiated	Short-term
3. Develop and implement GIS system to assist in preparedness, development of mitigations strategies, and response.	High	All	Federal, State, Local	County-wide	Initiated	Short-term
4. Public education for disaster preparedness/Encourage programs such as “Do1Thing”	High	All	Federal, State, Local	County-wide	Initiated	Short-term
5. Update local disaster response plan	High	All	State, Local	County-wide	Ongoing	Short-term

SECTION 6 GOALS & OBJECTIVES

The purpose of this section is to set forth goals and objectives that will guide hazard mitigation efforts in Shiawassee County. In developing community these goals and objectives, existing community characteristics such as social and economic conditions, services and facilities, environmental conditions, and existing land use was taken consideration as well as the hazard analysis and vulnerability assessments conducted as part of the Plan update.

Public meetings were announced to invite local officials, stakeholders and the general public to participate in the update of the Plan. The draft plan was also posted on the County's web site to provide an opportunity for everyone to review and comment. Based on feedback received, as well as their own analysis, the Local Advisory Committee reviewed and updated hazard mitigation goals and objectives.

Goals and Objectives

Goals are general guidelines that explain what a community wants to accomplish. Goals are usually long-term and represent broad visions. Objectives define strategies or implementation steps to attain the identified goals. Objectives 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.

Goal 1 Protect Public Health and Safety

Objectives:

- ✓ Encourage use of existing and promote new community wide hazard warning systems.
- ✓ Provide information and resources to increase hazard awareness and promote preparedness.
- ✓ Maintain existing resources, promote new resources and provide necessary training to multiple disciplines.
- ✓ Identify and obtain necessary resources and equipment to prevent or limit hazard effects, and to adequately respond to a manifested hazard.
- ✓ Provide education opportunities to the general public as well as support and fund education at school, the workplace and home.

Goal 2 Minimize Damage to Public and Private Property

Objectives:

- ✓ Apply proactive mitigation measures to prevent hazard damage.
- ✓ Secure necessary equipment, resources and training to protect property if hazard occurs.
- ✓ Adopt policies, rules and regulation to make property less vulnerable and keep persons and property out of harm's way.
- ✓ Conduct regularly scheduled training sessions and exercises to prepare for possible hazards.

Goal 3 Maintain Essential Services

Objectives:

- ✓ Inspect, maintain and upgrade all critical infrastructure and facilities.
- ✓ Repair or replace critical infrastructure and facilities that are damaged or degraded.
- ✓ Protect critical infrastructure and facilities from hazard damage.
- ✓ Obtain necessary resources and equipment to insure essential services are maintained in the event of a hazard.

Goal 4 Coordinate hazard mitigation with growth/development planning.

Objectives:

- ✓ Protect and conserve natural resources and emphasizing the involvement of multiple disciplinary agencies, department and groups.
- ✓ Develop hazard resistant growth policies and emphasizing the involvement of multiple disciplinary agencies, department and groups.
- ✓ Integrate hazard mitigation planning into land use planning, as well as develop policy statements that reinforce future rules and regulations to prevent development in high hazard areas.
- ✓ Encourage sustainable development.

Goal 5 Build partnerships for mitigation activities on a local and regional basis.

Objectives:

- ✓ Continue to work cooperatively with agencies and communities in Shiawassee County.
- ✓ Continue to work cooperatively with agencies and communities in Michigan and surrounding communities.
- ✓ Utilize other disciplines and their avenues for public involvement to spread the message of the importance of hazard mitigation.
- ✓ Develop regional grant applications for hazard mitigation implementation.

Goal 6 Build a public participation program.

Objectives:

- ✓ Continue to work cooperatively with agencies and communities in Shiawassee County to advise the general public, stakeholders, and specific interests of their relationship to hazard mitigation.
- ✓ Utilize other disciplines and their avenues for public involvement to spread the message of the importance of hazard mitigation.
- ✓ Develop avenues for outreach to the public, stakeholders and communities and build excitement in participating in hazard mitigation efforts.

Page Intentionally Left Blank

SECTION 7 ADOPTION AND IMPLEMENTATION

With the hazards affecting Shiawassee County and its participating communities having been identified, the goals and objectives of this Plan update having been established, and an initial list of mitigation actions and projects having been developed, it is necessary to provide guidance to current and future users on how to implement the Plan and create a living document that can be amended and updated.

Responsibility for Hazard Mitigation Plan

The Shiawassee County Office of Emergency Management has responsibility for developing and maintaining the 2016 Shiawassee County Hazard Mitigation Plan and overseeing its implementation through coordination and interaction with participating communities (including the component departments making up Shiawassee County), community stakeholders and the general public. Mr. Richard Warner, Emergency Management Coordinator, or other employee to hold the position shall be the point of contact for the plan.

Review and Update

Mitigation planning is an ongoing process and in order to for the Plan to stay current and responsive to the community, it is necessary for the Plan to be reviewed, revised, and updated on a periodic basis to account for the growth and development of the community and changes to vulnerability to hazards. The Disaster Mitigation Act of 2000 requires the plan to be reviewed and updated at least once every five (5) years to maintain federal funding eligibility. However, given that changes in demographics, growth and development and vulnerability to hazards can occur rapidly, review and analysis must occur at more frequent intervals than every five (5) years. Regular maintenance and review of the Plan, as in the case of the 5-year review, consists primarily of three main steps.

The following steps are taken from the "State and Local Mitigation Planning How-To Guide" (FEMA 386-4). The first step is to review the factors affecting the County's planning context. This step will help determine what changes to the Plan are warranted. The second step is to analyze the findings and determine whether to revise the planning process or the mitigation strategy. The third step is to incorporate the findings into the Plan. These steps and the specific actions associated with them are listed below in more detail.

Revisit the risk assessment to incorporate updated estimates of:

- ✓ Cost of Living

- ✓ Replacement Costs
- ✓ New Scientific Data on Hazard Areas
- ✓ Effect of Hazards on the Community
- ✓ Changes in Growth Patterns
- ✓ Reductions in Vulnerability due to Completion of Projects

It should be determined whether there are changes in the development patterns that could influence the effects of hazards in the community or create additional risks. Updated information can be obtained from recent hydrological, watershed, traffic, demographic studies, or new mitigation techniques that are being developed. When new information arises, often times the cost/benefit analysis needs to be revised to reflect the increasing or declining potential for losses.

Revisit capability assessment and determine changes in:

- ✓ Laws
- ✓ Authorities
- ✓ Community and State Resources
- ✓ Availability of Financial and Technical Tools

Some examples of what the County is capable of with regard to mitigation actions can be greatly affected by things like the strengthening, relaxing, or addition of land use, environmental, or other government regulations. Changes in the socioeconomic fabric of the community, such as recessions, booming economies, changes in political climate, and demographic shifts, often have repercussions on the community's sequence of mitigation priorities and the implementation of projects.

It is imperative that the list of hazard mitigation projects that have been set forth be reviewed and updated on an annual basis. As projects are accomplished, their status will need to be updated. New projects will be identified overtime and it is necessary to add these to the project list. As stated, the Plan is intended to be a living document to allow projects to easily be updated, modified, added, or deleted to respond to the needs of the community. This will also assist in updating the Plan on a five (5) year basis because the information will have had already been gathered.

A discussion of what actions should be taken to further the Plan's goals. The overall community and stakeholders should again be involved in reviewing the revised alternative mitigation actions. Questions guiding the discussion should include:

- Are the goals and objectives still applicable and has anything made them obsolete or irrelevant?

- Have any of the goals and objectives been satisfied or do they continue to relate to current conditions?

- Do the goals, objectives and priorities correspond with the State's priorities?

- Do existing actions need to be reprioritized?

- Are actions appropriate for available resources?

- Has financial resources changed?

    - Are past sources of funds still available?
    - Are there new sources of funding that can be tapped?
    - Are there new partnerships that can be developed?
    - What creative ways of implementing similar actions have other communities used?

It is recommended that the Office of Emergency Management/Homeland Security determine a date each year to meet with the Local Advisory Committee to conduct a review of the Plan to determine its adequacy and completeness. If it is determined that the Plan needs to be overhauled, the Office of Emergency Management should advise the County Board of Commissioners and take the steps necessary to update the Plan.

Any revision should include the most recent findings about the community, the hazards and vulnerabilities, and the applicable original actions of the Plan into the revised Plan. Other areas of the Plan will need to be updated including the description of the planning process to include the steps taken to revise the Plan and how the public was involved. The implementation strategy will need to identify who will be responsible for the new or revised actions, the time frame, and funding sources. Finally, the revised plan will need to be reviewed by all the key stakeholders and again passed through a formal adoption process.

Data collection and review over time that does not entail an overhaul, should be documented and kept with the Plan retained by the Emergency Management Coordinator.

Incorporating the Plan into Community Planning Mechanisms

Shiawassee County currently maintains a Master Plan pursuant to Public Act 33 of 2008 for areas covered under its zoning jurisdiction. As part of that Master Plan, other plans from other

communities are reviewed. The current draft of the 2016 Shiawassee County Master Plan includes reference to this Plan. It is anticipated that outreach will be made to other communities with master plans and future land use plans to also reference and take into account the provisions of this Plan.

Integrating the provisions of this Plan and the County's and other communities existing plans is extremely beneficial to achieving the objectives of this Plan. Community master plans and future land use plans influence the location, type, and characteristics of physical growth, specifically buildings and infrastructure. These master plans and future land use plans can support regulatory mechanisms (zoning, development ordinances, etc.) to implement this Plan's goals and objectives. Additionally, the master planning process is an established activity that is already familiar to the public, and it usually generates a great deal of interest and public participation.

Continued Public Participation

Throughout the initial Plan development, the most current version of the Plan has been made available on the County's web site. Each publication of the Plan, every time it is revised, will be posted on the County's website. Articles will also be published in the local newspapers to notify the public of the Plan's revision and the need for community input. At least annually, and coinciding with the meeting with the Local Advisory Group, the Office of Emergency Management will publish an article on hazard mitigation in local newspapers to focus attention on hazard mitigation planning. Should the need arise, a public forum or presentation will be conducted to address any questions or concerns the public may have regarding the Plan's modification.

APPENDIX 1- GLOSSARY OF TERMS

Glossary of Terms

Access Control Point - A point established by law enforcement officials to control access to a hazardous or potentially hazardous area.

Aiming Point - The area identified in NAPS-90 as the designated location of a nuclear detonation, also known as the target area.

Blast Area - A sharply defined wave of increased air pressure from the center of a nuclear detonation, measured in pounds per square inch (psi).

Close-In Shelter Area - The area between the Planned Evacuation Area and the General Shelter Area (from 5 psi to 2 psi) to the nuclear attack aiming point. Persons residing in this area will utilize home basements and available below ground public shelters.

Command Post - A facility established near the scene of a disaster and staffed by representatives of applicable agencies to coordinate immediate on-scene response.

Comprehensive Emergency Management (CEM) - An integrated approach to the management of emergency programs and activities for all four (4) emergency phases (mitigation. preparedness, response and recovery) for all types of emergencies and disasters (natural, technological and enemy attack), and for all levels of government (local, state and federal) and the private sector.

Contamination - The deposit of chemical, biological or radioactive material on the surface of structures, objects, or persons following a nuclear incident/explosion or a hazardous material incident.

Decontamination - The reduction or removal of contaminating material from a structure, area, object or person. Decontamination may be accomplished by 1) treating the surface so as to remove or decrease the contamination: 2) letting the material stand so that the contamination is decreased as a result of natural decay: 3) covering the contamination.

Decontamination Centers - A location with shower facilities and a large parking area used to monitor evacuees for contamination and to decontaminate evacuees and their belongings. Several of these centers may be established on the periphery of the hazard area. They may also double as reception areas.

Deputy Emergency Management Coordinator - *S*ame as Emergency Management Coordinator.

