Hazard Mitigation Plan

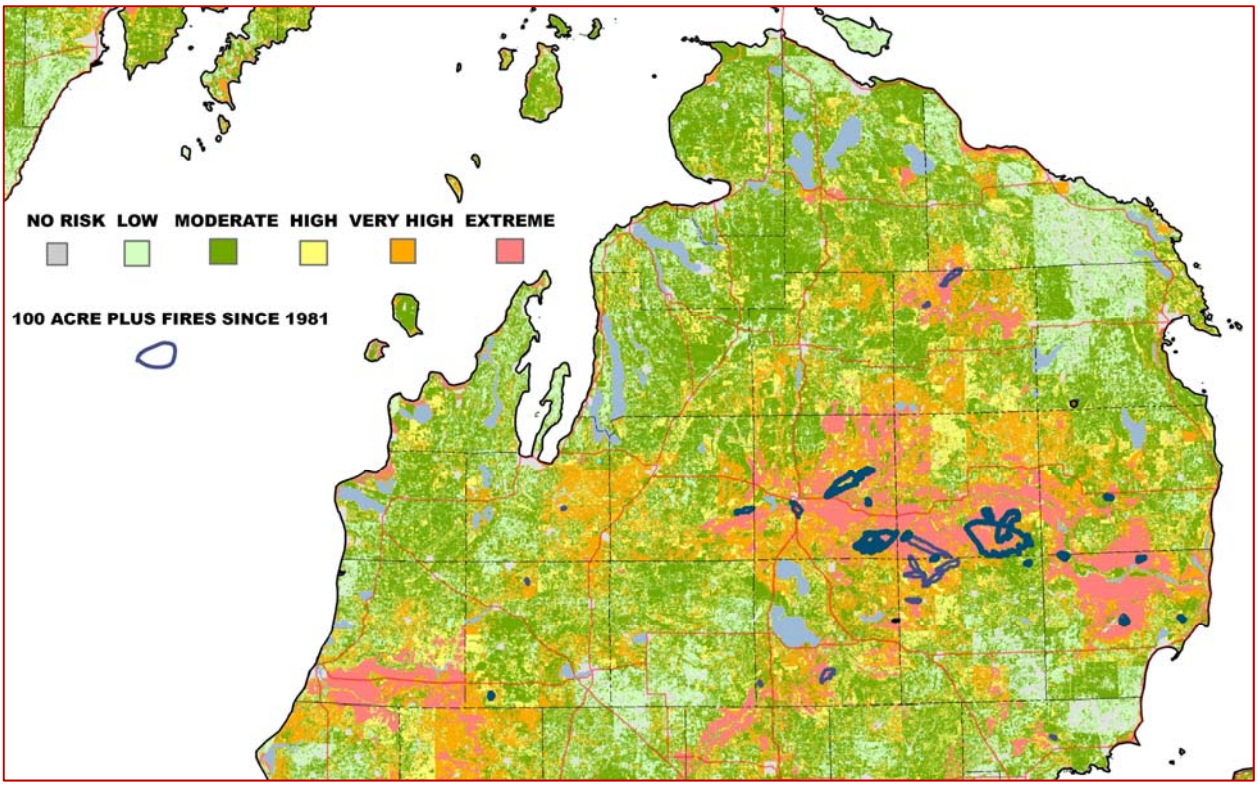
Crawford County Michigan

Crawford County Office of Emergency Management
202 W. Michigan Ave.
Grayling, MI 49738

2014

Hazard Mitigation Plan

Crawford County Michigan



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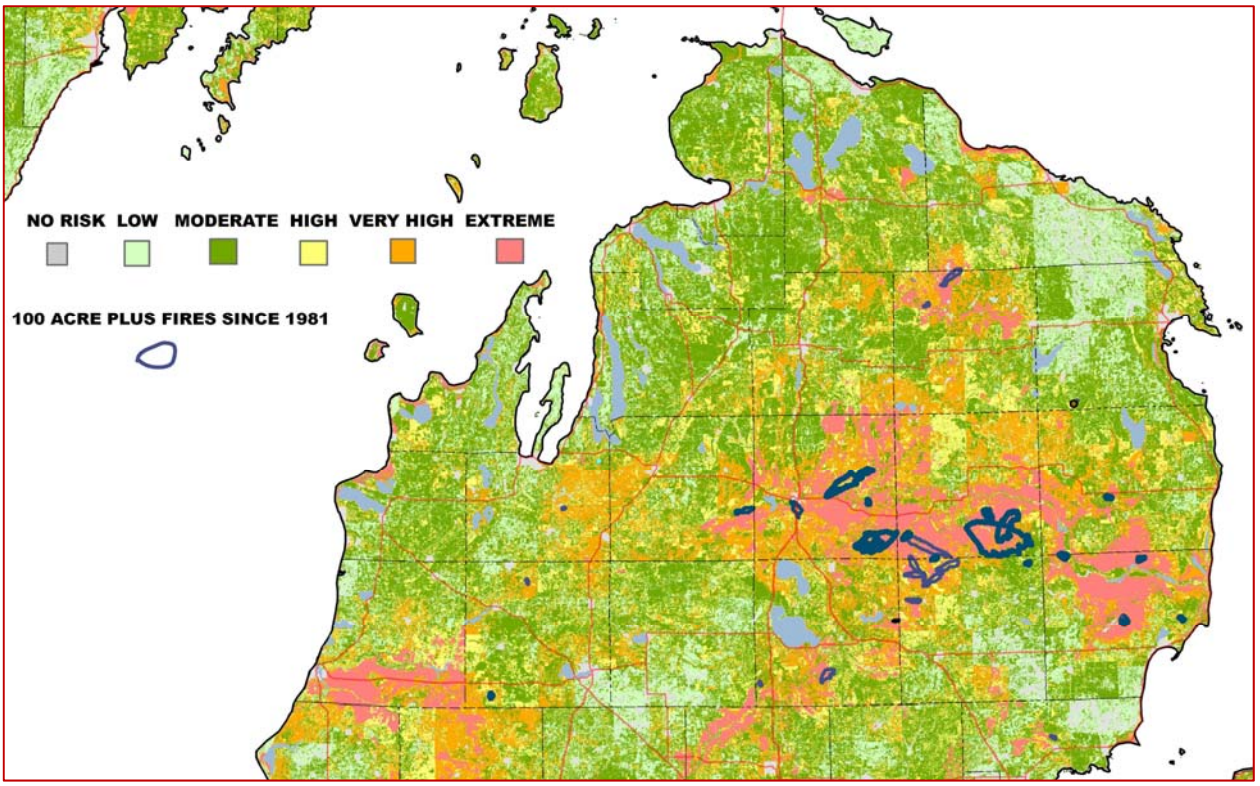

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CRAWFORD COUNTY HAZARD MITIGATION PLAN

Crawford County, Michigan

Prepared for:

Crawford County
and the
Communities of Crawford County

Prepared by:

Northeast Michigan Council of Governments
121 East Mitchell Street
P. O. Box 457
Gaylord, Michigan 49735

Adopted:

CRAWFORD COUNTY
HAZARD MITIGATION PLAN
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Chapter 1 - Introduction

Overview

Crawford County is located in the north central Lower Peninsula of Michigan. The county is composed of six townships: Grayling Township, Frederic Township, Maple Forest Township, Lovells Township, South Branch Township, and Beaver Creek Township. Also located in Crawford County is the City of Grayling, which is the county seat **(Figure 1.1)**.

Location and Regional Setting

Crawford County is approximately inland 35 miles from Lake Michigan and approximately 50 miles inland from Lake Huron. It is bordered on the east by Crawford County, on the south by Roscommon County, on the west by Kalkaska County, and on the north by Otsego County. Crawford County has a land area of 558 square miles and a population of 14,273. Its population density is 25.6 people per square mile.

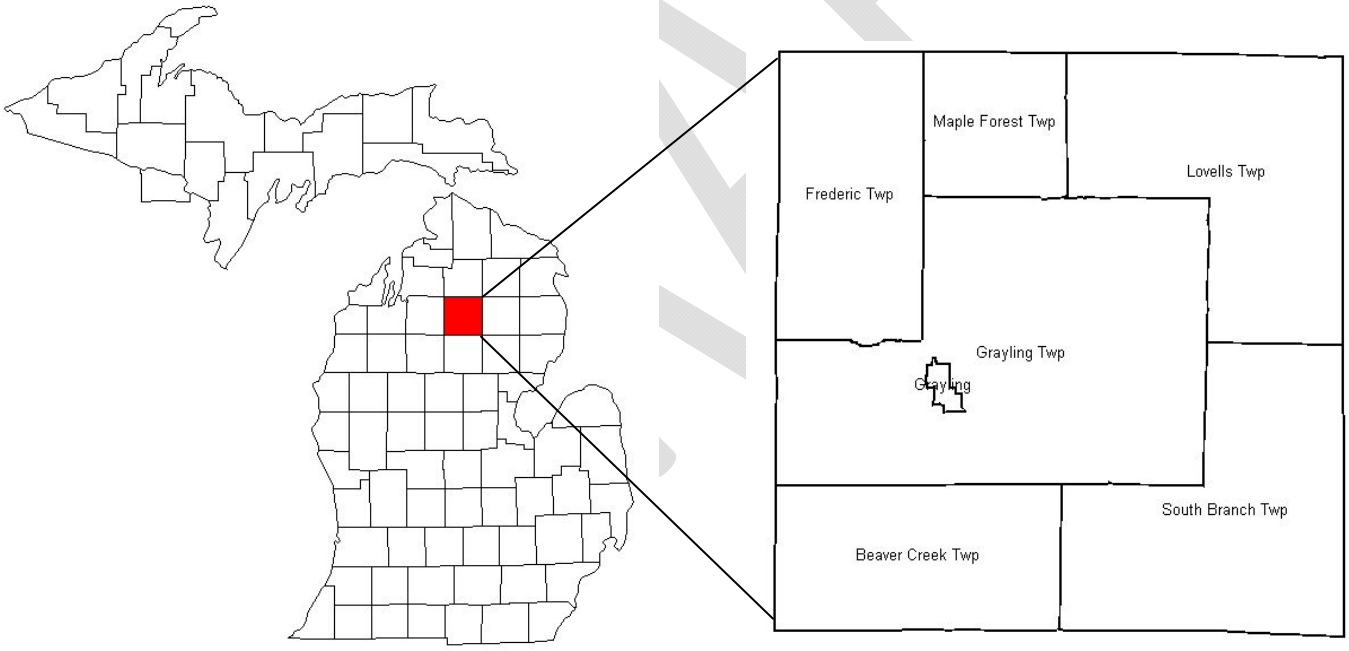


Figure 1.1

Purpose and Approach

In partnership with seven counties in Northeastern Lower Peninsula of Michigan, Northeast Michigan Council of Governments (NEMCOG) worked with each county in its region to prepare hazard mitigation plans. The Disaster Mitigation Act (DMA) of 2000 included new requirements for hazard mitigation planning. In order to become eligible for hazard mitigation grant program

funds in the future, counties must prepare and adopt hazard mitigation plans. The County prepared its first Hazard Mitigation Plan in 2005. This planning document represents an update of the 2005 plan.

The intent of a hazard mitigation plan is to inventory possible hazards, assess the vulnerability of community to hazards it faces, and to provide possible mitigation activities for those hazards. *The focus of the hazard mitigation plan is development of projects and policies that can be implemented to reduce or prevent losses from future disasters.* The **Crawford County Hazard Mitigation Plan** includes text, tables charts and maps necessary to describe and discuss the following: 1) a hazard analysis based on a current community profile, hazard identification, risk assessment, and vulnerability assessment; 2) a listing of the communities goals and objectives; 3) a discussion of the alternatives for solving problems; 4) evaluation and prioritization of alternatives; 5) selection of feasible mitigation strategies; and 6) recommended mitigation strategies. The plan contains a hazard mitigation element that can be easily integrated into county or township comprehensive plans.

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

- Reviewed and updated Chapter 2: Environment. Updated information on the climate, soils, sites of environmental contamination, wetlands, discharge permits.
- Reviewed and updated Chapter 3: Community Profile. Updated demographics and housing information
- Reviewed and updated Chapter 4: Land Use. Updated information on oil and gas wells
- Reviewed and updated Chapter 5: Community Services. Updated all sections of the chapter
- Reviewed and updated Chapter 6: Hazard Identification. The committee updated information on wildfires, severe weather, severe wind storms, extreme temperatures, other natural hazards, and technological hazards. Information on local jurisdictions was updated including compiling new maps for each community.
- Reviewed and updated Chapter 7: Risk and Vulnerability Assessment. Evaluation criteria, and hazard analysis evaluation measures and benchmark factors were reviewed and no changes were made. Crawford County Hazard Rating was reviewed and the committee made adjustments according to updated hazard information. The Risk Assessment and Vulnerability Assessment was updated to reflect data and activities
- Reviewed and updated Chapter 8: Goals and Objectives. The committee added a goal concerning regional cooperation
- Reviewed and updated Chapter 9: Mitigation Strategies and Priorities. The committee made changes to this section, eliminating some actions, adding new actions and amending this list of responsible parties.
- Changes were made to Chapters 1 & 9.

NEMCOG staff worked closely with the Crawford County Emergency Management Director and Local Emergency Planning Committee to prepare this Hazard Mitigation Plan. In addition, considerable effort was made to gain input from stakeholders in the county. This included meetings with townships; township association; county board of commissioners; local, state and federal agencies; local officials; community leaders and general public.

Information Collection

NEMCOG reviewed relevant plans, maps, studies and reports. Federal, state, regional and local government sources were reviewed to develop a current community profile. Information sources

included: U.S. Census, zoning ordinances, master plans, recreation plans, capital improvement plans, parcel maps, aerial photography, MIRIS land use/land cover, USGS topographic maps, U.S. Weather Service, NRCS soils maps, Michigan Department of Transportation, Michigan Hazard Analysis, local hazard analysis, Flood Insurance Rate Maps, emergency management plans, and Section 302 Sites from the LEPC.

Geographic Information System Support

NEMCOG's Geographic Information System (GIS) was used as a decision support tool and public education tool throughout the process. Existing data sets were incorporated and new data sets created in order to analyze existing conditions and study potential future scenarios. Specialized maps showing community hazards, land cover/use, infrastructure, topography, soils, national wetlands inventory, forest cover, gas and oil wells, zoning, future land use and community facilities were prepared as part of the plan development. Maps helped identify community characteristics, vulnerable populations, and hazard areas. GIS data and maps will be retained by the community for future use to help implement and monitor hazard mitigation activities.

Increased Community Awareness of Hazards and Hazard Mitigation

Information was disseminated to the communities and public through the use of public meetings, presentations, news releases, and contacts. A secondary benefit of the planning process was the education of community leaders and citizens of the community in regards to hazard awareness. This education supported the decision making process and will assist communities in making better, more informed decisions in the future. In addition, the process strengthened partnerships between local units of government, planning commissions, emergency services, public agencies and private interests to pool resources and helped facilitate communication and understanding between various entities. By fostering lines of communication and increasing awareness of the cross jurisdictional impacts of land use and policy decisions, better and more informed decisions will be made in the future.

Hazard Mitigation Steering Committee

The hazard mitigation plan was developed through the Local Emergency Planning Committee. The committee has representatives from local units of governments; local, state and federal agencies; law enforcement, fire departments and community organizations. Committee members provided feedback throughout plan development, including identification of hazards and high hazard areas, identification of hazard mitigation strategies and selection of an action plan.

Community Involvement

The planning process provided several opportunities for public, community and agency input and comments. Public meetings involved the County Board of Commissioners during plan development and the draft plan was presented for commissioners' approval. Staff met with the Local Emergency Planning Committee during plan development. The group, together with the Emergency Management Director, was instrumental in guiding plan development. Public meetings were noticed and held in Crawford County. Notices of the public meetings were sent to LEPC members and local communities officials.

Meetings:

Region 7 Meeting – January 5, 2012 Provided information on the planning updates. Also, NEMCOG staff met with county Emergency Managers prior to the regional meeting.

Crawford County Mitigation Planning Committee (LEPC): Meeting to discuss the planning process and existing conditions sections of the plan, January 11, 2012

Crawford County Mitigation Planning Committee (LEPC): subcommittee meeting to update risk and vulnerability assessment, goals and objectives, and mitigation strategies, June 13, 2012.

Crawford County Firewise Planning Committee: Meeting to discuss wildfire and Firewise planning activities in Crawford County. July 26, 2012

Crawford County Mitigation Planning Committee (LEPC): Meeting to discuss Wildfire Protection planning and Firewise: August 2, 2012

Crawford County Mitigation Planning Committee (LEPC): Review draft plan and approve for review and comment. _____, 2013

Crawford County Township Association: _____, 2013

Crawford County Board of Commissioners: _____, 2014

Governmental Participation

During the two-year development of the Crawford County Hazard Mitigation Plan representatives from all local governmental units participated directly in one or more planning and prioritization meetings held around the county. In addition to Crawford County government, local jurisdictions, community organizations, and state and federal agencies were involved in the process. The following communities are continuing participants in the Crawford County Hazard Mitigation Plan.

Beaver Creek Township
Frederic Township
Grayling Township
Lovells Township
Maple Forest Township
South Branch Township
City of Grayling

Public Input for Plan Approval

A copy of the draft plan on CD was sent to local communities and any agencies requesting a copy for review. In addition, the plan was posted on NEMCOG's web site and a copy of the plan was available for review at the Crawford County Emergency Management Office.

Review and Adoption of Plan

The steering committee, stakeholders and the public reviewed a draft plan. Comments and suggestions obtained in the 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. Upon final approval, the hazard mitigation plan will be presented to the

Crawford County Board of Commissioners. Requests will be to the Grayling City Council and all Township Boards of Trustees for their review and adoption.

Recommended Plan Implementation Process

A Hazard Mitigation Committee (HMC), was formed from members of the County LEPC, and will be the local group responsible for overseeing implementation of this plan. The Crawford County Emergency Management Director will function on an ad-hoc basis as county staff providing program administration and project oversight. The HMC will develop a five-year action list of projects from the mitigation strategies identified in the Crawford County Hazard Mitigation Plan. The HMC should review the hazard mitigation plan each year, to determine what projects have been accomplished and add new projects to the five-year action list. The Hazard Mitigation Committee may assist other agencies to identify steps needed to accomplish a chosen project, such as funding sources, staff and agencies required to complete project, timelines and overall project costs. It should be understood, that HMC involvement will be determined by available emergency management staff time.

Since the Hazard Mitigation Committee is a subcommittee of the Crawford County LEPC, it will function, as does the LEPC, under the umbrella of the Crawford County Board of Commissioners. Members of the HMC must be members of the LEPC, who in turn are appointed by the County Board. Staff support will be provided by the Crawford County Emergency Management office which functions as a county department and therefore the program must coordinate with the County Board of Commissioners.

Local units of government, county departments, and local, state and federal agencies will have the ability to propose and sponsor projects identified in the hazard mitigation plan. The HMC will coordinate and support plan implementation as well as monitor progress and determine timing and scope of plan revisions.

Chapter 2 - Environment

Overview

The greatest attraction for the residents and visitors of northern Michigan is the area's environment and rural characteristics. Recreational activities such as hunting, fishing, golfing, snowmobiling, boating and a multitude of other outdoor activities attract people from urban areas of Michigan, as well as from other states. Many long time visitors have chosen to move to northern Michigan upon retirement. Because of the abundant outdoor recreation opportunities, the natural environment is a major economic base and income generator.

Climate

The continental type of climate at Grayling is characterized by larger temperature ranges than in areas at the same latitude near the Great Lakes, which have moderated temperatures. As a result of the prevailing westerly winds, this region experiences some lake effect. However, this is minimal and is essentially limited to increased cloudiness and snowfall during the late fall and early winter. Diminished wind speeds or winds which do not traverse large, unfrozen lakes often produce clearing skies and the colder temperatures expected at continental locations.

Moderately warm temperatures dominate summers. The warmest days occur in the month of July. Between the years of 1971-2000, there was an average of 7 days per year that exceeded the 90-degree mark. Temperatures over 100 degrees have been recorded in the months of June, July, August and September and temperatures in the high 80's have occurred as early as March and as late as October. Normal temperatures for the area range from the high 70's to the low to mid 40's in the summer and from the low 30's to single digits in the winter (**Table 2.1**).

The following temperature extremes for this station are:
Maximum: 104 °F (July 11, 1936)
Minimum: -45 °F (February 3, 1898)
Warmest monthly mean: 75.5 °F (July 1921)
Coldest monthly mean: 4.4 °F (February 1904)

Based on the 1971-2000 period, the average date of the last freezing temperature in the spring was May 30, while the average date of the first freezing temperature in the fall was September 17. The freeze-free period, or growing season, averaged 110 days annually.

In the summer, precipitation comes mainly in the form of afternoon showers and thundershowers. Most precipitation occurs in the months of April-September, which received an average of 20.76 inches or 62% of the average annual total for the 1971-2000 period. During this same period the average wettest month was September, which averaged 4.01 inches, while the average driest month was February which averaged 1.27 inches. The average seasonal snowfall was 104.7 inches. During the 1971 –2000 period, 123 days per season averaged 1 inch or more of snow on the ground but varied greatly from season to season.

The following precipitation extremes for Crawford County are:
Greatest one day precipitation total: 5.02 inches (August 8-9, 1965)
Greatest monthly total: 12.51 inches (September 1986)

Least monthly total: 0.00 inches (April 1889)
Soil moisture replenishment during the fall and winter months plays an important role in the success of agriculture for this area. While drought occurs periodically, the Palmer Drought Index indicated drought conditions reached extreme severity only 2% of the time.

Severe Weather

Data from the National Oceanic and Atmospheric Administration shows that from 2006 through Spring of 2012 there were 37 severe weather events in Crawford County causing over $815,000 in damages.

Although relatively rare, tornados have occurred in Crawford County. Michigan is located on the northeast fringe of the Midwest tornado belt. The lower frequency of tornadoes occurring in Michigan may be, in part, the result of the colder water of Lake Michigan during the spring and early summer months, a prime period of tornado activity. Over the past 35 years, 9 tornados touched down in the County injuring16 people and causing over $350,000 in property damage. Seven of the nine tornados occurred between 1:00 P.M. and 8:00 P.M. The majority of tornados have occurred in the months of May-August, although tornados have occurred as early as April 19 and as late as September 7. The magnitude of a tornado is described by using the Fujita Scale. The Scale ranks tornados from F0 to F6 based on wind speed and intensity. F0 and F1 tornados are described as weak tornados with wind speeds from 40 to 112 mph, F2 and F3 are strong tornados with wind speeds from 113-206 mph, F4 and F5 are violent tornados with wind speeds from 207 to 318 mph, and an F6 is an inconceivable tornado with wind speeds above 319 mph. Of the 9 tornados that have struck Crawford County, two were F2, five were F1, and two were F0. The most destructive tornado was an F2 that occurred on April 19, 1975, causing $250,000 in property damage and injuring 14.

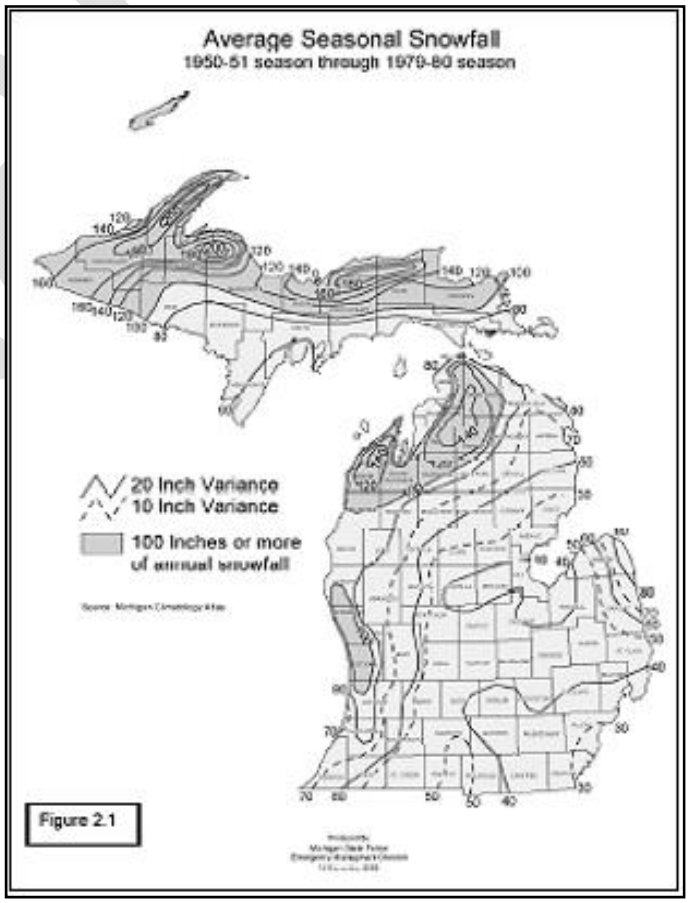


Figure 2.1

Strong winds and thunderstorm winds are the most prevalent severe weather that affects Crawford County. Annually, thunderstorms will occur on an average of 30 days per year with an average of one per year that has severe winds. From 1996 to 2012 there have been six thunderstorm severe wind events in the County. One of the most powerful windstorms ever recorded in the Great Lakes region occurred on November 10, 1998. Wind speeds from this powerful storm reached 82 knots and straight-line winds caused extensive damage in several northern Michigan communities
Winter storms consisting of heavy snow, freezing rain and blizzards are common seasonal hazards that can be expected to occur several times every year. Heavy snowstorms have happened most often in December and January. Freezing rain events have been recorded

January, February, and March and have caused wide spread damage to trees and power lines. Crawford County's location at the southeastern edge of Lower Michigan's "Snow Belt", does not experience intense lake effect snows experienced further north along the I-75 corridor. Snow fall extremes, based on the time period of this station's published record, are:

Greatest observation-day total: 14.0 inches (March 9, 1942)
Greatest monthly total: 59.0 inches (December 1985)
Greatest seasonal total: 172.8 inches (1989-90)
Least seasonal total: 35.5 inches (1920-21)
Greatest snow depth: 51 inches (March 2, 1922)

Table 2.1
Temperature and Precipitation Summary 1981-2010

	Temperature Averages			Precipitation Averages	
Month	**Max**	**Min**	**Mean**	**Precip. Equivilent**	**Snow**
JAN.	25.8	7.9	16.8	1.71	30.1
FEB.	28.8	8.0	18.4	1.29	20.7
MAR.	38.8	15.4	27.1	1.72	14.2
APR.	53.4	28.8	41.1	2.77	3.8
MAY	66.0	39.3	52.7	3.27	.1
JUNE	75.8	49.2	62.5	3.69	.0
JULY	79.8	53.9	66.8	3.58	.0
AUG.	77.6	51.9	64.7	3.68	.0
SEPT	69.5	43.7	56.6	3.75	.0
OCT.	56.0	33.9	45.0	3.77	1.3
NOV.	42.4	25.3	33.8	2.61	11.3
DEC.	30.5	15.6	23.1	1.76	26.5
ANNUAL	53.7	31.1	42.4	33.6	108.0

Source: Midwestern Regional Climate Center, Champaign IL, Station 203391 Grayling MI

Topography

Most of the county is nearly level or gently rolling. Local differences in elevation are slight, in a few places exceeding 100 feet, although the hills and plateau like ridges appear to rise above adjacent sand plains when viewed from a distance. Slopes of hilly land are both long and expansive or, where the relief is choppy, smooth and rounded. There are no steep slopes except along watercourses.

The northern part of the county consists of three broad highland plateaus having a general north-south direction, three complementary broad sand valleys, and a wide sandy plain on the east. The central part, from eastern to western boundaries, is a wide level sand plain through which the AuSable River and its tributaries have cut narrow shallow trenches. Several detached swells or ridges, irregular in outline but having general east to west trends, characterize the southern part of the county. Here the general relief is gently rolling or moderately hilly. Level sand plain and swamps intervene between masses of higher land.

Geology

Two main bedrock formations underlie Crawford County. The northern part of the county is underlain by bedrock of the Napoleon Formation. This formation is composed of 50 to 100 feet of white and light gray sandstone of late Mississippian age. The southern part of the county is underlain by the slightly younger Michigan formation, also of late Mississippian age. This formation is composed of interbedded layers shale sandstone and limestone and is as much as 500 feet thick. These two formations are covered by glacial drift ranging from 600 to 800 feet thick in the northern part of the county to less than 200 feet thick in the southern part. The bedrock formations contain deposits of gas and oil which are being exploited. **Figure 2.2** is a map that shows locations of wells that are color coded to show well types and **Table 2.2** shows well by status. As can be seen, there are concentrations of wells in western Beaver Creek Township; northern Federic and Maple Forest Townships; south-central South Branch Township and northeastern Lovells Township.

Table 2.2
Oil and Gas Exploration in Crawford County

Well Type	Number
Brine Disposal Well	13
Dry Hole	114
Gas Well	221
Gas Brine Disposal Well	2
Lost Hole	2
Location only - not yet completed	306
Mineral Well	1
Oil Well	223
Other Part 615 Injection Well	1
Water Injection Well	66

Source: Michigan DEQ 2011

Soils

Surface geology is directly related to the advancing and retreating glaciers of thousands of years ago. The surface geology of Crawford County consists of moraines, till plains and outwash plains. Moraines are linear hilly ridges that represent the former position of a glaciers edge and are made up of unconsolidated sand, gravel, rock, and clay. Moraines are found south of Grayling running east to west and three moraines that trend north and south are found just north of Grayling. Till plains are the level areas between moraines and consist of unconsolidated sand, gravel, rock, and clay. Outwash plains are water-laid deposits formed from the melting glacier consisting of stratified deposits of sand, gravel, rock, and clay. The only outwash plain in the county is located in Beaver Creek and South Branch Townships.

When planning for types and intensity of land uses, soil types and slopes are two important factors that determine the carrying capacity of land. Additionally, knowledge of the location of excessively drained soils will assist in identifying wildfire prone areas. Soil types influence the location of plant communities that grow in the county. Pine forests, particularly jack pine, are adapted to grow on sandy, draughty soils. While northern hardwood forests thrive on sandy loam soils and cedar forests prefer mucky wet soils.

The Natural Resource Conservation Service completed a detailed soil survey of Crawford County. A digital or computerized version of the soil survey maps was acquired from the Michigan Center for Geographic Information and used to analyze soils conditions and generate color thematic soil maps.

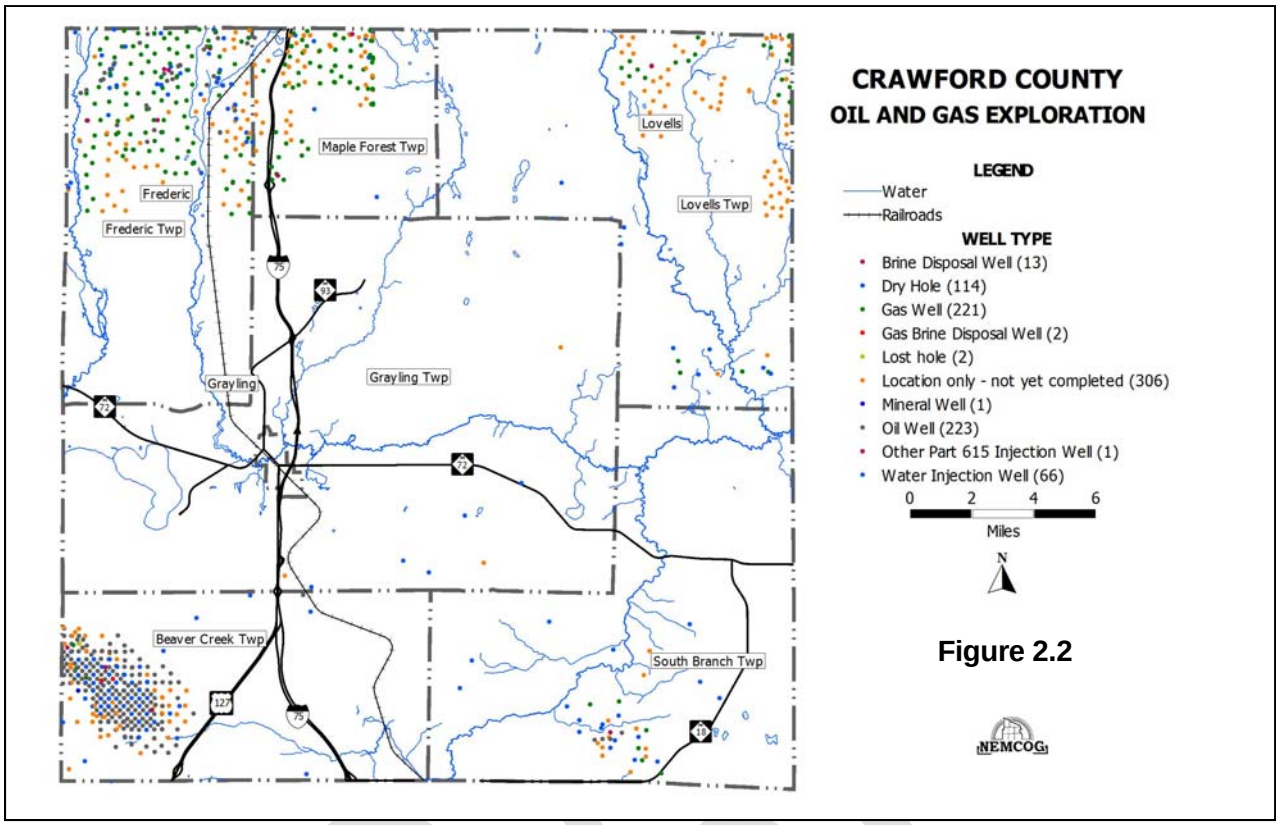


Figure 2.2

Hydric Soils and Steeply Sloped Areas

Figure 2.3 is a map that classifies hydric soils and soil units with slopes 18% and greater. The hydric soils (colored green on the map) are mainly located adjacent to streams and creeks. This connectivity of riparian wetlands and surface water features can be seen throughout the landscape. Areas colored light brown are soils with small areas of hydric inclusions (areas too small to be delineated from the primary soils type). Hydric soils have high water tables and will not support heavy equipment. These areas can be barriers when deploying fire suppression equipment. Hills and steeply rolling terrain may provide opportunities for spectacular views of the landscape. However, steeply sloped sites have severe building constraints and are more difficult and costly to develop. Steeply sloped areas influence fire behavior and are difficult to access when fighting wildfires. Areas with slopes 18 percent or greater are colored red on the map.