Direct Weapons Effects – The immediate emissions of a nuclear detonation considered most hazardous, namely, blast, heat and initial nuclear radiation. Generally, direct weapons effects are present within a several mile radius. Indirect weapons effects, mostly fallout, affect areas where a direct nuclear explosion has not occurred.

Disaster - An occurrence or imminent threat of widespread or severe damage, injury or loss of life or property resulting from a natural or human-made cause, including fire, flood, snow**,** ice, windstorm, wave action, water damage, oil spill, utility failure, hazardous peacetime radiological incident, major transportation accident, epidemic, air contamination, blight, drought, infestation, explosion, military or para-military action as defined in Act 390. PA. 1976). Riots or other civil disorders are not within the meaning of this term unless they directly result from, and are an aggravating element of, the disaster.

Disaster Field Office (DFO) – The location established within the disaster area that functions as the joint government center for all response and recover activities.

Disaster Mitigation Act (DMA) of 2000 – Public Law 106-390, signed into law on October 30, 2000, which amended sections of the Robert T. Stafford Disaster Relief and Emergency Assistance Act (Stafford Act) and placed new hazard mitigation planning requirements on states and local governments in order to obtain Stafford Act disaster relief assistance.

Disaster Recovery Center (DRC) – A location established within the disaster area that functions as a "one-stop" information source for disaster recovery and hazard mitigation-related issues. DRCs are staffed by personnel from FEMA and other Federal agencies, state and local agencies, and private, voluntary relief organizations.

Disaster Relief Forces - All agencies of county and municipal government, private or volunteer personnel, public officers and employees, and all other persons or groups of persons identified in the Emergency Operations Plan or those called into duty or working at the direction of a party identified in the plan to perform a specific disaster or emergency related task during a local state of emergency.

District Coordinator - State Police Emergency Management and Homeland Security Division District Coordinator or his authorized representative.

Dosimeter - A radiation monitoring device which measures the amount of radiation to which the instrument has been exposed. It comes in both permanent record and self-reading types.

Electromagnetic Pulse (EMP) - Energy radiated by a nuclear detonation in the medium-to-low frequency range that may affect or damage electrical or electronic components and equipment.

Emergency - Any occasion or instance in which assistance is needed to supplement efforts to save lives, protect property and the public health and safety, or to lessen or avert the threat of a disaster.

Emergency Coordination Facility - A facility from which coordination of the emergency or disaster response takes place. All organizations responding to the incident are represented in this facility and coordinate their actions. This may be an Emergency Operations Center (EOC), command post, or other type of facility depending on the nature of the incident.

Emergency Management Coordinator - The person appointed pursuant to Act 390. PA. 1976, as amended, to coordinate emergency management activities for an emergency management program.

Emergency Management and Homeland Security Division (MSP/EMHSD) – The division within the Department of State Police which coordinates the comprehensive emergency management activities of state and local government and maintains the Michigan Emergency Management Plan. The commanding officer of the division is designated the Deputy State Director of Emergency Management.

Emergency Management Program – A program established to coordinate mitigation, preparedness, response and recovery activities for all emergency or disaster situations within a given geographic area made up of one or several political subdivisions. Such a program has appointed an emergency management coordinator and meets the program standards and requirements as established by the Department of State Police, Emergency Management and Homeland Security Division.

Emergency Operations Center (EOC) – The designated facility, away from the incident scene, from which government officials coordinate response in an emergency/disaster.

Emergency Operations Plan (EOP) -The plan developed and maintained by an emergency management program for the purpose of organizing and coordinating the emergency management activities of the jurisdiction(s) under the plan.

Emergency Planning District - The geographic area designated by the Michigan Emergency Planning and Community Right-to-know Commission as the area which plans must be developed for response to a hazardous material incident. In Michigan, each County has been designated as a district and municipalities over 10,000 may petition the commission to be designated a district. There have been 97 districts designated in Michigan.

Emergency Planning Zone (EPZ) – The area around a nuclear power plant for which planning is required to assure that prompt and effective action will be taken to protect the public in the event of an accident.

Essential Resource – Any facility, supply or piece of equipment considered vital to emergency operations and which should be protected either by movement away from a direct risk, or by securing it in place.

Evacuation – A population protection strategy that provides for the orderly movement of people away from an actual or potential hazard.

Evacuation Area – The evacuation area is defined by known land features (streets, railroads, rivers, etc.) from the center of the situation or disaster.

Fallout (Radioactive) – The process of radioactive matter falling back to the earth's surface over time. The term is also applied in a collective sense to the contaminated particular matter itself.

Fallout Shelter (Public) – A habitable structure used to protect its occupants from radioactive fallout. Such a shelter shall have a minimum protection factor of 40, a minimum of 10 square feet of floor space per person, 65 cubic feet of space per person, and at least one 3 cubic feet of fresh area per minute when capacity is based on minimum space requirements. In unventilated underground space, 500 cubic feet of space per person is required.

Federal Emergency Management Agency (FEMA) – The federal agency that coordinates emergency planning, preparedness, mitigation, response and recovery within the federal government. FEMA has been delegated primary responsibility for administering the President's Disaster Relief Program, which includes the Hazard Mitigation Grant Program (HMGP). FEMA also administers the Flood Mitigation Assistance Program (FMAP), Pre-Disaster Mitigation Program (PDMP), Repetitive Flood Claims Program (RFCP), and Severe Repetitive Loss Program (SRLP).

Flood Mitigation Assistance Program (FMAP) – A grant program created under the National Flood Insurance Reform Act of 1994 to provide mitigation planning and project grants to states and communities. The program is funded through flood insurance policy fees. A maximum of $20 million in grant money is available annually.

Floodplain – The lowland and relatively flat areas adjoining inland or coastal waters including, at a minimum, the area subject to a one percent or greater chance of flooding in any given year (the "base flood" or 100-year flood).

Hazard Mitigation – Any action taken to reduce or permanently eliminate the long-term risk to human life and property from natural, technological and human-related hazards.

Hazard Mitigation Assistance (HMA) – An "umbrella" program that contains numerous sources of grant funds for hazard mitigation activities.

Hazard Mitigation Grant Program (HMGP) – A grant program authorized under Section 404 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act that provides funding for hazard mitigation projects that are cost-effective and complement existing post-disaster mitigation programs and activities by providing funding for beneficial mitigation measures that are not funded through other programs.

Height of Burst (HOB) – The height, above the earth's surface, at which a bomb is detonated in the air.

Hot Zone – The exclusion area around a hazardous material incident. The size of the "Hot Zone" will vary depending upon the material involved.

Incident Command System – A system used to respond to incidents, required to be used for response to all hazardous material incidents, and many other types of emergencies.

Incident Commander – The person in charge of the response to an incident, under the Incident Command System.

In-Place Protection – A population protection strategy that provides for the indoor sheltering of people to prevent contact with a hazard.

Joint Public Information Center (JPIC) – A center established near the scene of a disaster or emergency for issuing emergency information. It provides a central location for joint issuance of accurate information to the news media representatives by a level of government and private industry.

Key Worker – A person whose skills or services are required to continue operation of vital facilities and activities that will provide goods and services to residents or ensure continuance of the nation's production capabilities and preservation of its economic system.

Local Emergency Planning Commission (LEPC) – The committee appointed by the Michigan

Emergency Planning Committee and Community Right-to-Know Commission as required by SARA Title III, to perform local emergency planning and community right-to-know activities. Committees are appointed in each emergency-planning district in the state and are required to have representation from a variety of groups.

Local State of Emergency – A declaration by a county or municipality with an appointed emergency management coordinator when circumstances indicate that the occurrence or threat of widespread or severe damage, injury or loss of life or property from natural or man-made cause exists.

Michigan Emergency Management Plan (MEMP) – The plan which is developed and continuously maintained by the Director of the Department of State Police, pursuant to Act 390, P.A. 1976, as amended, for the purpose of coordinating the emergency management activities of mitigation, preparedness, response and recovery within the state.

Mitigation – Activities which actually eliminate or reduce the chance of occurrence or the effects of a disaster.

National Flood Insurance Program (NIFP) – The program established in 1968 under the National Flood Insurance Act to provide property owners in floodplains with federally-subsidized flood insurance in those communities that implement ordinances to reduce future flood losses. The National Flood Insurance Reform Act of 1994 revised and strengthened many aspects of the program.

Preliminary Damage Assessment (PDA) – An assessment conducted by teams of federal, state and local officials to determine the severity and magnitude of a disaster and also to identify capabilities and resources of state, local and other federal agencies. Identification of hazard mitigation opportunities is a key part of the PDA process.

Pre-Disaster Mitigation Program (PDMP) – The program authorized under Section 203 of the Stafford Act that provides funding to states and local communities for cost-effective hazard mitigation activities that complement a comprehensive mitigation program and reduce injuries, loss of life, and damage and destruction of property.

Preparedness – Planning how to respond in case a disaster or emergency occurs, and working to increase the availability of resources to respond effectively.

Protective Actions – Those emergency measures taken to protect the population from the effects of a hazard. These may include in-place sheltering or evacuation.

Public Assistance – Federal financial assistance provided through the Public Assistance Grant Program (PAGP) to state and local governments or to eligible private nonprofit organizations for disaster-related requirements. Cost-effective hazard mitigation measures may be funded under the PAGP as part of public facility repair, restoration or reconstruction project.

Radiological Monitor (RM) – An individual trained to measure, record and report radiation doses and dose rates; and to provide limited field guidance on radiation hazards.

Radiological Release –

1. An airborne release of radiological contaminants in gaseous or particulate form. This release could be instantaneous in the form of a single cloud or puff or it could be a prolonged release or plume.

2. A liquid release of radiological contaminants that flow into a waterway or other surface or sub-surface distribution system

Reception Center – A center established to register evacuees and for assessing their needs.

Record of Environmental Review – A document that is prepared for all Hazard Mitigation Grant Program (HMGP), Flood Mitigation Assistance Program (FMAP), Pre-Disaster Mitigation Program (PDMP), Repetitive Flood Claims Program (RFCP), and Severe Repetitive Loss Program (SRLP) projects to detail that potential environmental concerns will be addressed. This document serves to determine if an Environmental Assessment is needed.

Recovery – The final phase of the Emergency Management cycle. Recovery continues until all the systems return to normal, or near normal. Short-term recovery returns vital life support systems to minimum operating standards. Long-term recovery from a disaster may go on for years, until the entire disaster area is completely re-developed; either as it was in the past or for entirely new purposes that is less disaster-prone.

Repetitive Flood Claims Program (RFCP) – A grant program authorized by the Bunning-Berauter-Blumenauer Flood Insurance Reform Act of 2004 that provides funding to reduce or eliminate the long-term risk of flood damage to structures insured under the National Flood Insurance Program (NFIP) that have had one or more claim payments for flood damages. The long-term goal of RFCP is to reduce or eliminate claims under the NFIP through mitigation activities that are in the best interest of the National Flood Insurance Fund (NFIF). RFCP funds may only mitigate structure that are located within a State or community that cannot meet the cost share or management capacity requirements of the Flood Mitigation Assistance Program (FMAP).

Response – Activities which occur during and immediately following a disaster. They are designed to provide emergency assistance to the victims of the event and reduce the likelihood of secondary damages.

Risk Area – An area considered likely to be affected by a hazard.

Severe Repetitive Loss Program (SRLP) – A grant program authorized by the Bunning-Bereuter-Blumenauer Flood Insurance Reform Act of 2004 that provides funding to reduce or eliminate the long-term risk of flood damage to severe repetitive loss of residential structures insured under the National Flood Insurance Program (NFIP). The definition of severe repetitive loss as applied to this program was established in section 1361A of the National Flood Insurance Act, as amended (NFIA), 42 U.S.C. 4102a. An SRL property is defined as a residential property that is covered under an NFIP flood insurance policy and:

1. That has at least four NFIP claim payments (including building and contents) over $5,000 each, and the cumulative amount of such claims payments exceeds $20,000; or

2. For which at least two separate claims payments (building payments only) have been made with the cumulative amount of the building portion of such claims exceeding the market value of the building.