Soil Drainage Class

Figure 2.4 is a map that classifies soil drainage classes. "Drainage class (natural)" refers to the frequency and duration of wet periods under conditions similar to those under which the soil formed. Alterations of the water regime by human activities, either through drainage or irrigation, are not a consideration unless they have significantly changed the morphology of the soil. Seven classes of natural soil drainage are recognized: excessively drained, somewhat excessively drained, well drained, moderately well drained, somewhat poorly drained, poorly drained, and very poorly drained. These classes are defined in the "Soil Survey Manual." – Natural Resource Conservation Service.

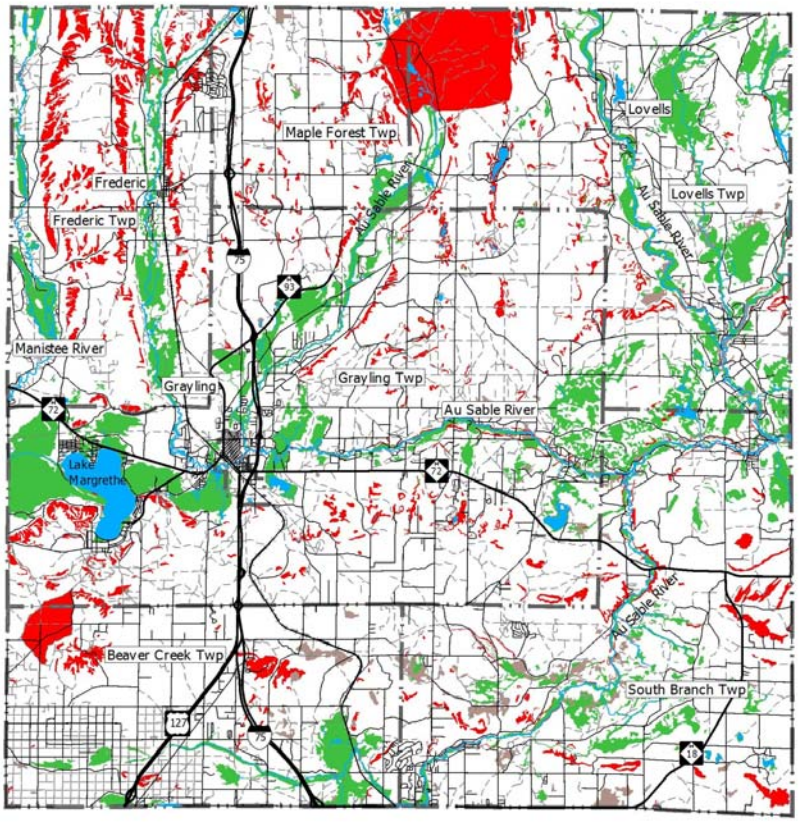


Figure 2.3

CRAWFORD COUNTY

SOILS CONSTRAINTS MAP

UNIMPROVED ROADS
CO. ROADS
RAILROADS
HIGHWAYS

HYDRIC SOILS & STEEP SLOPES

SLOPES 18% & GREATER
HYDRIC SOILS
HYDRIC SOILS IN MAPPING UNIT
WATER

0 2 4 6
Miles

N

NEMCOG

DATA SOURCE:
NATURAL RESOURCE CONSERVATION SERVICE
MICHIGAN CENTER FOR GEOGRAPHIC INFORMATION

MAP BY:
NORTHEAST MICHIGAN COUNCIL OF GOVERMMENTS

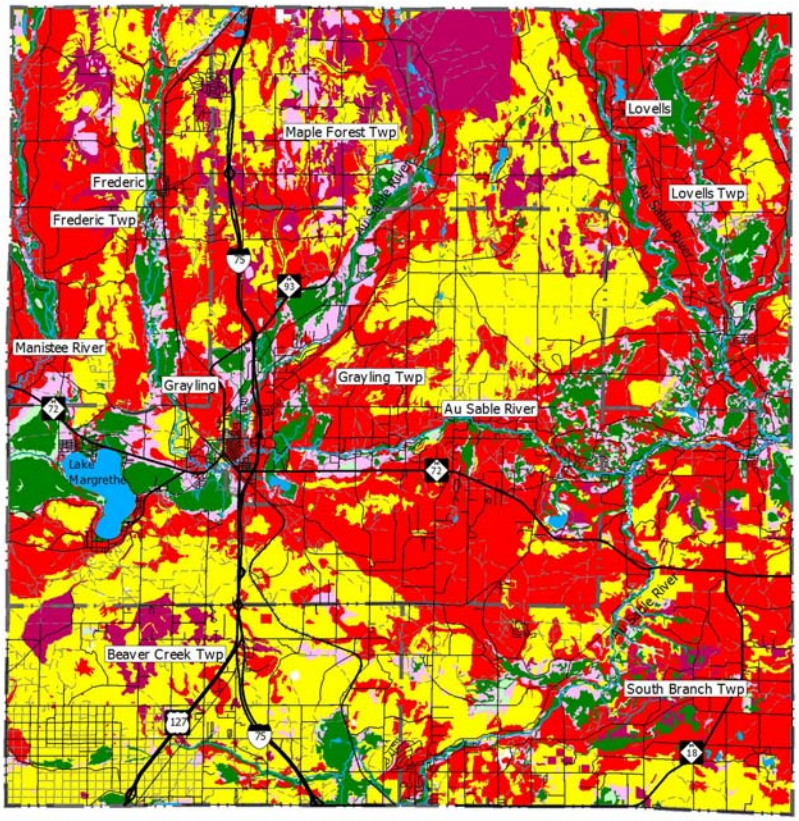


Figure 2.4

CRAWFORD COUNTY

SOILS CONSTRAINTS MAP

UNIMPROVED ROADS
CO. ROADS
RAILROADS
HIGHWAYS

Rating

Excessively drained
Moderately well drained
Poorly drained
Somewhat excessively drained
Somewhat poorly drained
Very poorly drained
Well drained

0 2 4 6
Miles

N

NEMCOG

DATA SOURCE:
NATURAL RESOURCE CONSERVATION SERVICE
MICHIGAN CENTER FOR GEOGRAPHIC INFORMATION

MAP BY:
NORTHEAST MICHIGAN COUNCIL OF GOVERMMENTS

Excessively drained and somewhat excessively drained sandy soils support vegetation that can tolerate draughty conditions. Jack, red and white pine; northern pin, red and white oak; bigtooth and quaking aspen; paper birch and red maple are common. Jack pine and northern pin oak are most common on the sandy excessively drained soils. Plants produce ample amounts of fuels, and during spring months and other dry times of the year conditions are conducive to wildfires.

Water Resources

Crawford County has an abundance of lakes and streams. The county has a total of 53 lakes that are 1 acre or larger. The largest body of water in the county is Lake Margrethe in Grayling Township with a surface area of 1,928 acres, an average depth of 16 feet, and a maximum depth of 65 feet. Seven lakes are over 100 acres. The large majority of the lakes are less than 50 acres in size. The county is predominantly within the AuSable water shed. The Manistee River drains the western portion of the county. There are 45 miles of inland shoreline in Crawford County with approximately 25 miles open to the public. Almost all of the lakes and streams provide good fishing and many tourists come to the county to fish. Lake Margrethe is at the headwaters of the Manistee River Watershed and is a popular recreational and tourist area in the county. Other significant lakes in the county include Shupac Lake, Shellengarger Lake and Jones Lakes. Smaller lakes are quite numerous.

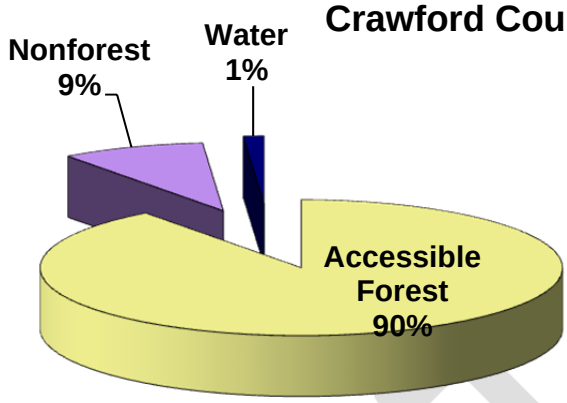
Woodland Resources

According to 2001 U.S. Forest Service statistics, forestland accounts for approximately 90% of the county's total land area**, Figure 2.5.** The majority of timberland in the county is in public ownership. 52% is state owned and 16% is federally owned in the form of the Au Sable State Forest and the Huron National Forest, **Figure 2.6.** Most of these lands are managed under a multi-use concept, which is directed toward recreation. The use of military forestland is not geared toward commercial forest production. Some areas have been determined as refuge areas for the endangered Kirtland Warbler. The next largest ownership class is in individual ownership at 32%.

Major forest species found in the county are Jack Pine (27%), Oak/Hickory Group (23%) and Aspen (21%). The Maple/Beech/Birch Group totals 12%. A small amount of forestland is comprised of Black Spruce (6%), Balsam Fir (4%), and Red Pine (4%) Smaller acreages of Eastern White Pine, White Spruce, Northern White Cedar, White Pine/Red Oak/White Ash, and Paper Birch are also present. The abundance of jack pine and oak forests dramatically increase wildfire hazard for Crawford County.

The Michigan Department of Natural Resources has compiled pre-European settlement vegetation maps of counties in Michigan. The maps were generated from information contained in the first government land survey notes in the 1800's along with information such as current vegetation, land forms and soils. A review of the pre-settlement vegetation map of Crawford County shows extensive areas were covered with jack pine-red pine forest, white pine-red pine forest, pine barrens and pine/oak barrens, see **Figure 2.7.** Note extensive areas of pine barrens and oak barrens (colored yellow), which clearly shows wildfires were very much part of the natural ecosystem, prior to logging and associated wildfires in the late 1800's. Logging, land clearing and wildfires have resulted in a greater presence of aspen and oak. Also, with better wildfire control and reforestation efforts, there's actually more forestland today than in the early 1800's.

Figure 2.5
Crawford County Forestland



Source: U.S. Forest Service 2001

Figure 2.6
Crawford County Forestland Ownership

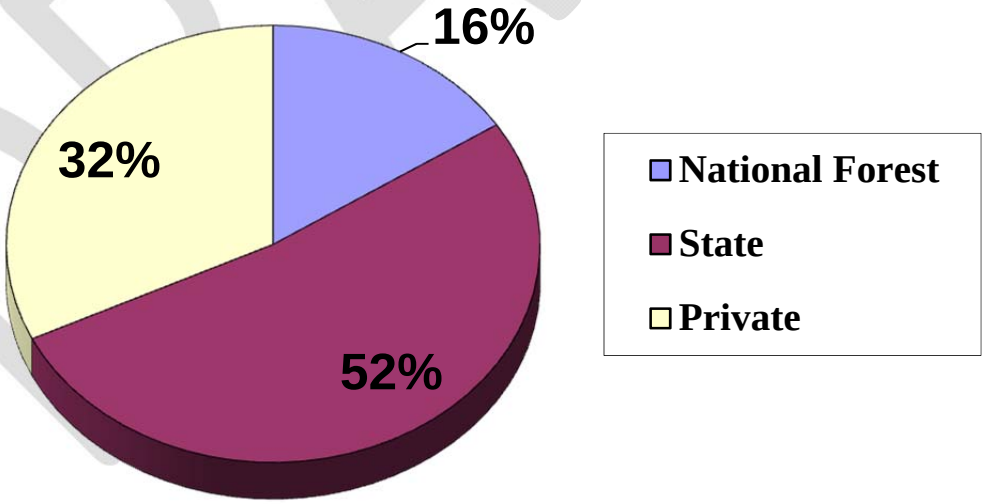
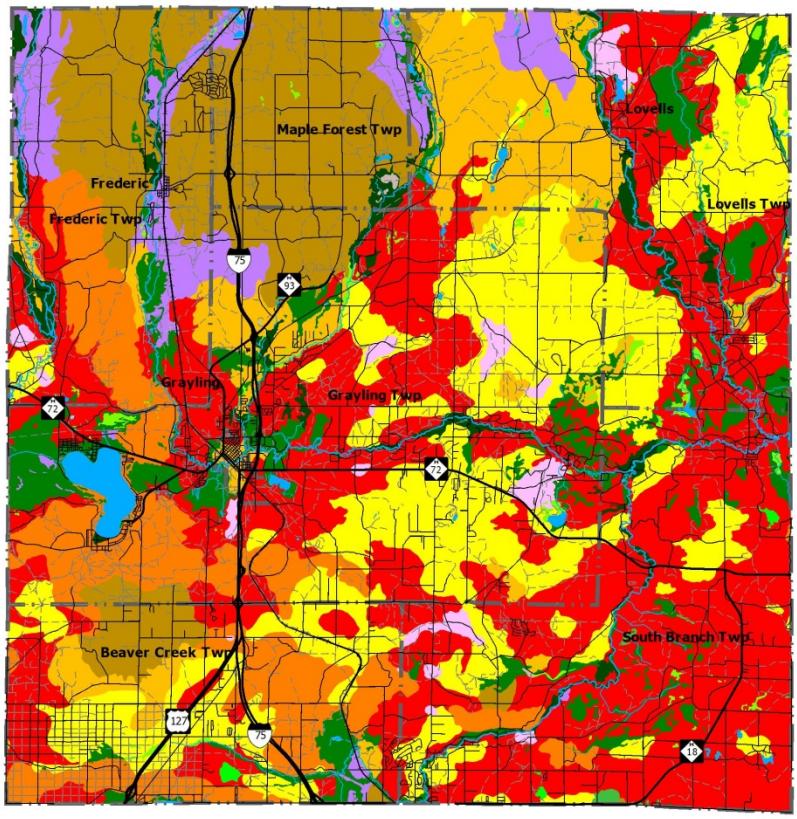


Figure 2.8 shows forest types generated from the Michigan Resource Information System inventory in the 1980's. The map shows the continued dominance of pine forest types in the County. The map depicts the urban-rural interface of residential development in areas dominated by Jack Pine and Red Oak indicating wildfire susceptibility.



CRAWFORD COUNTY

PRE-SETTLEMENT VEGETATION
COVERTYPE

- ASPEN-BIRCH FOREST
- BEECH-SUGAR MAPLE-HEMLOCK FOREST
- CEDAR SWAMP
- GRASSLAND
- HEMLOCK-WHITE PINE FOREST
- JACK PINE-RED PINE FOREST
- LAKE/RIVER
- MIXED CONIFER SWAMP
- MIXED HARDWOOD SWAMP
- MIXED PINE-OAK FOREST
- MUSKEG/BOG
- OAK/PINE BARRENS
- PINE BARRENS
- SAND DUNE
- SHRUB SWAMP/EMERGENT MARSH
- WHITE PINE-RED PINE FOREST

0 2 4 6
Miles
10-12-04

N

Figure 2.7

DATA SOURCE:
MICHIGAN CENTER FOR GEOGRAPHIC INFORMATION
MICHIGAN DEPARTMENT OF NATURAL RESOURCES

MAP BY:
NORTHEAST MICHIGAN COUNCIL OF GOVERMMENTS

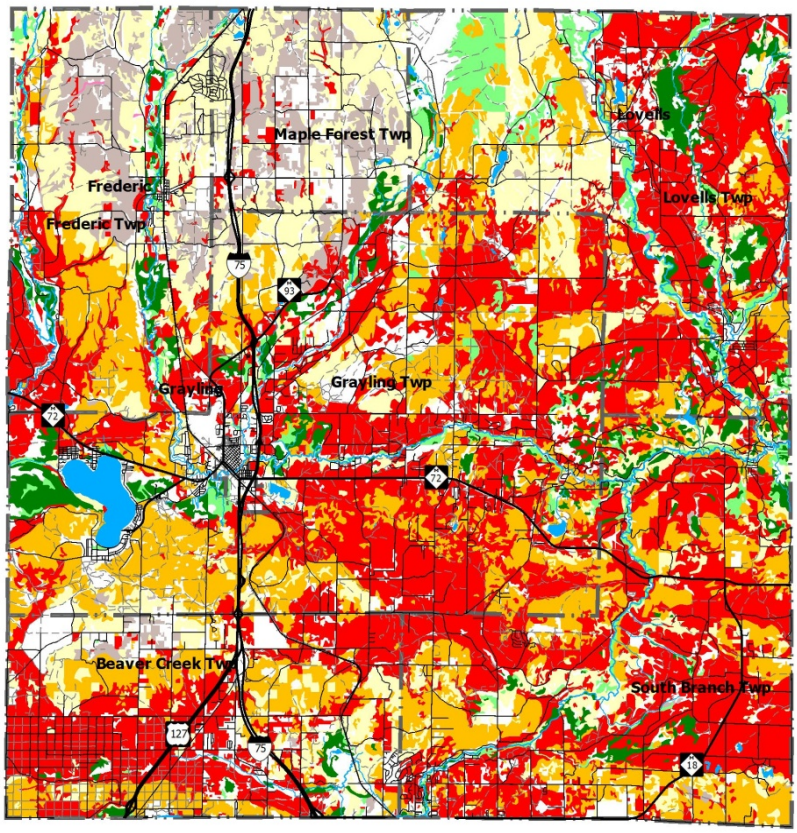


Figure 2.8

CRAWFORD COUNTY
FOREST COVER MAP

- UNIMPROVED ROADS
- CO. ROADS
- RAILROADS
- HIGHWAYS

FOREST TYPES

- Aspen, Birch
- Central Hardwood
- Lowland Conifer
- Lowland Hardwood
- Northern Hardwood
- Other Upland Conifer
- Pine

0 2 4 6
Miles
MIRIS 1978

N

NEMCOG

DATA SOURCE:
MICHIGAN CENTER FOR GEOGRAPHIC INFORMATION
CRAWFORD COUNTY

MAP BY:
NORTHEAST MICHIGAN COUNCIL OF GOVERMMENTS

Contamination Sites

The Michigan Environmental Response Act (Part 201 of PA 451 of 1994, as amended) provides for the identification, evaluation and risk assessment of sites of environmental contamination in the State. The Environmental Response Division (ERD) is charged with administering this law. A site of environmental contamination, as identified by ERD, is "a location at which contamination of soil, ground water, surface water, air or other environmental resource is confirmed, or where there is potential for contamination of resources due to site conditions, site use or management practices.

The agency publishes a list of environmentally contaminated sites by county showing the sites by name pollutant(s) and site status (**Table 2.3**). A Site Assessment Model (SAM) score is computed to assess the relative risk a site may pose and to help determine the aggressiveness of cleanup efforts. SAM scores range from 0 to 48 with 0 being the least contaminated and 48 the most contaminated. In some instances where the score is high and further contamination is possible, immediate response may be required. Conversely, a location where the score is low and the conditions of the site are not likely to change; no action may be the preferred course.

Table 2.3
Crawford County Contamination Sites

Site ID & Status	Location	Source	Pollutant	SAM Score
20000002 Interim Response in progress	North I-75 BL	National security	PCE , TCE	28
20000003 Active	Sherman Rd	Landfill	Fe; Solid wastes	24
20000004 Remedial Action in Progress	6636 AuSable Street (Old 27)	Gasoline Service Station	1,2,4 TMB; 1,3,5 TMB; Naphthalene; PCE; Xylenes	30
20000007 Interim Response in progress	Rt #1, 7 Mile Rd.	Pumps & Pumping Equipment	BTEX	31
20000009 Inactive	5453 M-18 Hwy	Gasoline Service Station	BTEX , 1,2 DCA	27
20000010 No Action Taken	123 Barbara St	Private Households	BTEX	22
20000028 Monitoring Only	427 South Grayling Road	Auto Dealer & Service Stations	Solvents	17
20000049 Active	Industrial Dr	Sewerage Systems	Fe	24
20000058 Active	106 Jonassen	Private Households	Heating Oil , Ethylbenzene	14
20000060 Remedial Action in Progress	2459 Industrial Drive	Wood Preserving	Cr+6	20
20000064	200 West Michigan	Railroad	As;	29

Inactive	Ave.	Transportation	Benzo(a)anthracene; Benzo(a)pyrene	
20000065 Inactive	9851 Beech Terrace Drive	Private Households	Fuel Oil	20
20000066 Inactive	308 Huron Street (M-72)	Lumber & Wood Products	Acenaphthylene; Benzo(a)pyrene; Dibenzo(a,h)anthracene; Fluoranthene; Phenanthrene	21
20000071 Interim Response in progress	Camp Grayling	National Security	Pb	17
20000073 Interim Response in progress	N. Down River Rd. & Stephan Bridge Rd.	Sporting & Athletic Goods	1,2,4 TMB; 1,3,5 TMB; Benzene; Ethylbenzene; PCE; Toluene; Xylenes; n-Propylbenzene	31
20000074 Interim Response in progress	10360 W. Deward Rd.	Pipelines	Ethylbenzene	22
20000075 Interim Response in progress	4364 North Down River Rd	Fabricated Metal Products	PCE; TCE; cis-1,2 DCE	34
20000077	9439 East North Down River Rd.	Gasoline Service Station	1,2,4 TMB; 1,3,5 TMB; Benzene; Ethylbenzene; Naphthalene; Toluene; Xylenes	31
20000090 Inactive	4622 Young Street	Lumber &Wood Products	1,2,4 TMB; Pb	27
Source: Department of Environmental Quality				

Chapter 3 – Community Profile

Population

The 2010 Census showed that Crawford County had population of 14,074, which equated to a 1.4% decline in population from the 2000 US Census. Prior to this, Crawford County had experienced 30-year trend of population gains. a steady growth in population until the latter part of the 2000's. Population is concentrated in the City of Grayling and Grayling Township area with other population centers located in South Branch, Beaver Creek and Frederic Townships.

Further examination of the demographics shows Crawford County's population is aging at a higher rate than the State and Nation. Shifting population bases create new demands on community services and emergency response.

Population by Municipality

The City of Grayling, Grayling and Frederic Township experienced population loss over the past decade, while Beaver Creek, Lovells, Maple Forest and South Branch Townships experienced population gains. The county as a whole showed a population loss over the past decade. **Table 3.1** shows population trends for communities in the County.

Table 3.1
Population For Crawford County & Municipalities, 1990-2000

Municipality	2000 Population	2010 Population	Percent Change	Numeric Change
Crawford County	14,273	14,074	-1.4%	-196
City of Grayling	1,952	1,884	-3.50%	-68
Beaver Creek Township	1,486	1,736	16.80%	250
Frederic Township	1,401	1,341	-6.10%	-87
Grayling Township	6,516	5,827	-0.10%	-658
Lovells Township	578	626	8.30%	48
Maple Forest Township	498	653	3.90%	154
South Branch Township	1,842	2,007	9.0%	165

Source: U.S. Bureau of the Census
Note: Red text indicates decline and green text indicates increase

Seasonal Population

Obtaining accurate numbers of seasonal residents and tourists is difficult. Because the U.S. Census is conducted each decade in April, the numbers only reflect those persons who live in the county on a year-round basis. Tourism and annual events can provide large increases in population on any one weekend. The Weyerhaeuser AuSable River Canoe Marathon in July can attract as many as 50,000 people to area.

A rough estimate of the number of county seasonal residents can be calculated by multiplying the number of county seasonal housing units by the county's average number of persons per household. The 2010 Census showed that there were 4,535 seasonal housing units in the county and an average household size of 2.5 persons. Considering the additional influx of seasonal visitors or tourists staying in area motels, campgrounds, or family homes, a spike in population could exceed 10,000 persons on during certain times. These spikes in populations should be acknowledged when identifying hazard mitigation strategies.

Age Distribution

According to the 2010 Census, Crawford County's year round population was 14,074 persons. This figure represents a loss of 199 persons or 1.4 percent from the 2000 Census. Even with the loss, the age group of 45 years and older gained population, increasing by 1,571 persons (26% increase). However, the county experienced losses in age groups that represent young families. Youth age group (19 years and younger) lost 703 persons (18.4% decrease) and the adult age group (25-44 years of age) declined by 1,073 persons (28.3% loss). See **Table 3.2 and Figure 3.1.**

The median age of the County has increased from 34.7 years in 1990 to 47.7 years in 2010. At the same time the State's median age increase from 32.5 to 38.9 years. The difference in median age between the County and State increased from 1990 to 2010 as the County's population make-up "ages" at the faster rate, **Figure 3.2**

In conclusion, shifts in the County's demographic make-up are changing the population structure. Long term trends in the increase in median age continue at the faster rate than the State of Michigan and US. The rate has increased with the down turn in the economy, as young families move to other areas for employment. An aging population needs access to social and medical services. The county's emergency response services will experience an increase in demands.

Figure 3.2

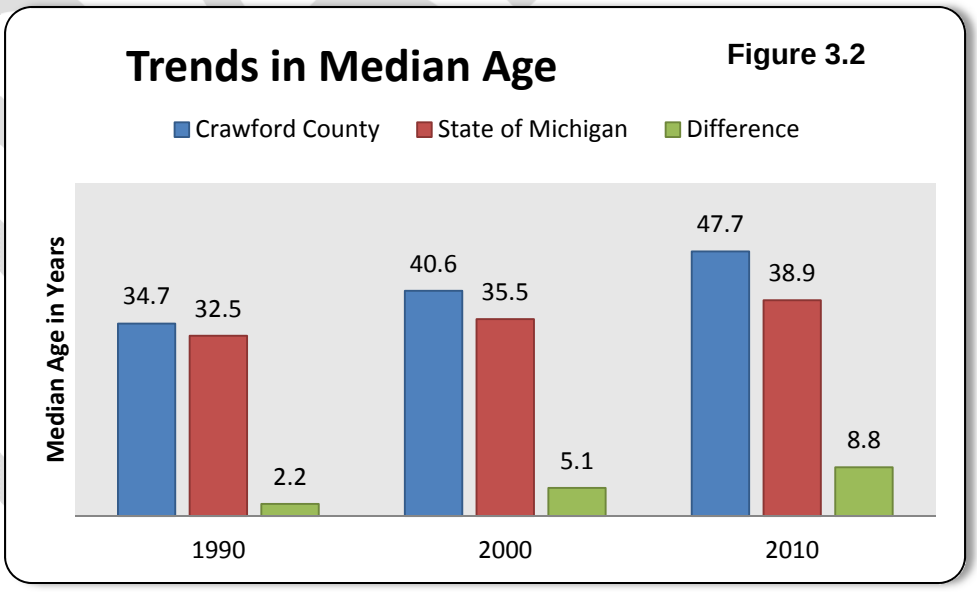


Figure 3.1

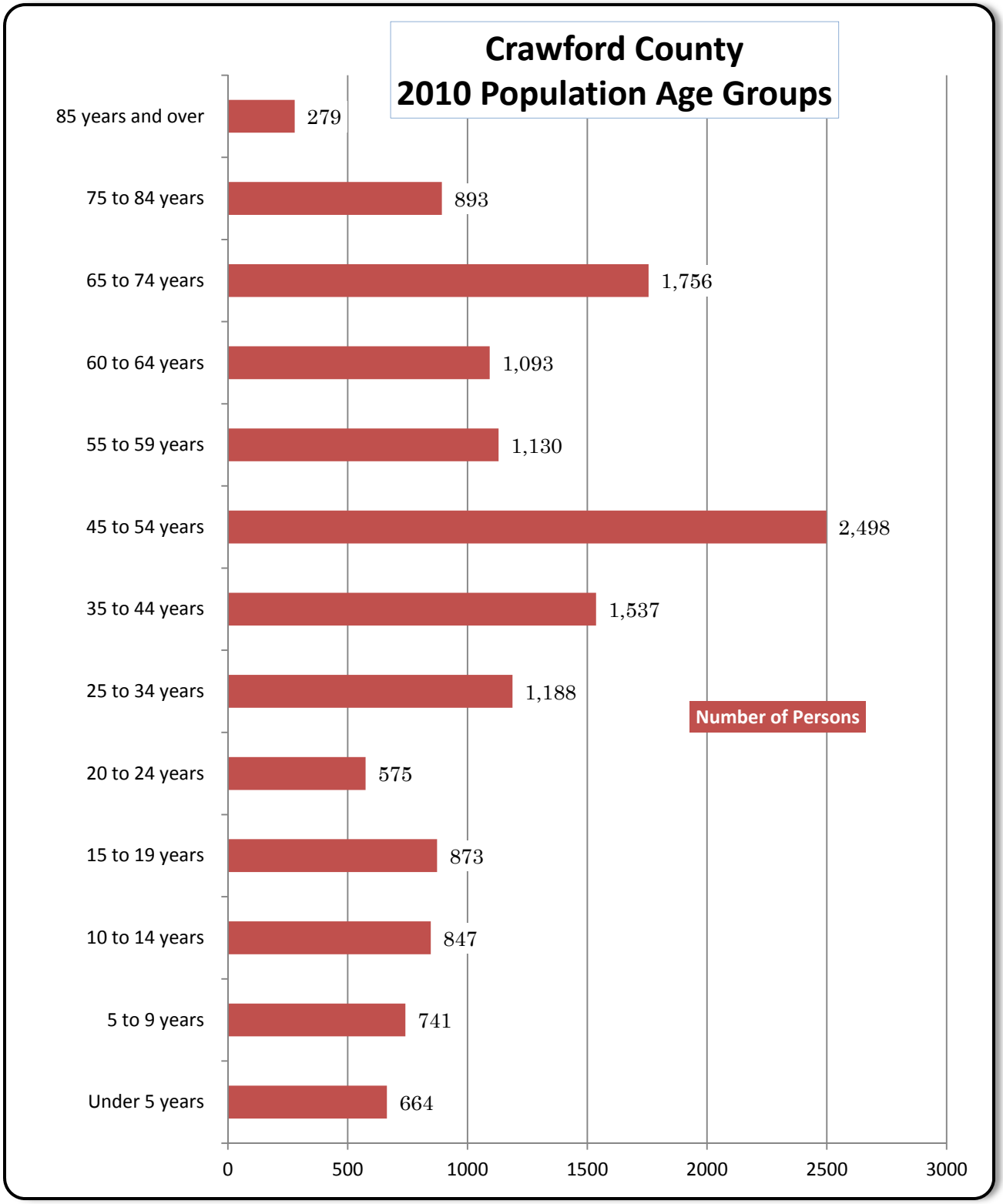

Crawford County
2010 Population Age Groups
85 years and over
279
75 to 84 years
893
65 to 74 years
1,756
60 to 64 years
1,093
55 to 59 years
1,130
45 to 54 years
2,498
35 to 44 years
1,537
25 to 34 years
1,188
20 to 24 years
575
15 to 19 years
873
10 to 14 years
847
5 to 9 years
741
Under 5 years
664
Number of Persons
0
500
1000
1500
2000
2500
3000

Table 3.2
Age Distribution By Municipality For Crawford County - 2010

MUNICIPALITY	< 5 Yrs.	%*	5-19 Yrs.	%*	20-24 Yrs.	%*	25-44 Yrs.	%*	45-64 Yrs.	%*	65 Yrs. & >	%*	Median Age
City of Grayling	124	6.6	385	20.4	118	6.3	450	23.9	417	22.1	390	20.8	38.6
Beaver Creek Township	67	3.9	330	19.0	67	3.9	317	18.3	601	34.7	354	20.3	47.8
Frederic Township	62	5.2	243	18.1	53	4.0	266	19.9	456	34.0	261	19.4	47.5
Grayling Charter Township	282	4.8	1019	17.5	241	4.1	1137	19.4	2009	34.6	1139	19.6	45.0
Lovells Township	14	2.2	63	10.0	14.0	2.2	71	11.4	258	41.2	206	32.9	57.5
Maple Forest Township	28	4.3	126	19.3	19	2.9	129	19.8	235	36.0	116	17.7	46.8
South Branch Township	87	4.3	295	14.7	63	3.1	355	17.7	745	37.1	462	23.0	50.8
Crawford Co.	**664**	**4.7**	**2461**	**17.5**	**575**	**4.1**	**2725**	**19.3**	**4721**	**33.5**	**2928**	**20.8**	**47.7**

*Figure shows the percentage each age grouping represents of the local unit's total population.
Source: U.S. Bureau of the Census

Housing Stock

Over past decades, Crawford County has experienced a steady increase in number housing units, with a high percentage used as seasonal housing. New housing starts drastically dropped in 2008 with the down turn in the U.S. economy.