For both (a) and (b) above, at least two of the referenced claims must have occurred within any ten-year period and must be greater than 10 days apart.

Shelter – A facility in an area that is safe from the effects of a hazard and that may be used to house and care for evacuees.

Stafford Act – The Robert T. Stafford Disaster Relief and Emergency Assistance Act, PL 100-707, signed into law November 23, 1988. The Stafford Act amended the Disaster Relief Act of 1974, PL 93-288. The Stafford Act was amended by the Disaster Mitigation Act (DMA) of 2000 (PL 106-390), signed into law on October 30, 2000.

Staging Area – A large parking area to provide a base for resource transfer, assembly of persons, and a rally-point for mutual aid and debarking.

State Director of Emergency Management – The Director of the Department of State Police or their authorized representative.

State Emergency Operations Center (SEOC) – The primary center for coordination of state

government response and recovery operations in time of emergency/disaster.

Standard Operating Procedure (SOP) – Detailed procedures that are unique to a specific emergency or disaster situation or those that are written by a specific department or agency to detail the tasks assigned in an emergency operations plan.

State of Disaster or State of Emergency – A declaration by executive order or proclamation by the Governor under the provisions of Act 390, P.A. 1976, as amended, which activates the response and recovery aspects of state and local emergency operations plans.

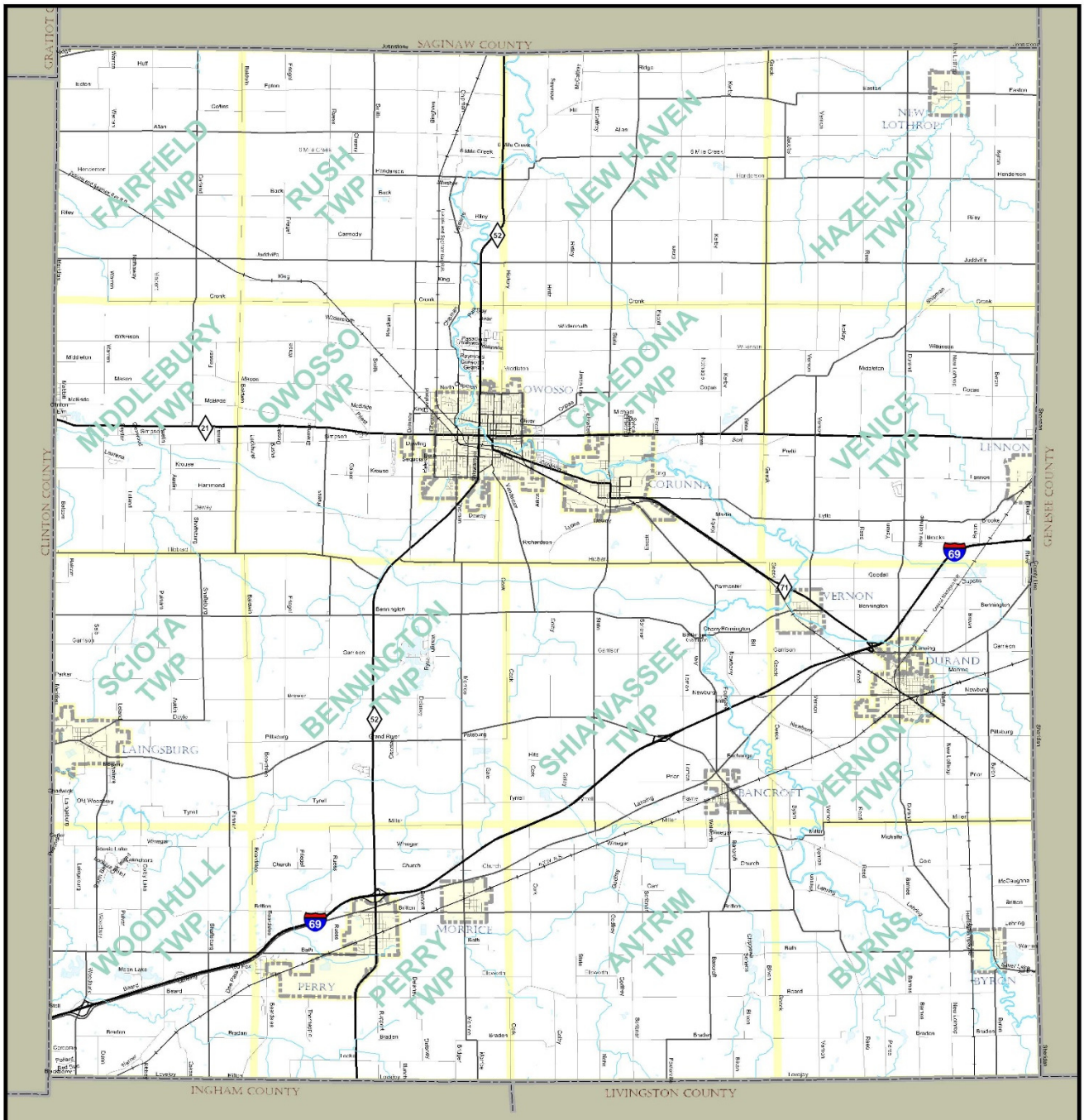
Terrorism – Any willful act that is intended to cause fear and/or personal injury and destruction of property.

Warm Zone – The contamination control area outside the "hot" zone around a hazardous material incident.

Weapons of Mass Destruction – Any type of intentional weapon use that would cause severe injuries/fatalities and/or massive damage to property.

Wetlands – Those areas which are inundated or saturated by surface or ground water with a frequency sufficient to support, or that under normal hydrologic conditions does or would support, a prevalence of vegetation or aquatic life typically adapted for life in saturated or seasonally saturated soil conditions.

APPENDIX 2- MAPS



LOCATION MAP

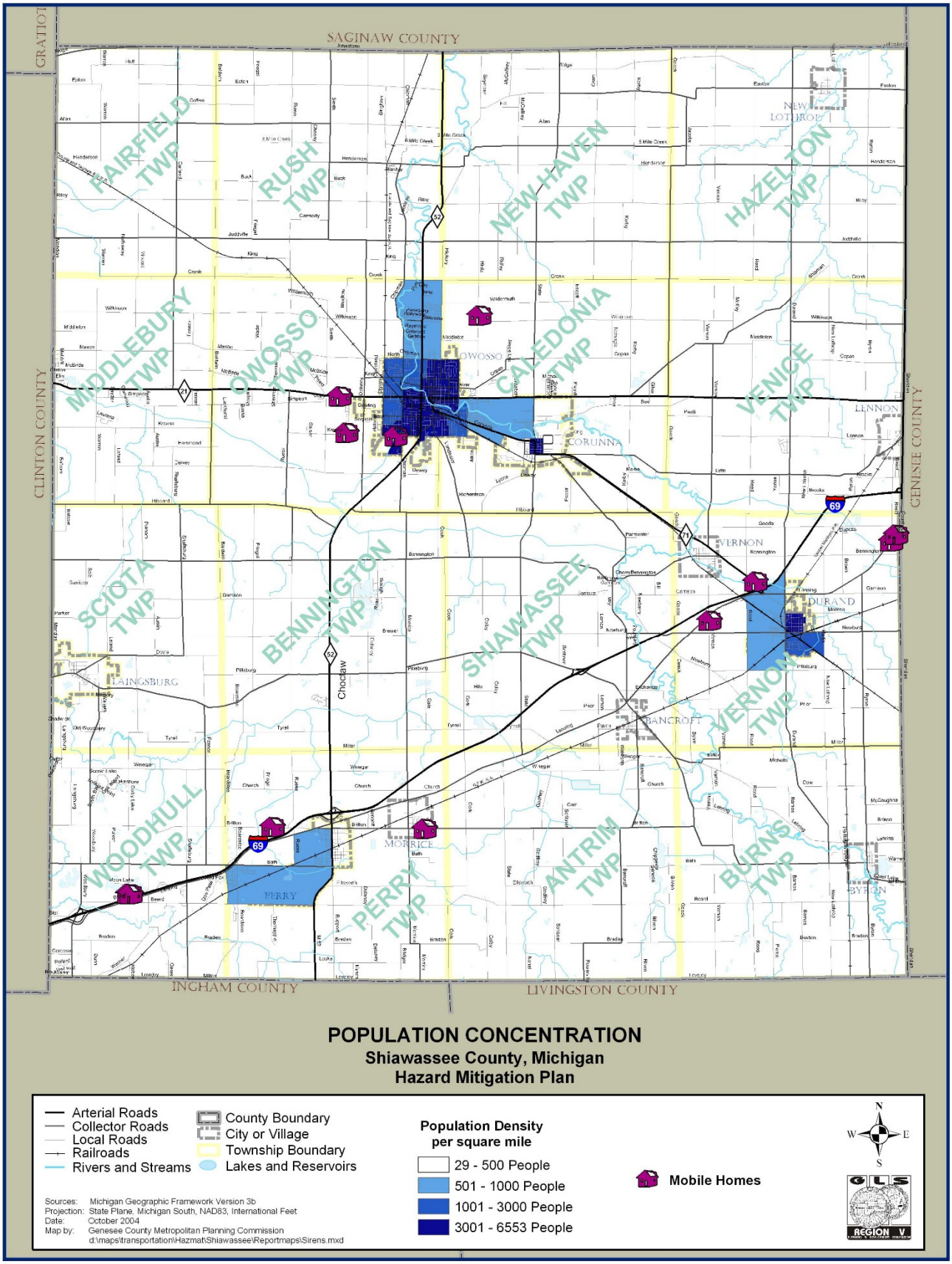
Shiawassee County, Michigan
Hazard Mitigation Plan

GLS REGION V PLANNING & DEVELOPMENT COMMISSION

- Arterial Roads
- Collector Roads
- Local Roads
- Railroads
- Rivers and Streams
- County Boundary
- City or Village
- Township Boundary
- Lakes and Reservoirs

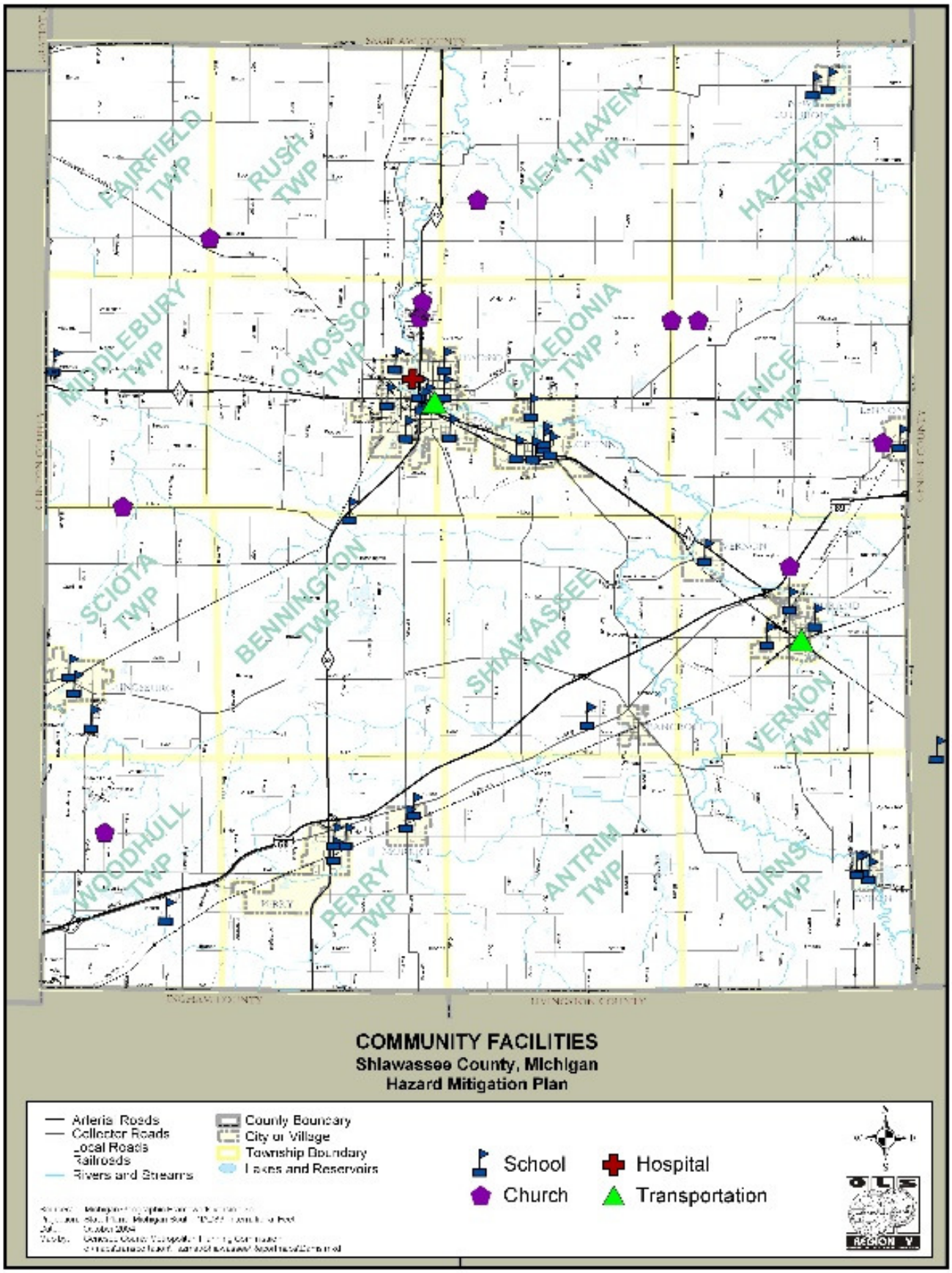
N W E S

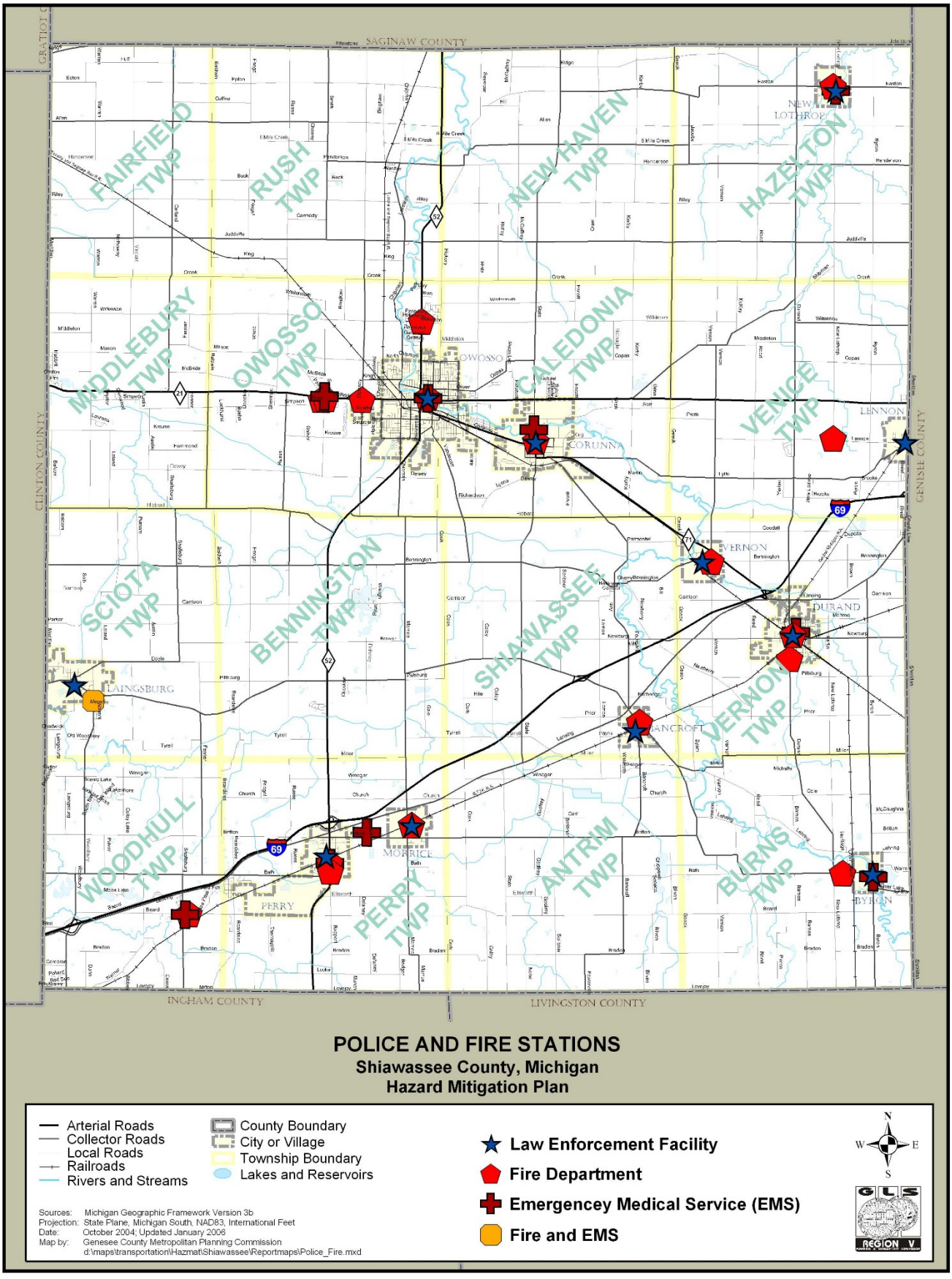
Sources: Michigan Geographic Framework Version 3b
Projection: State Plane, Michigan South, NAD83, International Feet
Date: July 2004
Map by: Genesee County Metropolitan Planning Commission
d:\maps\transportation\Hazmat\Shiawassee\Reportmaps\Dams.mxd



POPULATION CONCENTRATION
Shiawassee County, Michigan
Hazard Mitigation Plan

Sources: Michigan Geographic Framework Version 3b
Projection: State Plane, Michigan South, NAD83, International Feet
Date: October 2004
Map by: Genesee County Metropolitan Planning Commission
d:\maps\transportation\Hazmat\Shiawassee\Reportmaps\Sirens.mxd


FAIRFIELD TWP
RUSH TWP
NEW HAVEN TWP
HAZELTON TWP
MIDDLEBURY TWP
OWOSSO TWP
CALEDONIA TWP
VENICE TWP
SCIOTA TWP
BENNINGTON TWP
SHIAWASSEE TWP
VERNON TWP
WOODHULL TWP
PERRY TWP
ANTRIM TWP
BURNS TWP
PERRY
SHIAWASSEE COUNTY
GENESEE COUNTY
COMMUNITY FACILITIES
Shiawassee County, Michigan
Hazard Mitigation Plan
Arterial Roads
Collector Roads
Local Roads
Railroads
Rivers and Streams
County Boundary
City or Village
Township Boundary
Lakes and Reservoirs
School
Church
Hospital
Transportation
REGION V



POLICE AND FIRE STATIONS

Shiawassee County, Michigan
Hazard Mitigation Plan

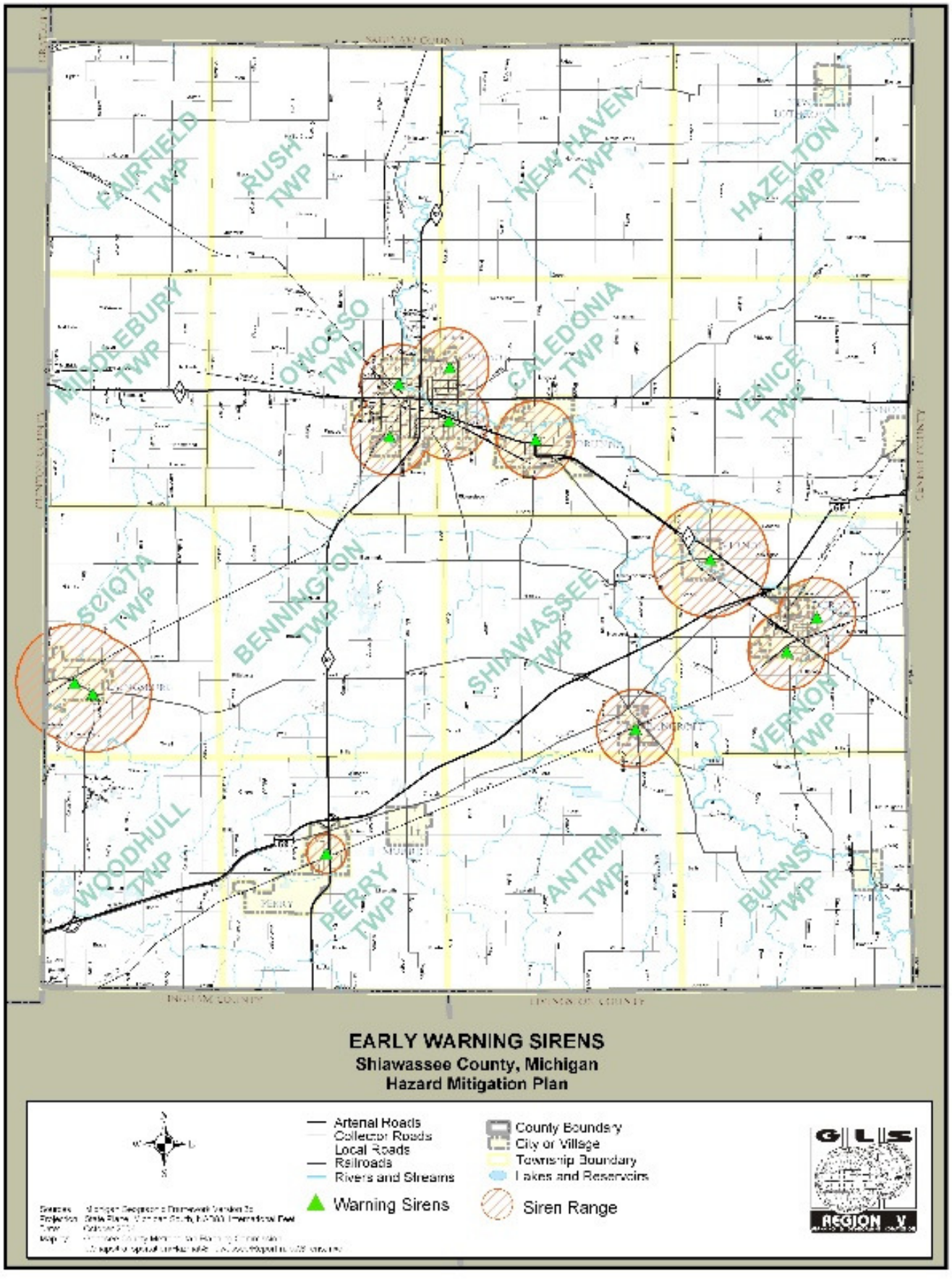
- Arterial Roads
- Collector Roads
- Local Roads
- Railroads
- Rivers and Streams
- County Boundary
- City or Village
- Township Boundary
- Lakes and Reservoirs