Housing characteristics from the 2010 US Census are presented in **Table 3.3**. The Census found 11,092 housing units with 6,016 units occupied and 5,076 units vacant. Grayling Township has the most housing units at 4,289 units (39% of the county total). As in many areas of northern Michigan, Crawford County has a large percentage of seasonal housing units, nearly 41 percent. Frederic, Lovells, and South Branch Township have percentages of seasonal housing units greater than 40 percent. The City of Grayling has a very low percentage of seasonal housing units (2.25%).

When conducting the hazard assessment for the CWPP, a critical step in the process is locating housing developments in relation to forest types and high risk wildfire areas. Parcel data and structure locations were provided by Crawford County. This data can be overlaid onto forest types and maps generated by the RAMS program. The results can be found in Chapter 4.

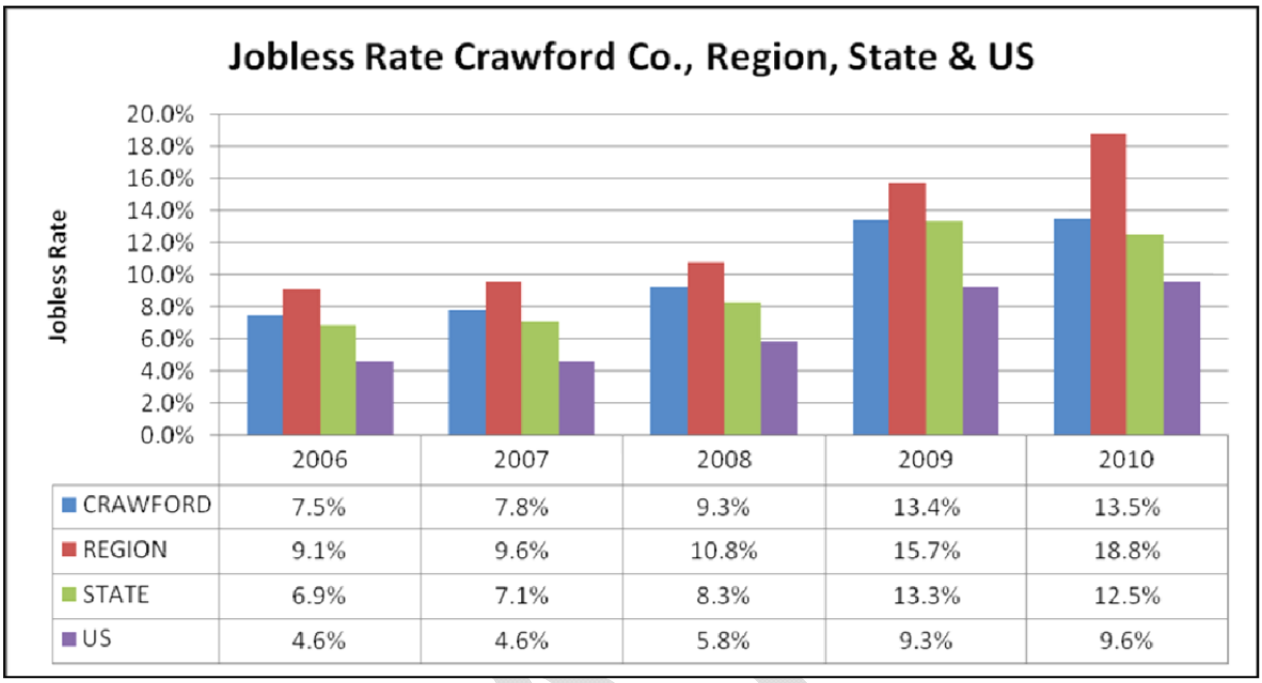
Table 3.3 Housing Counts and Occupancy Status in Crawford County						
Area Name	2010					
	Total	Occupied	Vacant	Percent Vacant	Seasonal	Percent Seasonal
Crawford County	**11,092**	**6,016**	**5,076**	**45.8%**	**4,535**	**40.89%**
Beaver Creek Township	1,317	733	584	44.3%	524	39.79%
Frederic Township	1,231	576	655	53.2%	586	47.60%
Grayling City	890	764	126	14.2%	20	2.25%
Grayling Township	4,289	2,464	1,825	42.6%	1,629	37.98%
Lovells Township	1,034	315	719	69.5%	694	67.12%
Maple Forest Township	470	263	207	44.0%	181	38.51%
South Branch Township	1,861	901	960	51.6%	901	48.41%
Source: US Census Bureau						

Selected Economic Indicators for Crawford County, MI

In Crawford County, 2010 Census data shows a loss in population levels over the last decade. The number of people in the labor force and employment has also dropped from 2004, as well the unemployment rate has increased. In 2009, Crawford County was 293 in the nation (of the 3144 counties) with the highest unemployment rate. The unemployment rate for the county has been consistently lower than region-wide rates. The median household income has remained relatively stable, showing a small drop from 2000 to 2010. Poverty rates have also increased in recent years. See **Table 3.4**. **Figure 3.3** shows the jobless rate for Crawford County, Northeast Michigan, Michigan and US. The County's employment was lower than the NEMCOG region's overall rate, but consistently higher than the state and US.

Table 3.4 Select Demographics and Economic Indicators			
Population (2010) Estimate	14,074	**Median Household Income (2007)**	$35,979
Labor Force (2010)	6,292	**Median Household Income (2009)**	$35,866
Employment (2010)	5,441	**Adults over 25 (2007) % Bachelor's Degrees**	12.9%
Unemployment Rate (2010)	13.5%	**Poverty Rate (2007)**	14.7%

Figure 3.3



	2006	2007	2008	2009	2010
CRAWFORD	7.5%	7.8%	9.3%	13.4%	13.5%
REGION	9.1%	9.6%	10.8%	15.7%	18.8%
STATE	6.9%	7.1%	8.3%	13.3%	12.5%
US	4.6%	4.6%	5.8%	9.3%	9.6%

Chapter 4 - Land Use Characteristics

This chapter presents information on both the types and location of land uses on a countywide basis. The process identifies both urban built-up land uses such as residential and commercial, along with natural land cover types like forests and wetlands. As a result the final map presented in this chapter is a hybrid that combines land cover and land use.

Land Division Patterns

As development occurs, larger tracts of land are generally broken down into smaller parcels. Therefore, studying the existing pattern of land divisions is one way to analyze the status of land use and development. Most of the private ownership is in tracts that are 10 acres and smaller. Large tracts of private ownership, typically hunt/fish clubs, are scattered throughout the County. Subdivisions and small tracts are located near rivers, around lakes along major highways, within recreational developments and clustered around the community of Grayling. Figure 4.1 shows the distribution of parcels 160 acres or larger, and parcels 10 acres or less.

A key factor that determines community character and the location of potential future development areas is the amount of land public ownership. Table 4.1 and Figure 4.2 show the breakdown of public land ownership in Crawford County. Excluding water, all public lands (including that owned by cities, townships, the county, as well as federal and state properties) make up over 70 percent of the county's total land area.

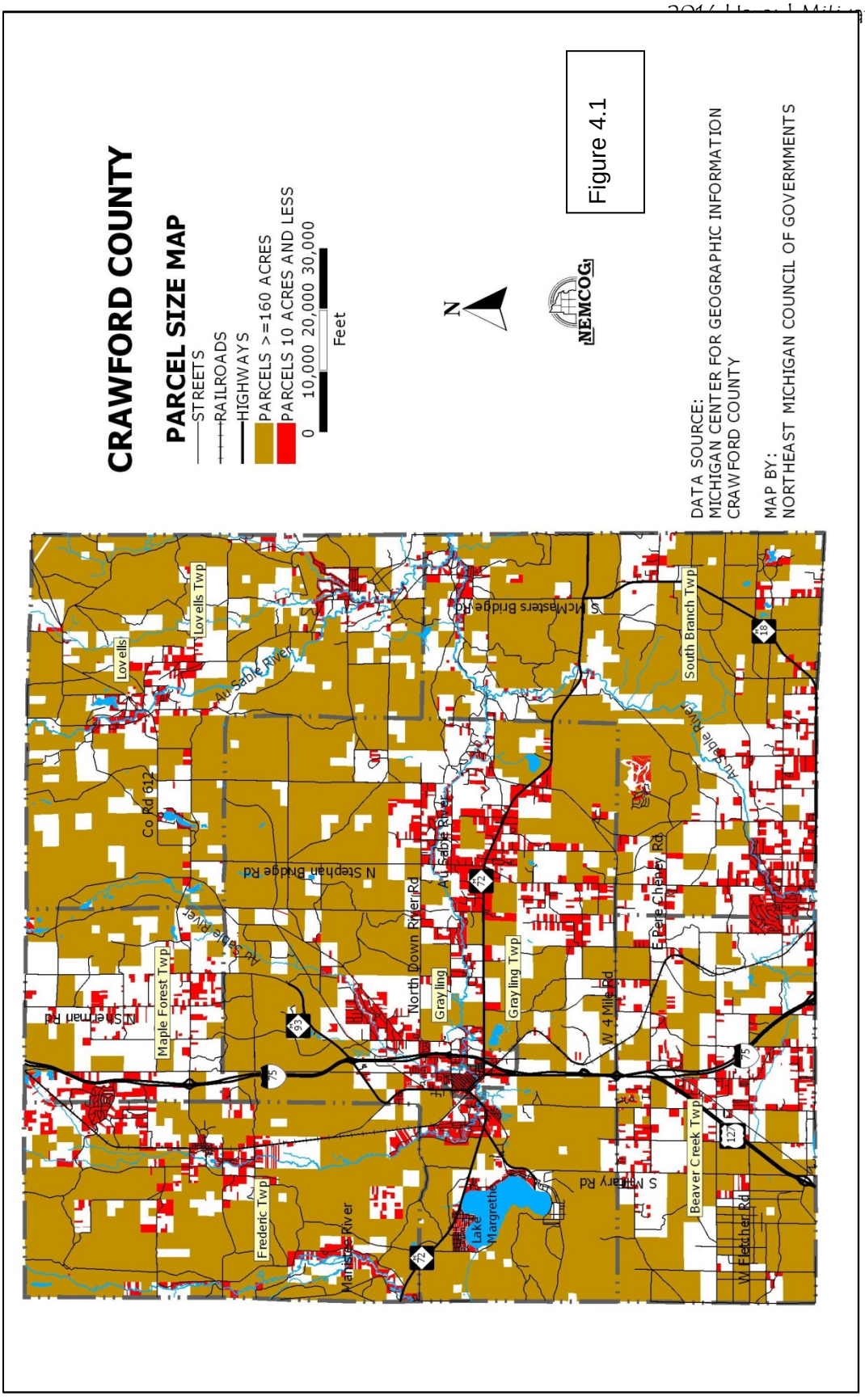
Table 4.1
Crawford County Land Ownership

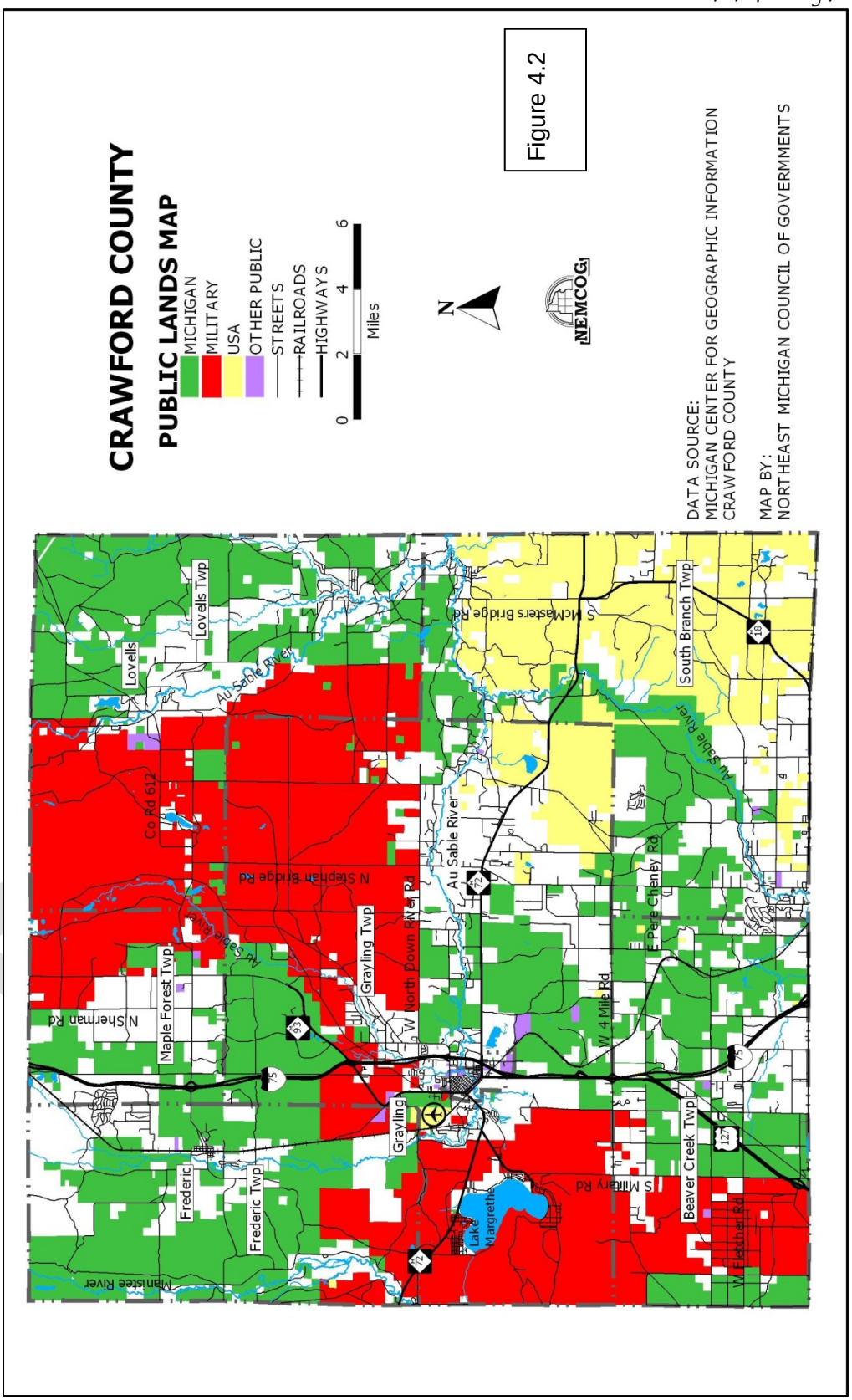
Public Lands	Acres	Percent
State of Michigan	116,734	32
Military	97,294	27
USA	41,433	12
Other Public	1,246	>1
Water	3,031	>1

Source: NEMCOG

Land Use

One of the features that attract people to Crawford County is the rural character of the area. Data from 1992 satellite imagery shows that 86.3 percent of the County's 360,294 total acreage is forested, with another 7.1 percent non-forest. Agriculture, wetlands and surface water each claim an additional 1.1 percent (Table 4.1 and Figure 4.1). Just a little over three percent of the County's land is used for urban-type purposes, including commercial, industrial, recreational and residential (see Table 4.2 and Figure 4.3)


CRAWFORD COUNTY
PARCEL SIZE MAP
STREETS
RAILROADS
HIGHWAYS
PARCELS >=160 ACRES
PARCELS 10 ACRES AND LESS
0 10,000 20,000 30,000
Feet
N
NEMCOG
Figure 4.1
DATA SOURCE:
MICHIGAN CENTER FOR GEOGRAPHIC INFORMATION
CRAWFORD COUNTY
MAP BY:
NORTHEAST MICHIGAN COUNCIL OF GOVERMMENTS
Lovells
Lovells Twp
Au Sable River
S McMasters Bridge Rd
South Branch Twp
Co Rd 612
N Stephan Bridge Rd
Maple Forest Twp
N Stephan Rd
North Down River Rd
Grayling
Grayling Twp
W 4 Mile Rd
E Perle Chaney Rd
Frederic Twp
Manistee River
Lake Margrethe
S Maple Ridge Rd
Beaver Creek Twp
W Fletcher Rd
75
72
127
18


CRAWFORD COUNTY
PUBLIC LANDS MAP
MICHIGAN
MILITARY
USA
OTHER PUBLIC
STREETS
RAILROADS
HIGHWAYS
0
2
4
6
Miles
N
NEMCOG
Figure 4.2
DATA SOURCE:
MICHIGAN CENTER FOR GEOGRAPHIC INFORMATION
CRAWFORD COUNTY
MAP BY:
NORTHEAST MICHIGAN COUNCIL OF GOVERMMENTS
Lovells Twp
Lovells
Au Sable River
S McMasters Bridge Rd
South Branch Twp
Co Rd 612
N Stephan Bridge Rd
Au Sable River
Au Sable River
Grayling Twp
W North Down River Rd
Au Sable River
E Perle Chaney Rd
W 4 Mile Rd
N Sherman Rd
Maple Forest Twp
Frederic
Frederic Twp
Grayling
S Military Rd
Beaver Creek Twp
W Fletcher Rd
Manistee River
Lake Margrethe

With the economic downturn in 2007, minimal development has occurred in the county. Therefore, no significant changes in development have occurred since the previous plan was completed.

Data for the land/cover use inventory was taken from the Michigan Land Cover Dataset (MLCD), which was produced as part of the National Land Cover Dataset (NLCD). The NLCD was compiled from Landsat satellite imagery in 1992 as a cooperative effort between the U.S Geological Survey (USGS) and the U. S. Environmental Protection Agency (US EPA) to produce consistent land cover data for the US. It is important to note this approach utilizes lower resolution satellite imagery and computer generated image interpretation to compile the generalized land cover map. The approach did not involve field checking and manual boundary adjustments. Due to the scale, low density urban development and development in dense forestland was not delineated. The computer generated map offers a general view of land use in the county, adequate for general planning purposes. The computer generated land use for Crawford County consists of the following ten classes:

Table 4.2
Crawford County General Land Use

Land Use Type	Acres	Square Miles	% of Total Area
Agricultural	3,957	6.18	1.1%
Commercial/Industrial/Transportation	2,679	4.18	0.7%
Extractive/Transitional	8,278	12.93	2.3%
Lowland Forest	43,959	68.68	12.2%
Non-Forest Upland	25,719	40.18	7.1%
Recreational	460	0.71	0.13%
Residential	472	0.73	0.13%
Upland Forest	266,861	416.97	74.1%
Surface Water	4,005	6.25	1.1%
Wetlands	3,904	6.10	1.1%
Total	360,294	562.95	100%

Residential

According to the MLCD, 0.14 percent (472 acres) of the County's total land area was used for residential purposes in the early 1990s. As noted in Chapter 2, the number of housing units in the County increased over 15 percent between 1990 and 2000. This increase in housing units indicates a likely increased percentage of land in residential use. The most popular areas for residential development tend to be along the banks of the County's water resources. Residential usage is concentrated in and around the City of Grayling, Frederic Township, around the north and east shore of Lake Margrethe, along the Manistee River in Frederic Township, along the Au Sable River in Grayling Township and along the South Branch of the Au Sable River in South Branch Township. For the most part, residential development in the County consists of single-family dwellings. However, single family duplexes, multi-family units, condominiums, mobile homes and mobile home parks are also listed in this category.

Commercial/Industrial/Transportation

Commercial land uses include primary/central business districts, shopping center/malls, secondary/neighborhood business districts, including commercial strip development, as well as industrial development, transportation, oil and gas, communication and utility facilities, and all

highways. The MLCD identified 2,679 acres, or 0.7 percent of Crawford County's in this land use category. Commercial/Industrial facilities are found primarily in the City of Grayling and in Frederic Township, with expansion noted in areas along M-72, along I-75 and in Beaver Creek Township around the junction I-75 and US 27.

Extractive/Barren
This category includes quarries, strip mines and gravel pits as well as land in transition (forest clear cuts, transition between agriculture and forest lands, and changes due to natural causes such as fire or flooding). Areas of bare rock, sand or clay with little green vegetation are also included in this class, which makes up 2.3 percent (8278 acres) of Crawford's land area.
Recreational
Land devoted specifically for recreational purposes amounted to approximately 0.13 percent, or about 460 acres in Crawford County. Land uses included in this category are public parks and campgrounds, golf courses, schools, churches and public buildings.

Agricultural
With only 3,957 acres classified as farmland, agriculture operations make up a relatively small portion (1.1%) of the County's land use. The largest concentration and majority of the agricultural land use is located in Maple Forest Township with smaller areas located in Beaver Creek Township and South Branch Township. Agriculture land is used predominately as pastureland hay and growing crops such as beans, oats, and barley. A small amount of land is used for livestock such as cattle, milk cows and hogs.

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Non-Forested Uplands
Non-forested land is defined as areas supporting early stage of plant succession consisting of plant communities characterized by grasses or shrubs. Non-forest land makes up 7.1 percent or 25,719 acres of the County's land area. Typical grass species are quack grass, Kentucky bluegrass, upland and lowland sedges, reed canary grass and clovers. Typical shrub species include blackberry and raspberry briars, dogwood, willow, sumac and tag alder. Also included in this category are the lands used by the National Guard at camp Grayling for artillery and bombing ranges.

Upland Forest

Upland forests make up 266,861 acres or 74.1 percent of the County's surface area. While some of this land may have been converted to other uses since 1990, it is still by far the largest single land cover/use in the County. The predominant species on much of these lands is jack pine but other species such as white, red, scotch pines, sugar and red maple, elm, beech, yellow birch, cherry, basswood, white ash, and aspen can also be found.

Lowland Forest
The County's land use inventory shows that 43,959 acres or 12.2 percent of the County's surface area consists of lowland forests. Lowland forests are defined as those containing ash, elm and soft maple, along with cottonwood and balm-of-Gilead. Lowland conifers, such as cedar, tamarack, black and white spruce and balsam fir stands are also included. Lowland forests are mostly found close to the rivers and lakes in the county.

Wetlands
As can be noted from Table 4.1, 3,904 acres or 1.1 percent of the County's land area was identified as wetlands. Wetlands are those areas between terrestrial and aquatic systems where the water table is at, near, or above the land surface for a significant part of most years. The hydrologic regime is such that it permits the formation of hydric soils or it supports the growth of hydrophytic vegetation. Examples of wetlands include marshes, mudflats, wooded swamps and floating vegetation situated on the shallow margins of bays, lakes, rivers, ponds, streams. These wetland categories include shrub wetlands, fresh-water marshes, wet meadows, open bogs, emergent wetlands and aquatic bed wetlands.

Surface Water
Crawford County is home to many small lakes and several major rivers. Surface water makes up 1.1 percent (4,005 acres) of the County's land use types. The combination of wetlands types, lowland forests and surface water makes up a significant portion (14.6 percent) of the County's surface area. Therefore, protecting the county's water and wetland resources should be a major priority in land use planning.

Planning & Zoning

Crawford County Planning Commission completed a master plan in 2009 and has initiated an update in 2013. Crawford County has no zoning enforced at the county level. Beaver Creek, Maple Forest, Frederic, South Branch, Grayling and Lovells Townships and the City of Grayling have exercised their authority under state statutes to administer their own planning and zoning. These three communities have a zoning administrator, planning commission and zoning board of appeals that administer their zoning. The planning commissions are responsible for overseeing the master plan, recreation plan and zoning ordinance. The Township Boards and County Board are the governing bodies responsible for managing finances and making policy decisions. None of the communities have planning and zoning staff and rely on planning commissions to oversee planning and zoning activities.

Planning and Zoning are the principal tools that local communities have to manage growth, preserve community character, protect property values and enhance the economic viability of the area. Planning helps establish and focus the desired future of the community and zoning ordinances are used as one of the primary ways to implement the community master plan and achieve the goals of the community.

A key element of the community master plan is the future land use plan. This is the culmination of the planning process that entails an analysis of existing conditions, public input and goal setting, and finally establishing the community's desired future. The community-wide future land use plan includes a map that depicts where the community envisions types and densities of development. As well, the plan may address important resource areas to protect. Accompanying text describes future land use categories, compatible uses, incompatible uses and development densities. Special issue areas may include utility service areas, roads, open space development and waterfront development. The future land use plan is a policy document designed to guide land use decisions over a given planning horizon, usually 20 years. By comparison, the zoning ordinance and zoning map is a local law that regulates how property can be developed today.

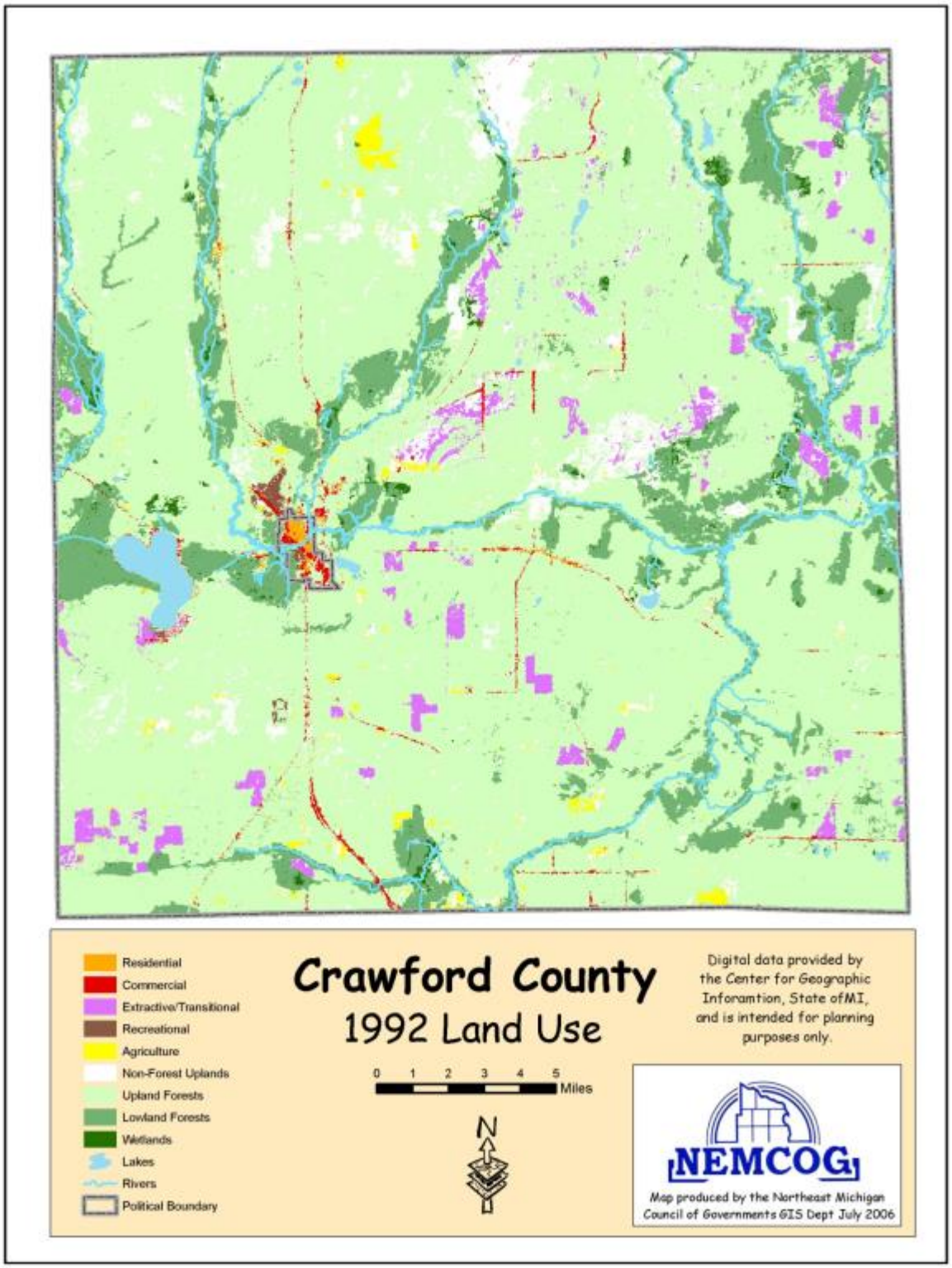
Land-use planning and zoning are governmental functions critical to public safety. However, because these functions are political as well, they are subject to intense differences of opinion and to public controversy. Therefore, they tend to lag behind development until the problem becomes aggravated. Being political they are also subject, even after enactment into law, to pressures for variances and modifications. With few exceptions, they cannot be made retroactive and, consequently, older developments are not much affected by them. Where land-use planning and zoning have been enforced, however, they have achieved significant degrees of fire safety (Oreg. St. Dep. For. 1978b, San Bernardino County Bd. Sup. 1974).

While building codes provide guidance on how to build in hazardous areas, planning and zoning activities direct development away from these areas, especially floodplains and wetlands. They do this by designating land uses that are compatible to the natural conditions of the land, such as open space or recreation in a flood plain, or by simply allowing developers more flexibility in arranging structures on a parcel of land through the planned development approach.

Capital improvement plans guide major public expenditures for communities for the next 5 to 20 years. Capital expenditures may include creating access roads and fire breaks, hazardous fuels reduction projects including community vegetation management, vegetation removal, and vegetation clearing and/or thinning, and retrofitting existing public structures against wildfire, etc.

Master plans, including the future land use plan, are implemented through zoning, capital improvement programs and recreation planning. Zoning is the primary tool used by most communities to implement their master plan. Zoning regulates the type, intensity and location of development in a community. As such, zoning provides communities a means to implement hazard mitigation strategies for land use development, which may include standards for private/public road construction; driveway standards; requirements for developments (such as subdivisions, condominium, commercial, recreational and industrial) to have two egress ingress roads; and house addresses to be displayed on 911 signs at the driveway end. Another important zoning tool available to communities is the Planned Unit Development (PUD). Use of PUDs provides flexibility to both the community and developer to incorporate Firewise development standards. In high risk areas, PUD standards should include use of defensible zones, fuel breaks, road and driveway design, signage for street identification, ingress and egress roads, underground utilities and vegetative maintenance for managing dangerous fuel loads in high fire risk areas.