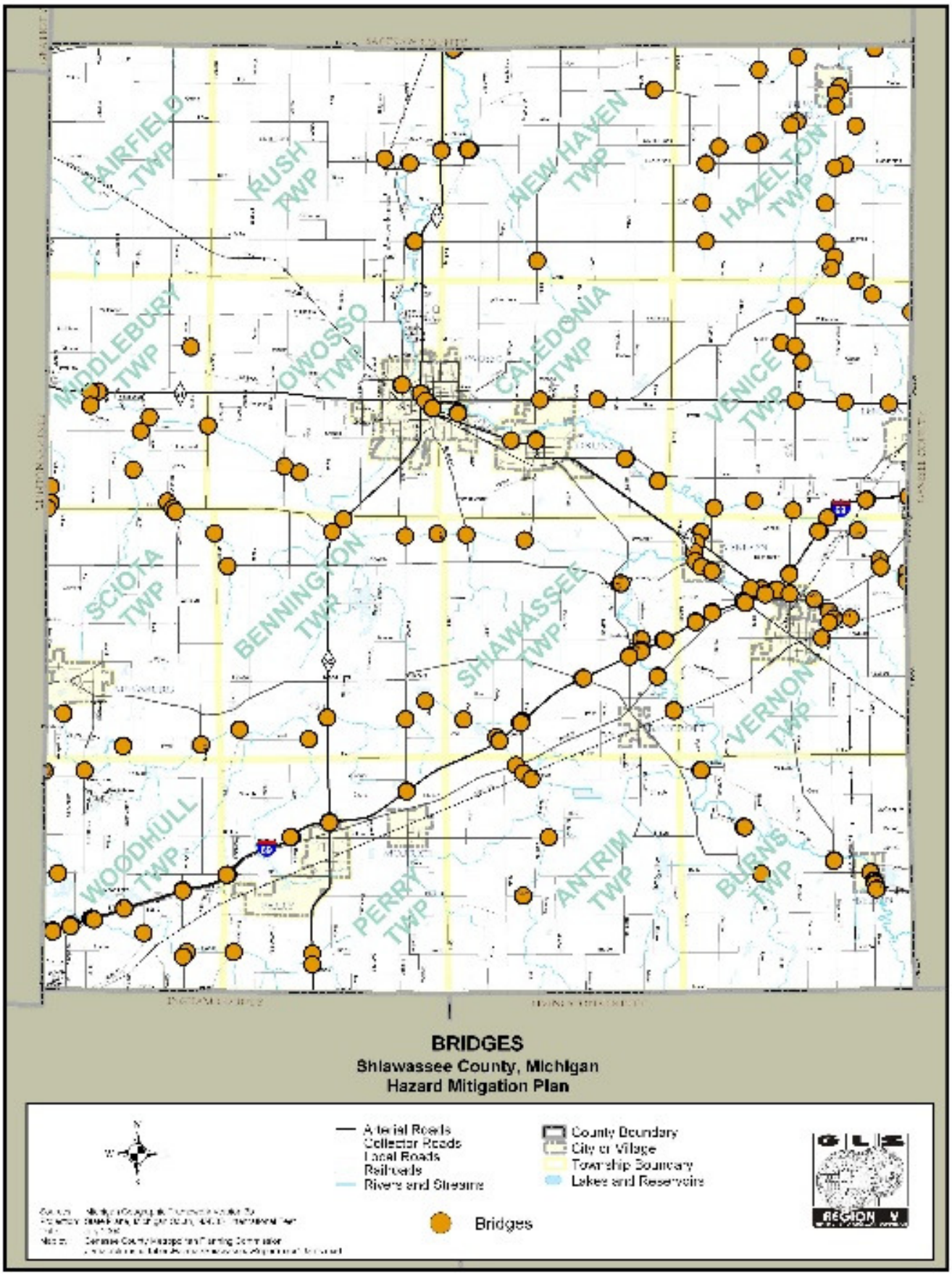
- **Law Enforcement Facility**
- **Fire Department**
- **Emergency Medical Service (EMS)**
- **Fire and EMS**

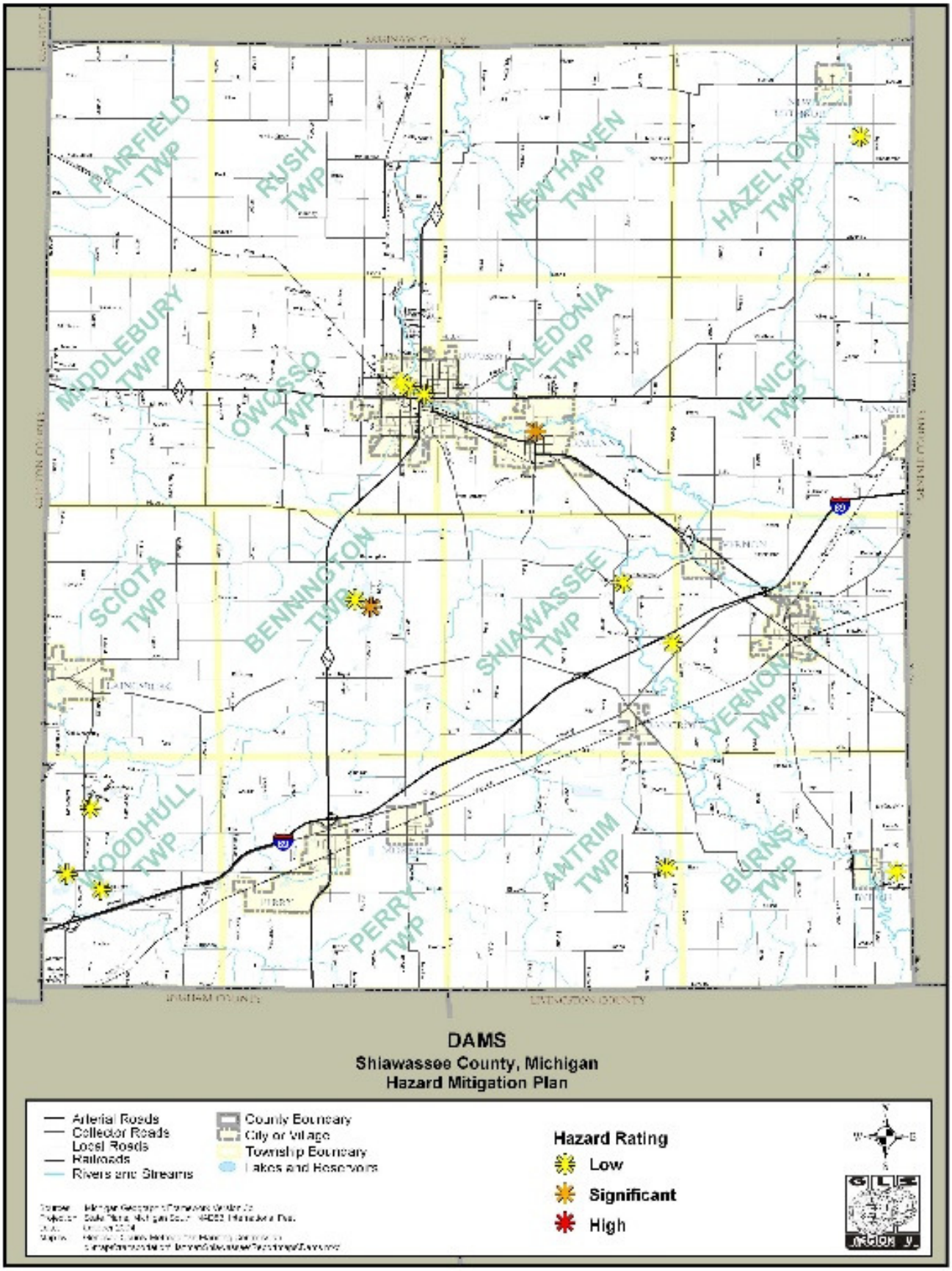
N
W E
S

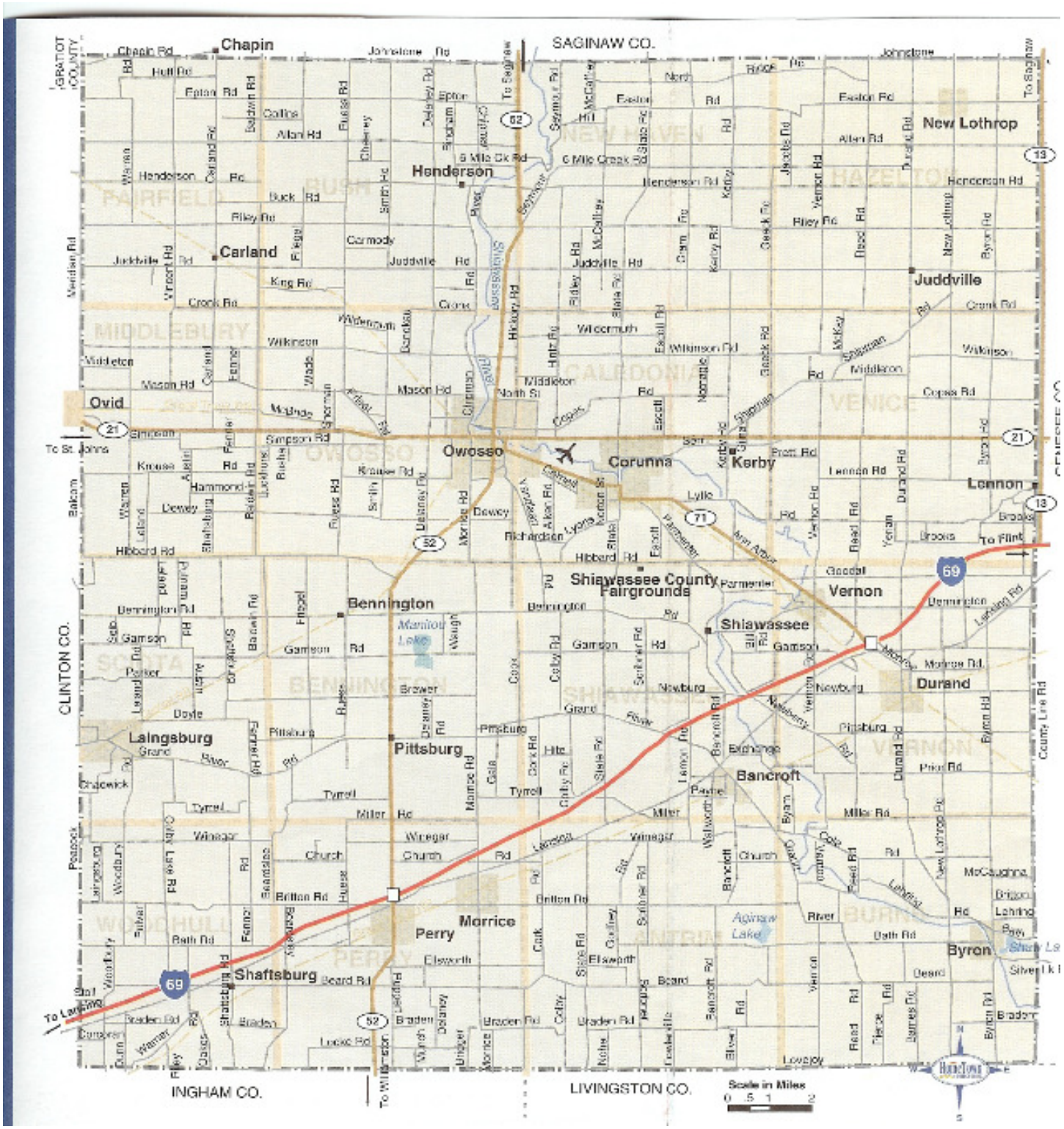
Sources: Michigan Geographic Framework Version 3b
Projection: State Plane, Michigan South, NAD83, International Feet
Date: October 2004; Updated January 2006
Map by: Genesee County Metropolitan Planning Commission
d:\maps\transportation\Hazmat\Shiawassee\Reportmaps\Police_Fire.mxd

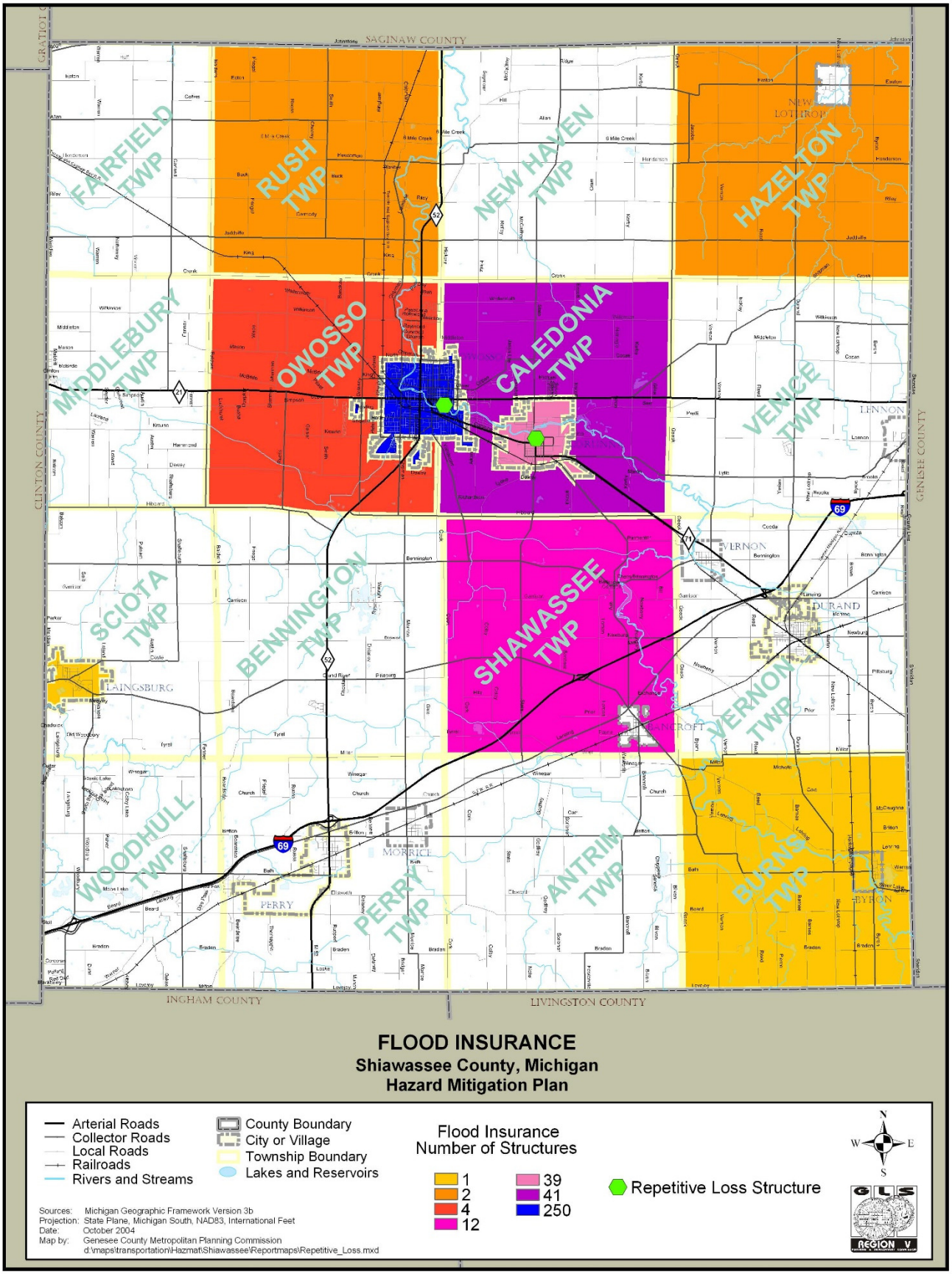
GLS REGION V


FAIRFIELD TWP
RUSH TWP
NEW HAVEN TWP
HAZELTON TWP
MIDDLEBURY TWP
OWOSSO TWP
CALEDONIA TWP
VENICE TWP
SCIOTA TWP
BENNINGTON TWP
SHIAWASSEE TWP
VERNON TWP
WOODHULL TWP
PERRY TWP
ANTRIM TWP
BURNS TWP
PERRY
SHIAWASSEE COUNTY
CLINTON COUNTY
GENESEE COUNTY
EARLY WARNING SIRENS
Shiawassee County, Michigan
Hazard Mitigation Plan
N
W
E
S
Arterial Roads
Collector Roads
Local Roads
Railroads
Rivers and Streams
Warning Sirens
County Boundary
City or Village
Township Boundary
Lakes and Reservoirs
Siren Range
GLS
REGION V


FAIRFIELD TWP
RUSH TWP
NEW HAVEN TWP
HAZELTON TWP
MIDDLEBURY TWP
OWOSSO TWP
CALEDONIA TWP
VENICE TWP
SCIOTA TWP
BENNINGTON TWP
SHIAWASSEE TWP
VERNON TWP
WOODHULL TWP
PERRY TWP
ANTRIM TWP
BURNS TWP
BRIDGES
Shiawassee County, Michigan
Hazard Mitigation Plan
Arterial Roads
Collector Roads
Local Roads
Railroads
Rivers and Streams
County Boundary
City or Village
Township Boundary
Lakes and Reservoirs
Bridges
GLS
REGION V

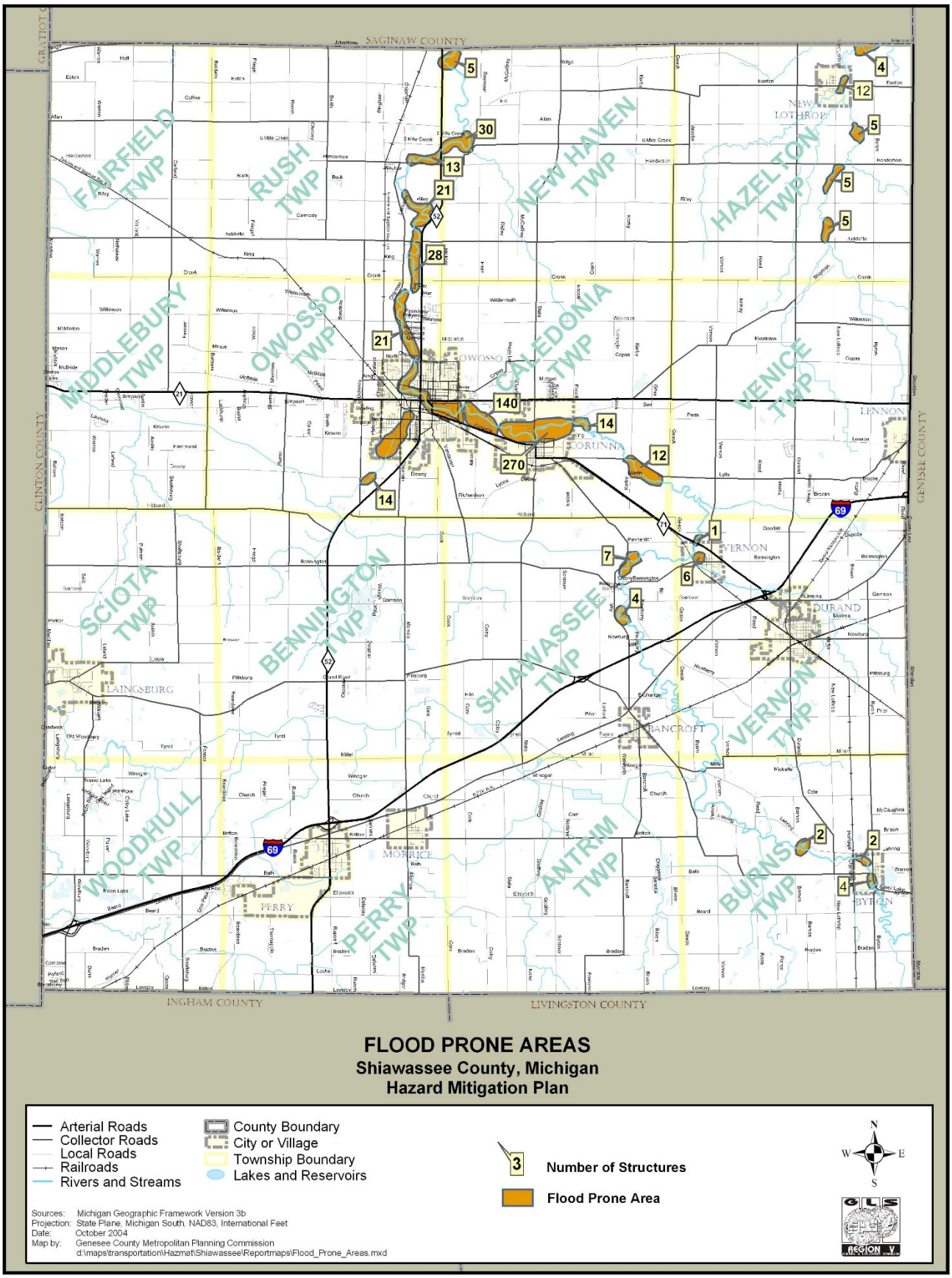

FAIRFIELD TWP
RUSH TWP
NEW HAVEN TWP
HAZELTON TWP
MIDDLEBURY TWP
OWOSSO TWP
CALEDONIA TWP
VENICE TWP
SCIOTA TWP
BENNINGTON TWP
SHIAWASSEE TWP
VERNON TWP
WOODHULL TWP
PERRY TWP
ANTRIM TWP
BURNS TWP
DAMS
Shiawassee County, Michigan
Hazard Mitigation Plan
Arterial Roads
Collector Roads
Local Roads
Railroads
Rivers and Streams
County Boundary
City or Village
Township Boundary
Lakes and Reservoirs
Hazard Rating
Low
Significant
High


Chapin
SAGINAW CO.
New Lothrop
Henderson
Carland
Juddville
Ovid
Owosso
Corunna
Kerby
Lennon
Shiawassee County Fairgrounds
Vernon
Bennington
Shiawassee
Durand
Laingsburg
Pittsburg
Bancroft
Perry
Morrice
Byron
Shaftsburg
CLINTON CO.
INGHAM CO.
LIVINGSTON CO.
To St. Johns
To Flint
To Lansing
To Williamston
Scale in Miles
0 .5 1 2



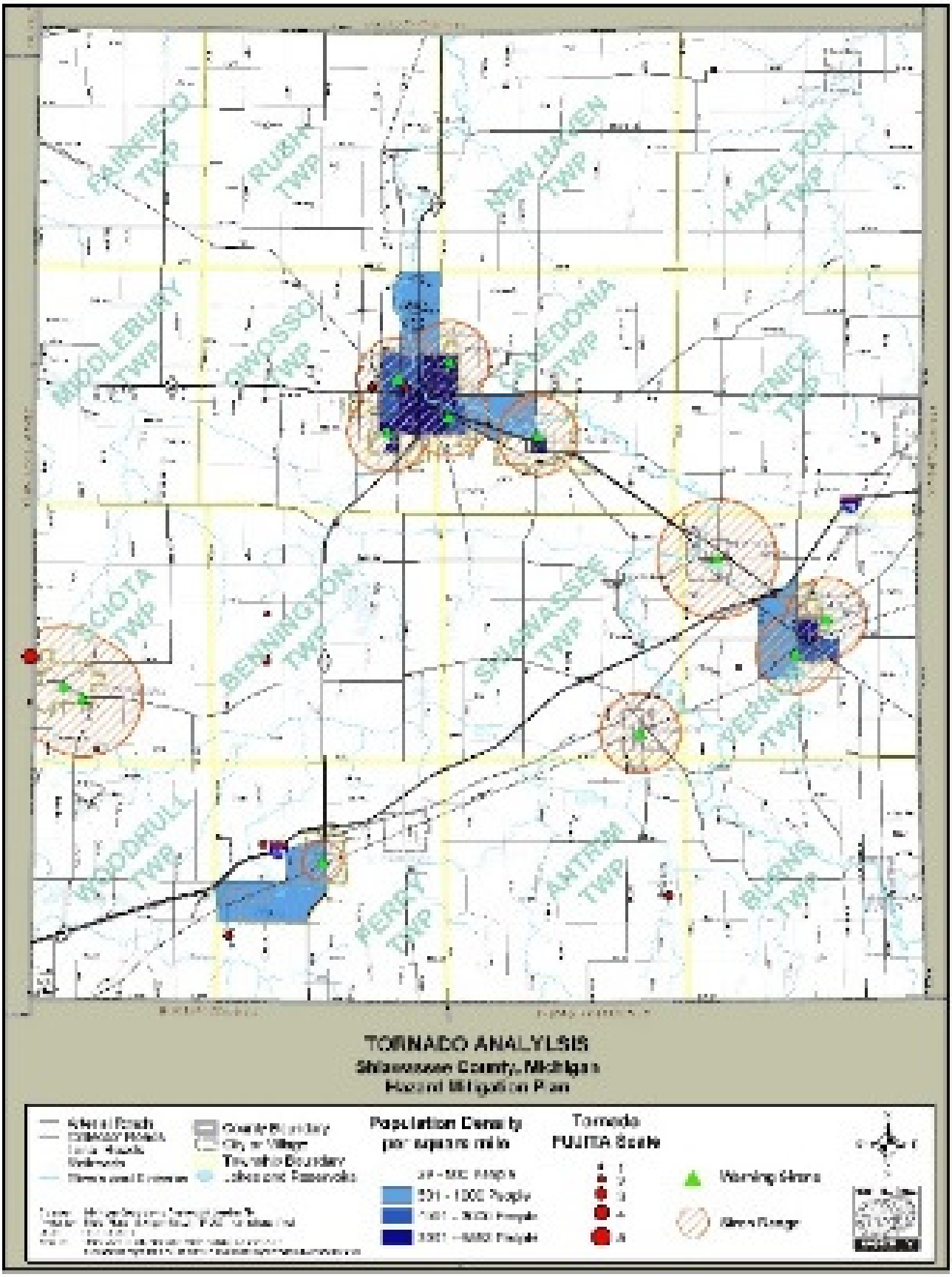
FLOOD INSURANCE
Shiawassee County, Michigan
Hazard Mitigation Plan