Figure 4-3


Residential
Commercial
Extractive/Transitional
Recreational
Agriculture
Non-Forest Uplands
Upland Forests
Lowland Forests
Wetlands
Lakes
Rivers
Political Boundary
Crawford County
1992 Land Use
0 1 2 3 4 5
Miles
N
Digital data provided by the Center for Geographic Inforamtion, State of MI, and is intended for planning purposes only.
NEMCOG
Map produced by the Northeast Michigan Council of Governments GIS Dept July 2006

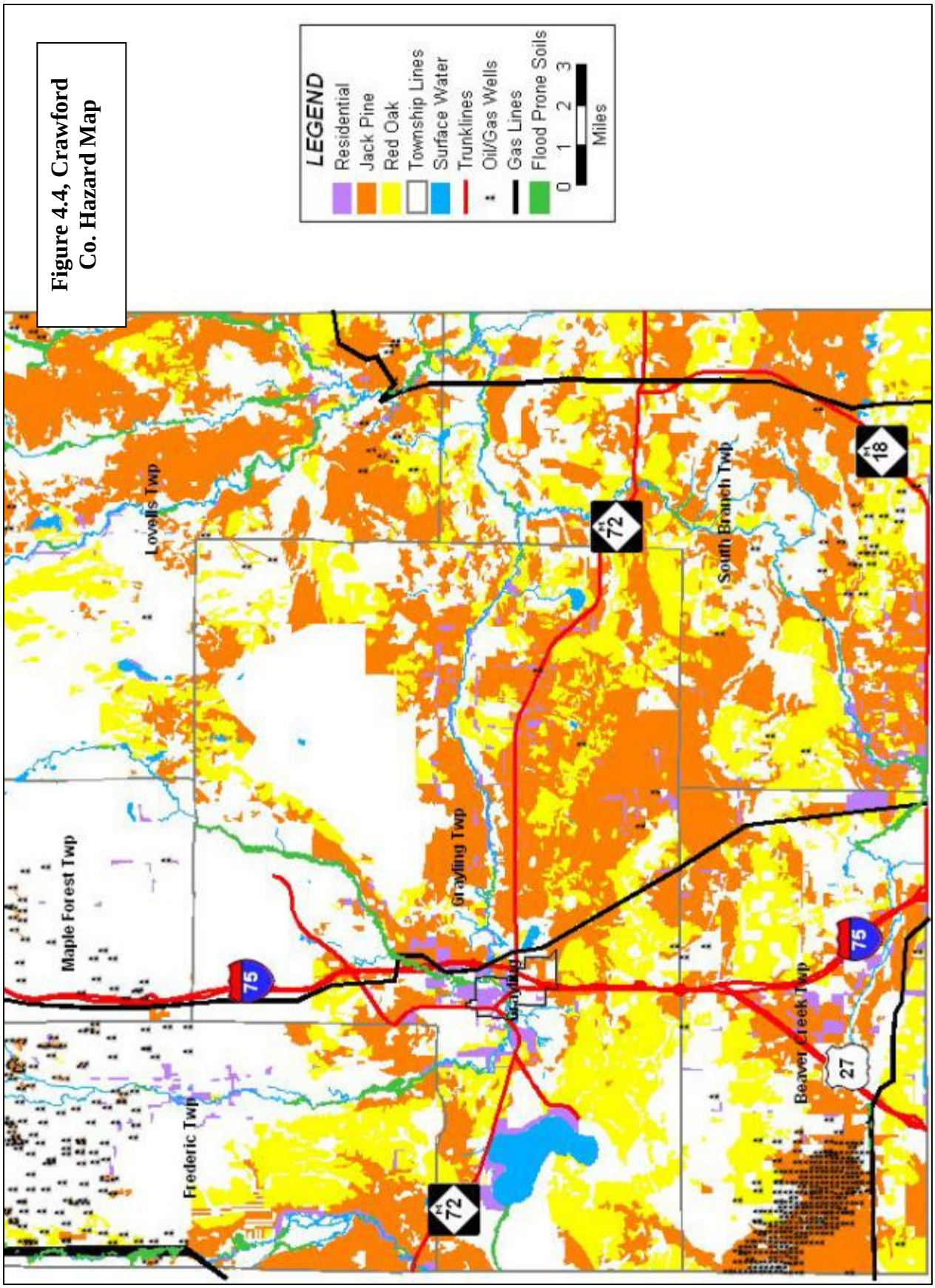


Figure 4.4, Crawford Co. Hazard Map

Chapter 5 - Community Services and Facilities

Overview

Adequate public and private infrastructure (roads and utilities) and public facilities and services are essential elements of modern life. The cost to construct new infrastructure and facilities and to maintain services is enormous. The costs together with the area's changing population and ever changing technologies associated with many of these items makes planning for future needs imperative. While the County encompasses 527 square miles, the majority of the population and infrastructure is concentrated in and around the City of Grayling and Grayling Charter Township.

County Government

The Crawford County Board of Commissioners meets on the fourth Thursday of each month, unless posted otherwise, at the County Building 200 W. Michigan Ave., Grayling, MI 49738, telephone (989)-348-2841. The County is represented by Seven Commissioners. Secretary to the Board is Sandra Moore 200 W. Michigan Ave., Grayling, MI 49738, (989)-344-3200.

District	Commissioner	Address	Telephone
1	Dave Wyman	604 Peninsular, Grayling, 49738	(989) 390-0833
2	Sharon Priebe	PO Box 691, Grayling, 49738	(989) 710-0337
3	Shelley Pinkelman, V-Chr.	3940 Manistee River Rd., Frederic, 49733	(989) 344-4146
4	Linda Munsey	9285 Outing Place, Grayling, 49738	(989) 348-5911
5	Rick Anderson	338 Red Tailed Hawk Loop, Grayling, 49738	(989) 348-4809
6	Dave Stephenson, Chair	5478 Appleton, Grayling, 49738	(989) 348-9678
7	Phil Lewis	707 Larson Ct., Roscommon, 48653	(989) 275-5716
Email the above at: First initial last name @crawfordco.org			

County Controller Paul Compo 200 W. Michigan Ave., Grayling (989) 344-3202 pcompo@crawfordco.org Fax: (989) 348-5743	**County Clerk/ Register** Sandra Moore 200 W. Michigan Ave., Grayling (989) 344-3200 smoore@crawfordco.org Fax: (989) 344-3223
Treasurer Joseph Wakeley 200 W. Michigan Ave., Grayling (989) 344-3229 jwakeley@crawfordco.org Fax: (989) 344-3223	**Sheriff** Kirk Wakefield 200 W. Michigan Ave., Grayling (989) 344-3205 sheriff@crawfordsheriff.org Fax: (989) 348-6532 Jail Fax: (989) 344-8300
Emergency Services Larry Akers 202 W. Michigan Ave., Grayling (989) 344-3268 emd@crawfordsheriff.org	**Transit Authority** Julee Dean 4276 W. N. Down River Rd (989) 348-8215 Grayling, 49738

Fax: (989) 348-6351	Fax: (989) 348-6631
Environ. Monitoring Paul Compo 200 W. Michigan Ave., Grayling (989) 344-3202 Fax: (989) 344-3258	**MSU Ext. Service** Linda Cronk 200 W. Michigan Ave., Grayling (989) 344-3264 Fax: (989) 344-3265
Conservation Dist. Ch. Walt Neilson PO Box 156, Roscommon, 48653 (989) 275-5231	**Distr. 10 Health Dept.** Kyle Anderson 202 Meadows Dr., Grayling, 49738 (989) 348-7800
Housing Commission Cy Wakeley 203 Huron, Grayling, 49738 (989) 348-3513 Fax: (989) 348-2958	

Minor Civil Divisions

Crawford County has six townships along with the City of Grayling.

Beaver Creek Township, 8888 S. Grayling Rd, Grayling, MI 49738, (989) 275-8878
Frederic Township, 7564 County Rd. 612, PO Box 78 Frederic, MI 49733, (989) 348-8778
Grayling Township, 2090 Viking Way, PO Box 521 Grayling, MI 49738, (989) 348-4361
Lovells Township, 8405 Twin Bridge Rd., Grayling, MI 49738, (989) 348-9215
Maple Forest Township, N. Sherman Rd. (mail to clerk), Frederic, MI 49733, (989) 348-5794
South Branch Township, P.O. Box 606, 5245 M-18, Roscommon, MI 48653, (989) 275-8232
City of Grayling, 1020 City Blvd., Grayling, Michigan 49738, (989) 348-2131

Public Safety

Law Enforcement
Crawford County has two local law enforcement agencies, the Sheriff's Office, located at 200 W. Michigan Avenue in Grayling and the City of Grayling Police Department located at 1020 City Blvd. in Grayling. The County 911 system is a separate county function and is co-located in the Sheriff Department as well as the Crawford County Jail. Crawford County is patrolled by Michigan State Police Troopers assigned to the Houghton Lake Post and the Kalkaska Detachment. There are troopers that are assigned to Crawford County that start and end their shifts at the Michigan State Police Crime Lab located on the I-75 business loop in Grayling. Camp Grayling will provide some law enforcement to Crawford County if needed.

Emergency Medical Services
Crawford County maintains Emergency Medical Services (EMS) throughout the county. Medical Response (MMR) units are located in Beaver Creek Township and the City of Grayling. South Branch Township and Frederic Township maintain local Emergency Medical Services (EMS).

Fire and Emergency Services
Crawford County has five community fire departments providing fire protection to all areas of the County. In addition, Camp Grayling has one fire departments, providing fire protection service

for the residents of Camp Grayling, but will assist fire departments in Crawford County if needed. **Table 2.5** provides a summary of fire and emergency services,

There are a total of nine Fire Departments located in Crawford County consisting of:

Frederic Township VFD, a partially paid fire department covering 108 square miles, and providing fire protection for approximately 1,994 persons. It is located on 6547 Frederic St., Frederic, MI. The Frederic VFD provides fire and emergency first responder services to Maple Forest Township. The mailing address is PO Box 79, Frederic, MI 49733. Phone (989) 348-8190.

Grayling City-Township FD, a partially paid fire department covering 180 square miles, and providing fire protection for approximately 8,468. It is located on 1041 City Blvd., Grayling, MI. The mailing address is 1041 City Blvd., Grayling, MI 49738. Phone (989) 348-6319. The operating budget is $250,000. Medical response is provided by MMR and Station 1-Frederic EMS. Water sources are located at Pollack Bridge, Euclid Bridge/Portage Creek, Stephan Bridge, Wakeley Bridge, Wilcox Bridge, and Lake Margrethe ½ mile west of Danish Landing Rd.

Lovells Township FD, a volunteer fire department covering 108 square miles, and providing fire protection for approximately 626. It is located on 8405 Twin Bridge Rd., Grayling, MI. The mailing address is 8405 Twin Bridge Rd., Grayling, MI 49738. Phone (989) 348-9215. The Lovells Township FD provides fire and first responder services township- wide. The annual budget for both the fire fighters and first responders is $96,425. The water sources are the lakes in the Township.

South Branch Township FD, a partially paid fire department covering 108 square miles, and providing fire protection for approximately 2000. It is located on 5245 N. M-18 Roscommon, MI. The mailing address is 5245 N. M-18, Roscommon, MI 48653. Phone (989) 275-4779. Annual Fire Budget: $269,000. The Township also provides ambulance protection within the Fire Department with an annual budget of $97,500.

Beaver Creek FD, a partially paid fire department covering 72 square miles, and providing fire protection for approximately 2000. It is located on 8972 S. Grayling Rd., Grayling, MI. The mailing address is 8972 S. Grayling Rd., Grayling, MI 49738. Phone (989) 275-8548. The current operating budget for the Fire Department is $262,247. Mobile Medical Response operates in Crawford County with their primary station located in the City of Grayling and uses this station as a full time satellite station.

Camp Grayling: Fire suppression has been funded through the military. The Camp contracts with the Grayling Fire Department for structural fire suppression and has a seasonal crew for first response on wildfire suppression from March to November.

DNR Grayling Field Office is located on 1955 Hartwick Pines Rd., Grayling, MI 49738. Phone: (989) 348-6371. The northern two thirds of the county covered out of Grayling field office.

DNR Roscommon Field Office is located at 8717 North Roscommon Rd, Roscommon. The southern one third of the county is covered out of the Roscommon Field Office.

(Note: Camp Grayling Fire Departments primarily provide fire protection service to the residents of Camp Grayling but will provide fire protection to Crawford County if needed).

Water Sources for Fire Suppression

Outside the City of Grayling, fire departments must rely on water tenders to fight structural fires and wildfires. In rural areas access to water sources such as dry hydrants need to be strategically located to minimize travel times. A key factor in locating water supply sites is proximity to population areas. In some cases, location is merely driven by easy access to surface waters such as river crossings. Community fire departments supplied maps with locations of developed water sources. Those sites were encoded into a geographic information system and used to develop a Water Supply Map of the county, see ~~Figure 5.1~~