Sources: Michigan Geographic Framework Version 3b
Projection: State Plane, Michigan South, NAD83, International Feet
Date: October 2004
Map by: Genesee County Metropolitan Planning Commission
d:\maps\transportation\Hazmat\Shiawassee\Reportmaps\Repetitive_Loss.mxd



FLOOD PRONE AREAS
Shiawassee County, Michigan
Hazard Mitigation Plan

Sources: Michigan Geographic Framework Version 3b
Projection: State Plane, Michigan South, NAD83, International Feet
Date: October 2004
Map by: Genesee County Metropolitan Planning Commission
d:\maps\transportation\Hazmat\Shiawassee\Reportmaps\Flood_Prone_Areas.mxd



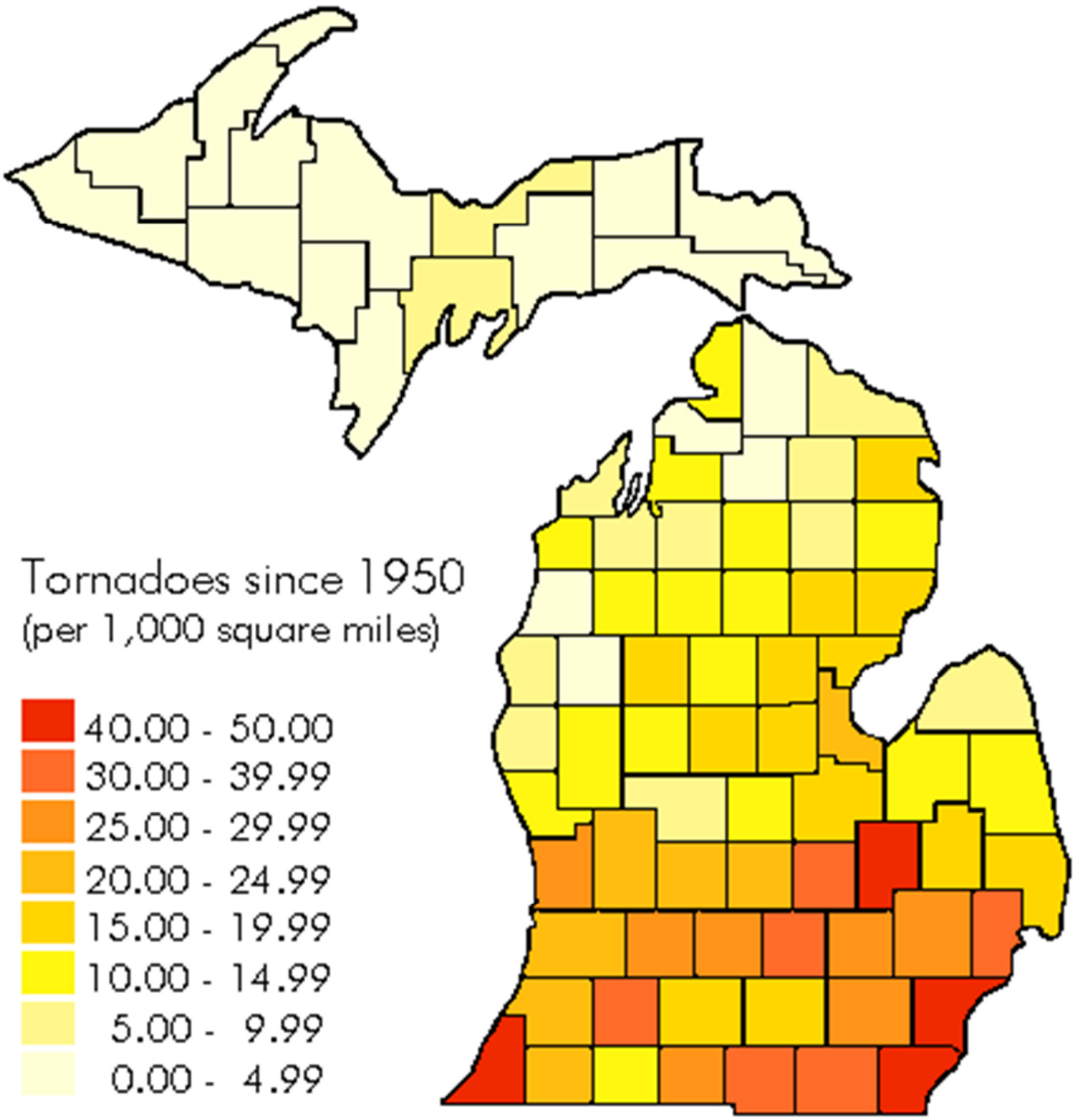
TORNADO ANALYSIS

Shiawassee County, Michigan

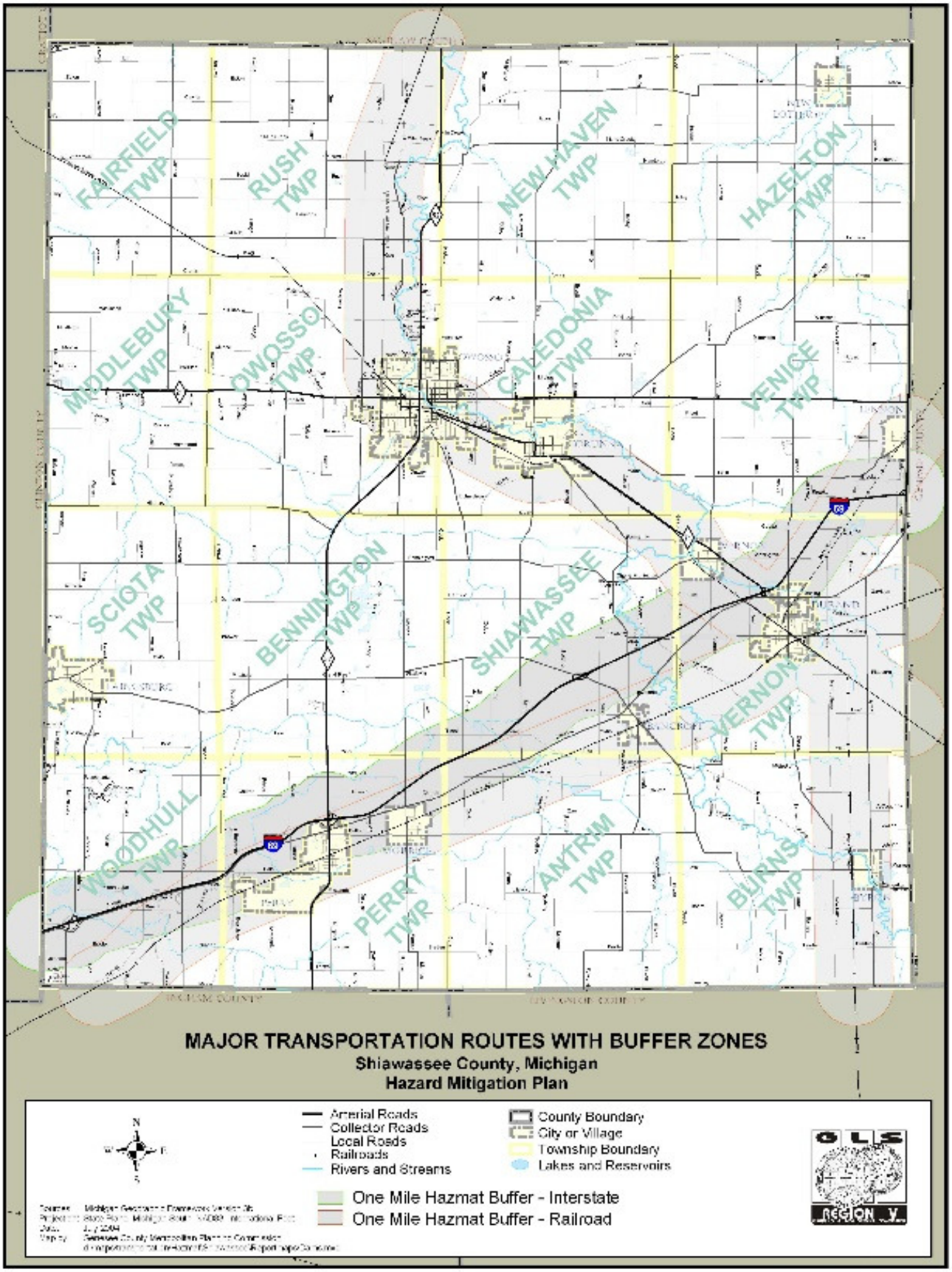
Hazard Mitigation Plan

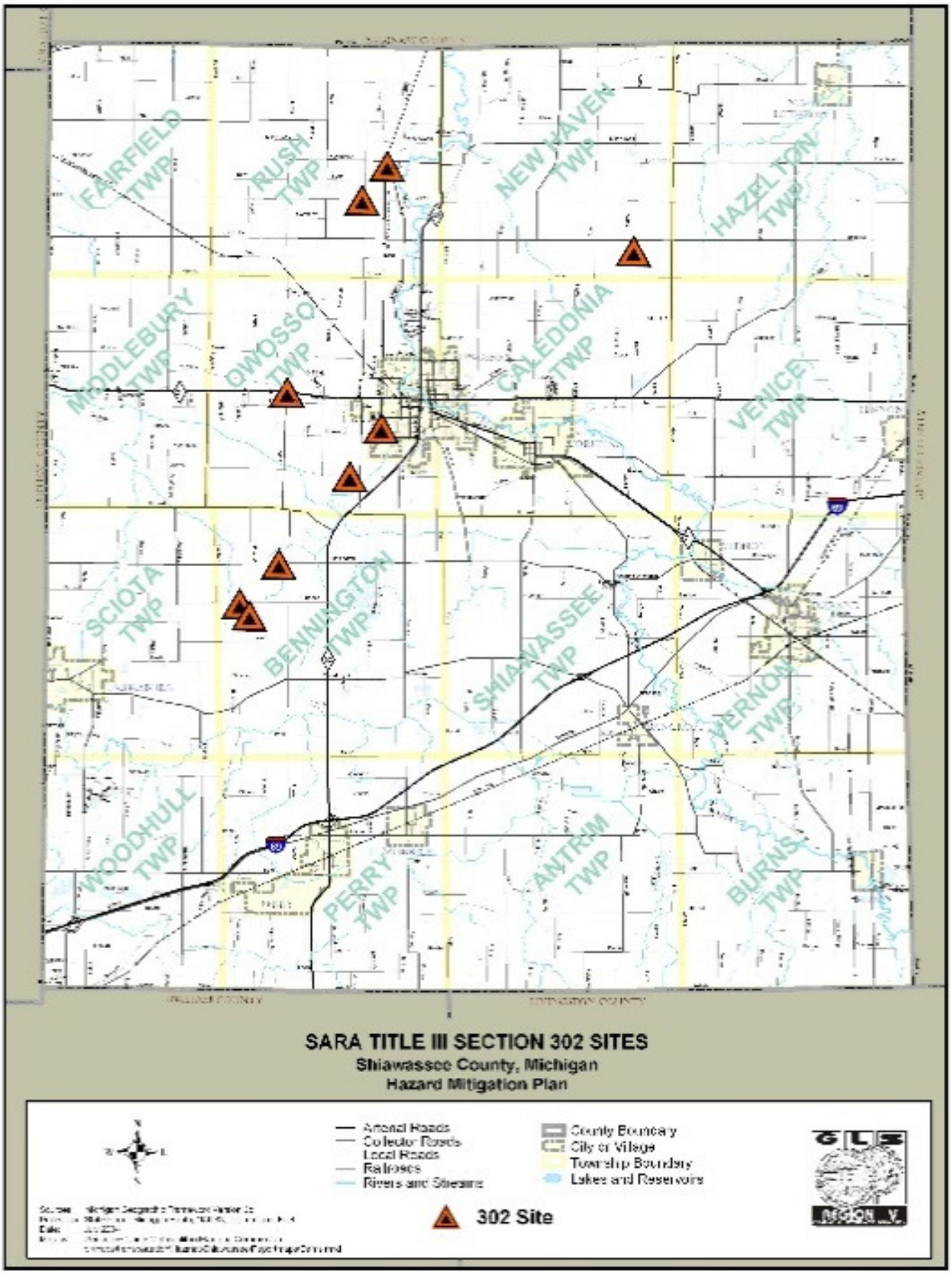
Thunderstorm Days Per Year:
State of Michigan Averages

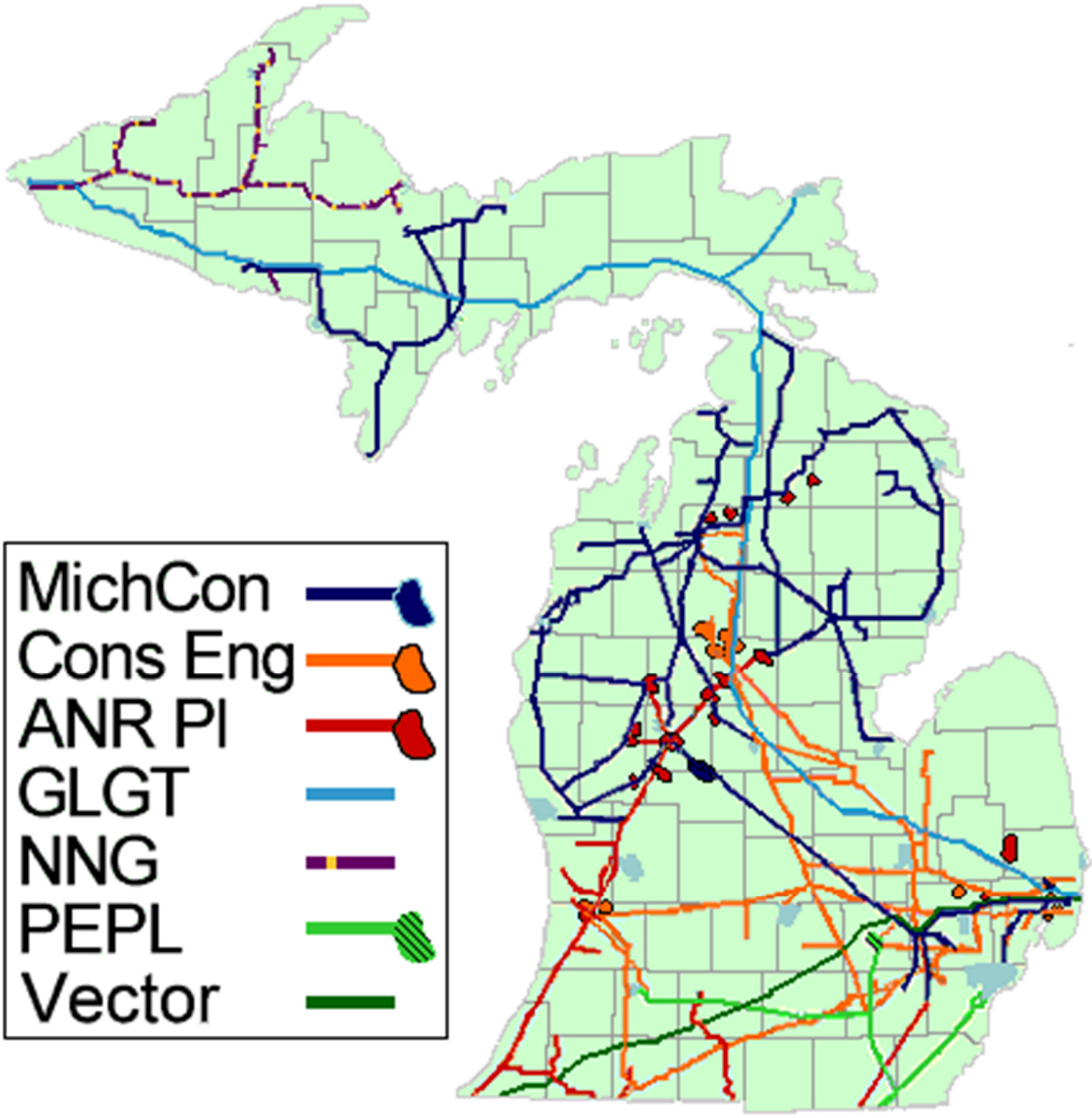
Produced by:
Michigan State Police
Emergency Management Division
20 November 2000



Source: Michigan State University, Department of Geography


FAIRFIELD TWP
RUSH TWP
NEW HAVEN TWP
HAZELTON TWP
MIDDLEBURY TWP
OWOSSO TWP
CALEDONIA TWP
VENICE TWP
SCIOTA TWP
BENNINGTON TWP
SHIAWASSEE TWP
VERNON TWP
WOODHULL TWP
PERRY TWP
ANTRIM TWP
BURNS TWP
MAJOR TRANSPORTATION ROUTES WITH BUFFER ZONES
Shiawassee County, Michigan
Hazard Mitigation Plan
N
W
E
S
Arterial Roads
Collector Roads
Local Roads
Railroads
Rivers and Streams
County Boundary
City or Village
Township Boundary
Lakes and Reservoirs
One Mile Hazmat Buffer - Interstate
One Mile Hazmat Buffer - Railroad
GLS
REGION V

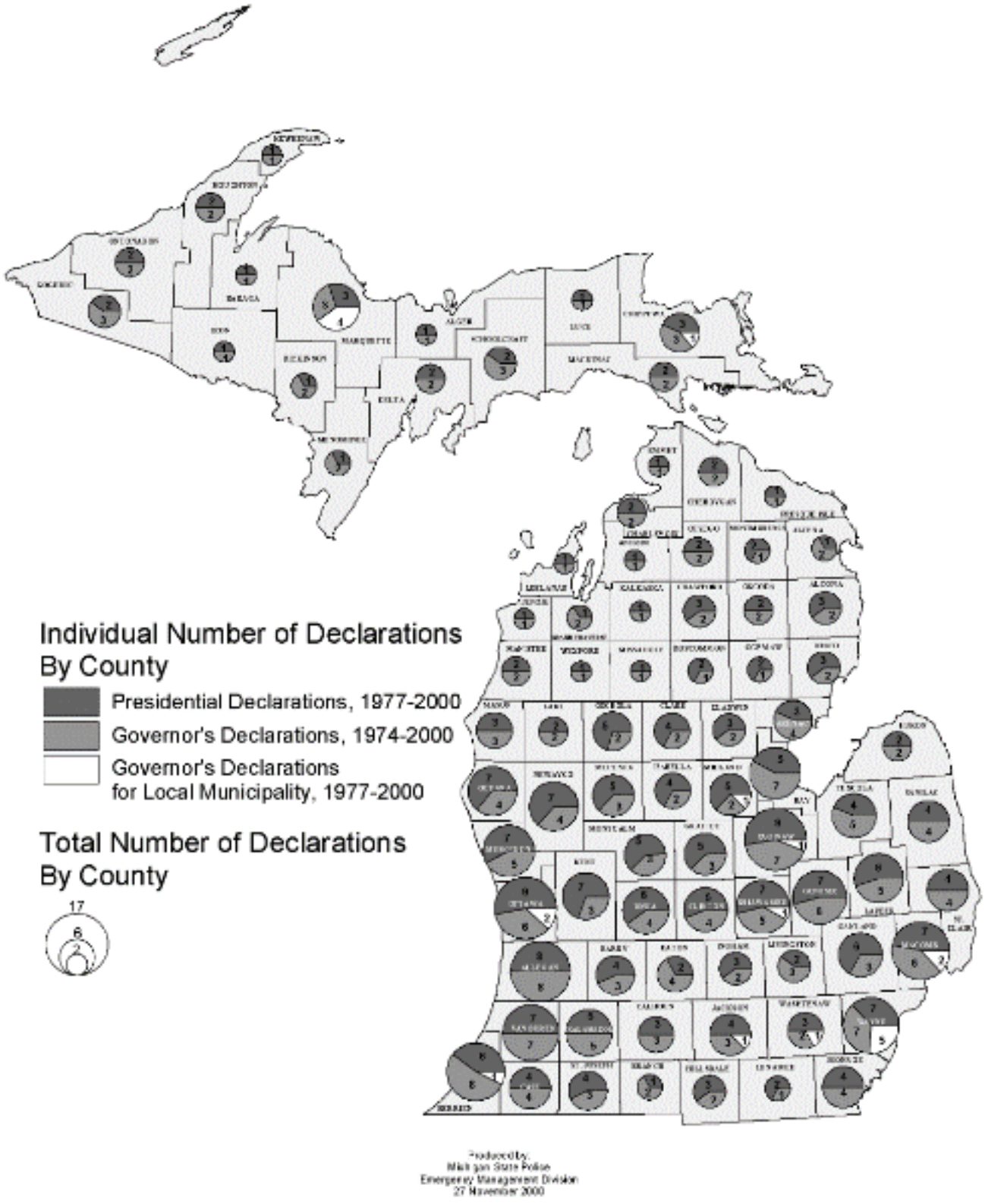

FAIRFIELD TWP
RUSH TWP
NEW HAVEN TWP
HAZELTON TWP
MIDDLEBURY TWP
OWOSSO TWP
CALEDONIA TWP
VENICE TWP
SCIOTA TWP
BENNINGTON TWP
SHIAWASSEE TWP
VERNON TWP
WOODHULL TWP
PERRY TWP
ANTRIM TWP
BURNS TWP
SARA TITLE III SECTION 302 SITES
Shiawassee County, Michigan
Hazard Mitigation Plan
Arterial Roads
Collector Roads
Local Roads
Railroads
Rivers and Streams
County Boundary
City or Village
Township Boundary
Lakes and Reservoirs
302 Site
GLS
MSDN_V



Source: Department of Licensing and Regulatory Affairs

Potential Dam Hazards (6/98)

Governor's & Presidential Declarations, by Jurisdiction



APPENDIX 3- SUPPLEMENTAL INFORMATION