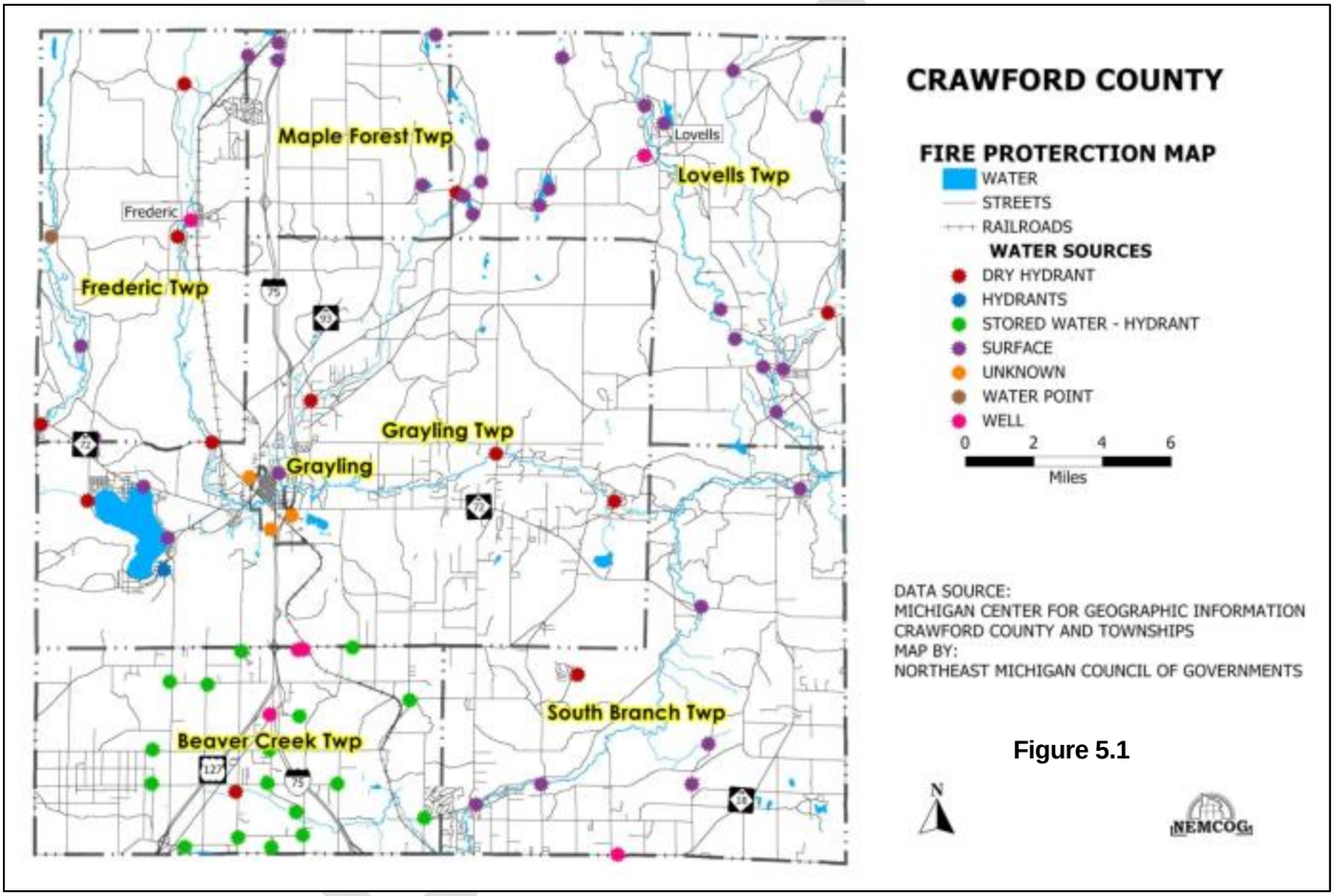


Figure 5.1

Figure 5.1

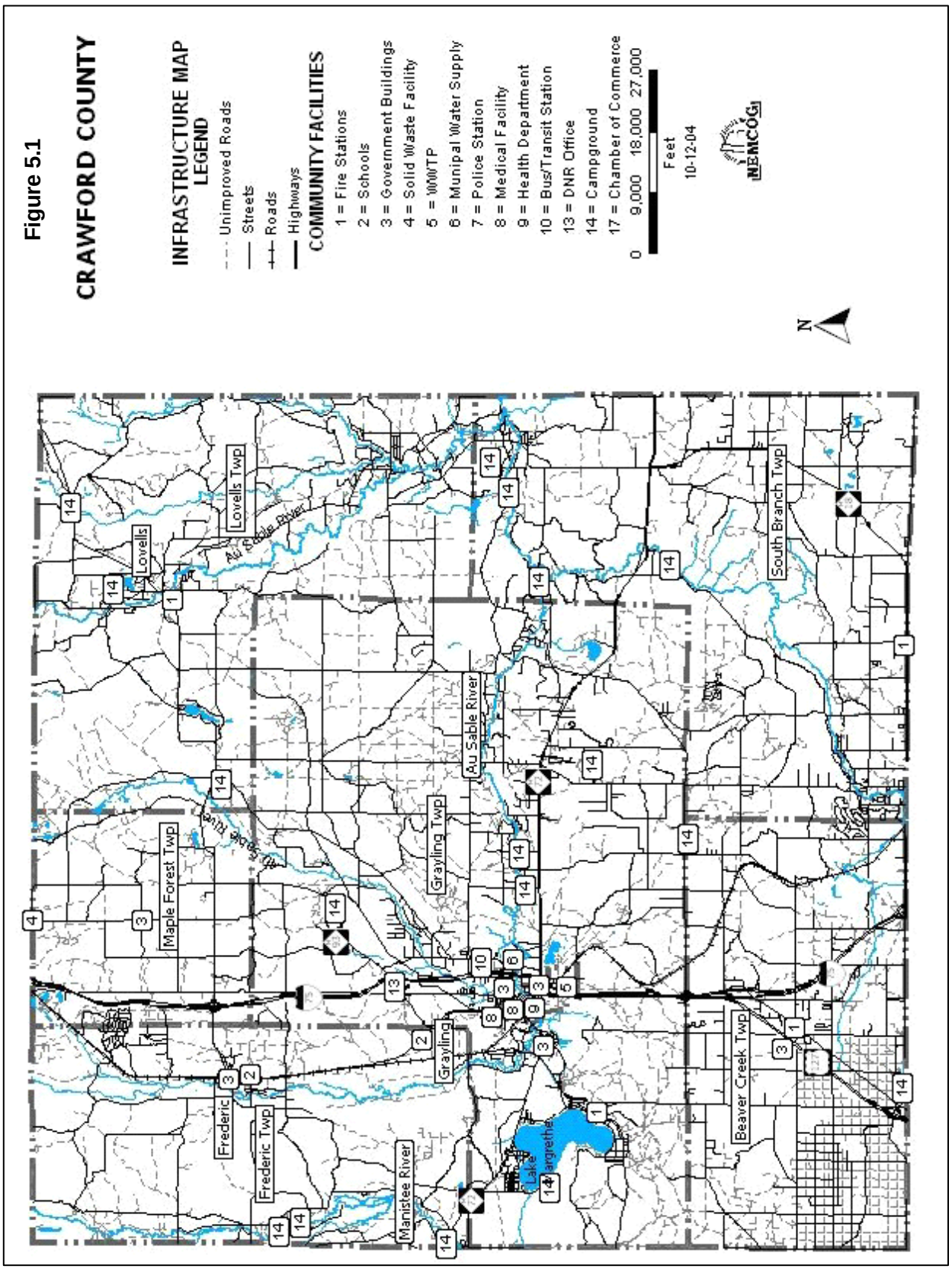

CRAWFORD COUNTY
INFRASTRUCTURE MAP
LEGEND
Unimproved Roads
Streets
Roads
Highways
COMMUNITY FACILITIES
1 = Fire Stations
2 = Schools
3 = Government Buildings
4 = Solid Waste Facility
5 = WWTP
6 = Munipal Water Supply
7 = Police Station
8 = Medical Facility
9 = Health Department
10 = Bus/Transit Station
13 = DNR Office
14 = Campground
17 = Chamber of Commerce
0 9,000 18,000 27,000
Feet
10-12-04
NEMCOG
N
Lovells
Lovells Twp
Au Sable River
Maple Forest Twp
Grayling Twp
Grayling
Frederic
Frederic Twp
Manistee River
Lake Margrethe
Beaver Creek Twp
South Branch Twp

Table 2.5
Crawford County Fire Protection

Name	Type	Coverage (Sq. miles)	Population	Equipment/Staff
Frederic-Maple Forest FD 6547 Frederic St., Frederic	Paid-Volunteer	108	1,287	Staff: 30 full time or paid on call members Equipment: 1 brush truck 2 engines 1 tanker of 3,000 gallons 1 ORV with a 50 gallon tank of water 4 Advanced Life support ambulances.
Grayling City-Township 1041 City Blvd., Grayling	Partially-paid	180	8,000	Staff/Volunteers: 18 Equipment: Truck #220 – 2,000 Gallon Type 1 Tanker/Pumper Truck #221 – Type 2 Engine, 2 Person Cab Truck #222 – Type 1 Engine, 5 Person Cab Truck #230 – 2,000 Gallon Type 1 Tanker Truck #240 – Light Rescue Truck, Jaws/Ice Rescue Truck #250 – Water Point Truck, 275 GPM Trash Pump Truck #251 – 75' Type 1 Aerial/Engine, Jaws
Lovells Township Twin Bridge Rd., Lovells Twp.	Volunteer	108	626	Volunteers: 15 Equipment: One Small (on a Ford F-550 chassis) Fire Truck One Large Fire Truck One (3,000 gallon capacity) Pumper Truck One vehicle assigned solely to medical response missions
South Branch Township M-18 Hwy., Roscommon	Partially-paid	108	2,001	Staff: 1 Full time Chief and 23 Paid on-call firefighters, 2 Paramedics, 14 EMT-B, 1 EMT-S, 1MFR Equipment: 1250 Gal. Main Engine 1250 Gal. Engine/2000 Gal. Tender 500 Gal. Tender/2000 Gal. 2000 Gal. Tender Water Point Truck Command/Echo Unit Light Brush Truck 300 Gal. 6X6 5 Ton Wild Fire Truck 6X6 2 ½ Ton Wild Fire Truck Basic Ambulance

Beaver Creek Grayling Rd., Beaver Creek Twp.	Paid	72	2,000	Staff and volunteers: The Department has five full time Responders and an additional six Paid On Call employees. Equipment: Unit 722 is a 1250 gpm / 1000 gallon Class A Apparatus. Unit 723 is a 1500 gpm / 1000 gallon Class A Apparatus. Unit 724 is a 1250 gpm / 1000 gallon Class A Apparatus. Unit 731 is a 50 gpm / 2000 gallon Tanker. Unit 740 is a Rescue vehicle Equipped with Medical First Response, Trench Rescue equipment and used to pull Hazmat Trailer or Snowmobile rescue trailer.
Grayling DNR Field Office 1955 Hartwick Pines Rd.	Paid	North 2/3 Crawford	NA	Staff at Grayling 1 Fire Supervisor 2 fulltime Fire Officers 7 other fire line qualified firefighters Equipment: 2- Tractor-plows 1- Skidgine (Skidder) with 500gal of water and plow unit 3- Large water units 1- small water unit
Roscommon DNR Field Office 8717 North Roscommon Rd.	Paid	South 1/3 Crawford	NA	1 Fire Supervisor 2- full-time Fire Officers 5- fire line qualified firefighters Equipment: 1-Tractor plow 2 large water units 1 small water units
Source:				

Medical Facilities

Mercy Hospital Grayling is a 130 bed facility (90 acute care, 40 long term care) and is the largest medical facility in Crawford County. It is located on 1100 E. Michigan Ave., Grayling, MI 49738. Phone: (989) 348-5461. Troop Medical Clinic is located within Camp Grayling and has minimal

staff much of the year that attend to troop related medical issues, only during troop training does it have a full staff.

District Health Department #10 is often able to fill health care needs of the community. The Crawford County Branch is located on 220 Meadows Dr., Grayling, MI 49738, Phone: (989) 348-7800. Programs offered by the Health Department fall under three categories: home health care services, environmental health services and personal health services. Northern Lakes Community Mental Health of Traverse City provides support services to developmentally disabled persons as well as persons needing mental health services, Phone: (231) 922-4850.

Public Water Supply

The Department of Environmental Quality (DEQ) has primary enforcement authority in Michigan for the Federal Safe Drinking Water Act under the Michigan Safe Drinking Water Act. The DEQ has regulatory oversight for all public water supplies including approximately 1,500 community and 11,000 non-community water supplies. The program also regulates drinking water well drilling for approximately 25,000 new domestic wells drilled each year. Like most of northern Michigan, Crawford County's only source of drinking water is groundwater. Public water supply for the County is summarized below:

Private Wells: Most of Crawford County's land area is served by private wells and nearly 2,645 of these wells supply water to County residents. If drinking water comes from a private well, the owner is responsible for the water's safety. EPA rules do not apply to private wells, but the agency recommends that well owners have their water tested annually.

Community Water Systems: Community water systems serve the population year-round, such as in private residences or businesses. There are five active community water systems in Crawford County, serving a total of 2,776 persons. This figure includes the City of Grayling community system, which supplies drinking water to 1,952 City residents and is maintained by the City of Grayling Department of Public Works.

Utility Services

Due to the large amount of public land, utility services are lacking in some areas of the County. MichCon provides natural gas service for much of the County, a portion of Crawford County does not have natural gas service. Frontier and AT&T provide telephone service to the largest geographic area of the County. However, there are pockets of un-served areas in the county. Consumer Energy and Great Lakes Energy provide electricity to the developed areas within the County.

The City of Grayling Department of Public Works provides water and sewer services to the City of Grayling. Residents and business owners in the remainder of the County must rely on on-site private wells for domestic drinking water needs and private on-site septic systems for wastewater disposal. District Health Department #10, regulates and maintains a permitting system for private wells and septic systems.

Schools

Most of Crawford County is within the Crawford AuSable School District located on 1135 N. Old US 27, Grayling, MI 49738, Phone: (989) 344-3500. South Branch Township and a portion of Beaver Creek Township are located in the Roscommon Area Public School District located at 702 Lake St., Roscommon, MI 48653, Phone: (989) 275-6600. **Table 2.6** provides a summary of school districts and schools servicing Crawford County.

Table 2.6
Crawford County Schools

Crawford AuSable School District		
School Name	**Address**	**Students and Staff**
Grayling Elementary-AuSable Primary School Phone: (989) 344-3604	100 Michigan Ave. Grayling, MI 49738	Students: 712 Staff: 79
Grayling Middle School Phone: (989) 344-3558	500 Spruce St. Grayling, MI 49738	Students: 368 Staff: 43
Grayling High School-Adult Ed Phone: (989) 344-3508	1135 N. Old-27 Grayling, MI 49738	Students: 566 Staff: 55
Roscommon Area Public Schools		
School Name	**Address**	**Students and Staff**
Roscommon Elementary School (989) 275-6610	175 W. Sunset Dr. Roscommon, MI 48653	Students: 510 Staff: 43
Roscommon Middle School Phone: (989) 275-6640	299H W. Sunset Dr. Roscommon, MI 48653	Students: 428 Staff: 44
Roscommon High School Phone: (989) 275-6675	10600 Oakwood Dr. Roscommon, MI 48653	Students: 474 Staff: 41
Other Schools		
School Name	**Address**	**Students and Staff**
Calvary Baptist Academy Phone: (989) 348-9220	6504 W. M72 Hwy Grayling, MI 49738	Students: 20 Staff:

Source: NEMCOG

Special Populations

Nursing homes and adult foster care facilities have residents with special medical needs. Additionally, evacuation of residents from larger facilities presents challenges. As a result, when planning for wildfire protection it is importation to identify the location and needs of these facilities. See **Table 2.7**

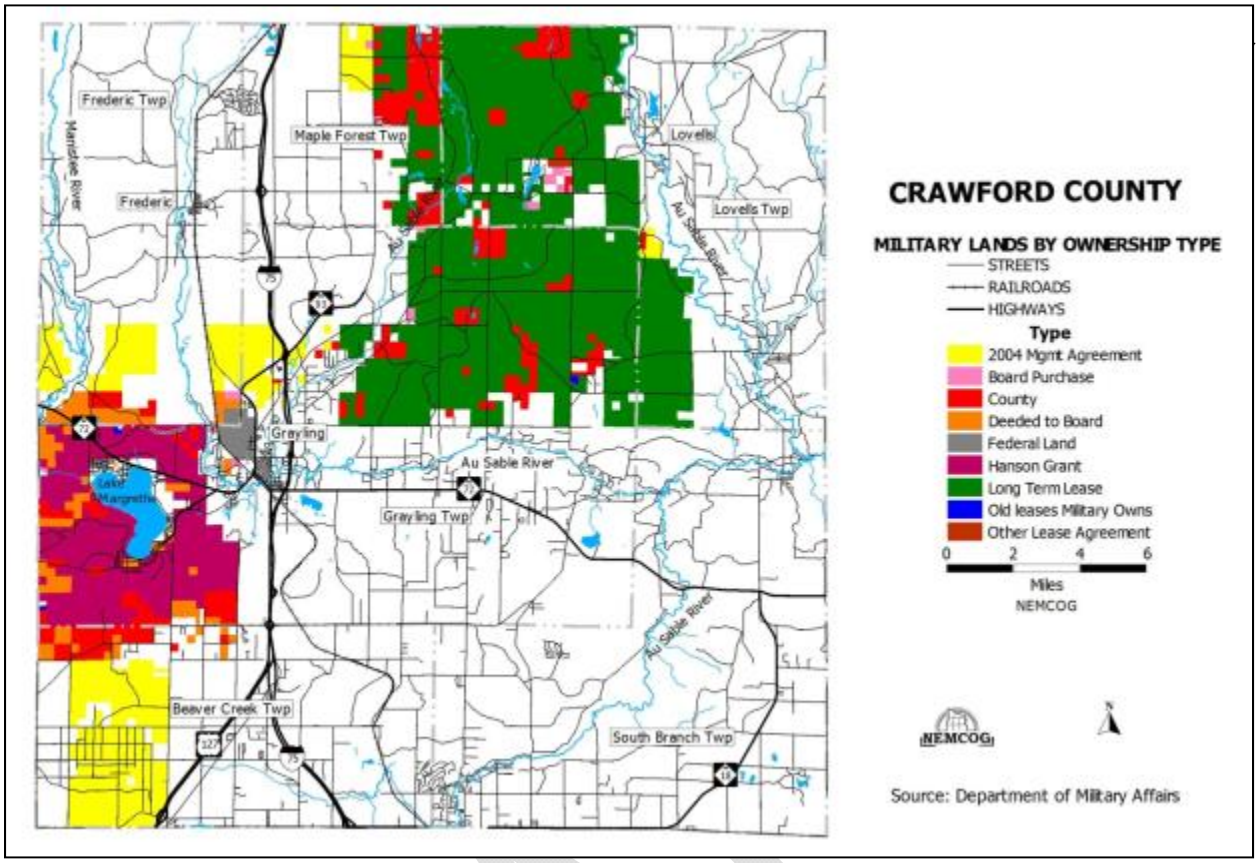
Table 2.7 Special Populations		
Nursing Homes		
Name	**Address**	**Information**
Grayling Nursing Centre Phone: (989) 348-2801	331 Meadows Drive Grayling, MI 49738	Beds: 120 Staff: 50
Mercy Hospital-Grayling LTCU Phone: (989) 348-5461	1100 Michigan Ave. Grayling, MI 49738	Beds: 40 Staff: 600
Adult Foster Care/Assisted Living Facilities		
Name	**Address**	**Information**
AuSable License Type: Small Group Phone: (989) 248-7603	1086 AuSable Trail Grayling, MI 49738	Capacity: 6 Staff: 1-2
Jones Lake Home License Type: Small Group Phone (989) 348-2461	PO Box 2909, 3464 Jones Lake Grayling, MI 49738	Capacity: 6 Staff: 1-2
Wargos Manor License Type: Medium Group Phone: (989) 348-9647	808 Chestnut Grayling, MI 49738	Capacity: 12 Staff: 1-2
The Brook Phone: (989) 745-6500	503 Rose St. Grayling, MI 49738	Capacity: 24 Apartments Staff: 10
Source: NEMCOG		

Governmental Facilities (Camp Grayling)

Camp Grayling is an important component of the Crawford County community landscape. Camp Grayling, with its 147,000 acres, is the largest military installation east of the Mississippi River, and the nation's largest National Guard training site. This state owned and operated facility accommodates a wide variety of training opportunities ranging from small arms to heavy artillery. It is home to a new "state of the art" Multi-Purpose Range Complex (MPRC) and a MATES facility that houses (527) tracked vehicles, including (77) M1 tanks. **Figure 2.6** shows lands under Camp Graying's jurisdiction.

Training is conducted here all year round with active and reserve units of the Army, Navy, Air Force, and Marine Corps all making use of Camp Grayling's unique combination of training resources. Training at Camp Grayling focuses on heavy vehicles and larger units.

Camp Grayling has 427 buildings for troop use located at both the main installation grounds and Grayling Army Airfield. Quarters available can house 725 officer and 6,144 enlisted personnel. In addition, tentage availability includes GP large, GP medium and GP small, along with 150 Arctic's with capability of housing 6,780 personnel. Total housing capacity is 13,649 personnel. There are fifteen battalion and higher headquarter buildings for administrative and supply support needs. The camp has an Ammunition Supply Point (ASP) on post, which can handle all ordnance requirements. Bulk fuel sites are operational providing JP-8 and diesel fuels. Seven vehicle buildings with a total of 14 bays can be utilized for maintenance support.



Helicopter/helicopter door gunnery and anti-armor gunneries are also conducted at Camp Grayling. The installation also operates a multi-purpose range complex (MPRC) for tank, TOW, door gunneries and infantry assaults with automated target scenarios. To coincide with all range assets is maneuver land for training tactics. The installation also conducts air-to-ground munitions delivery for fixed wing aircraft with drops up to 500 pounds.

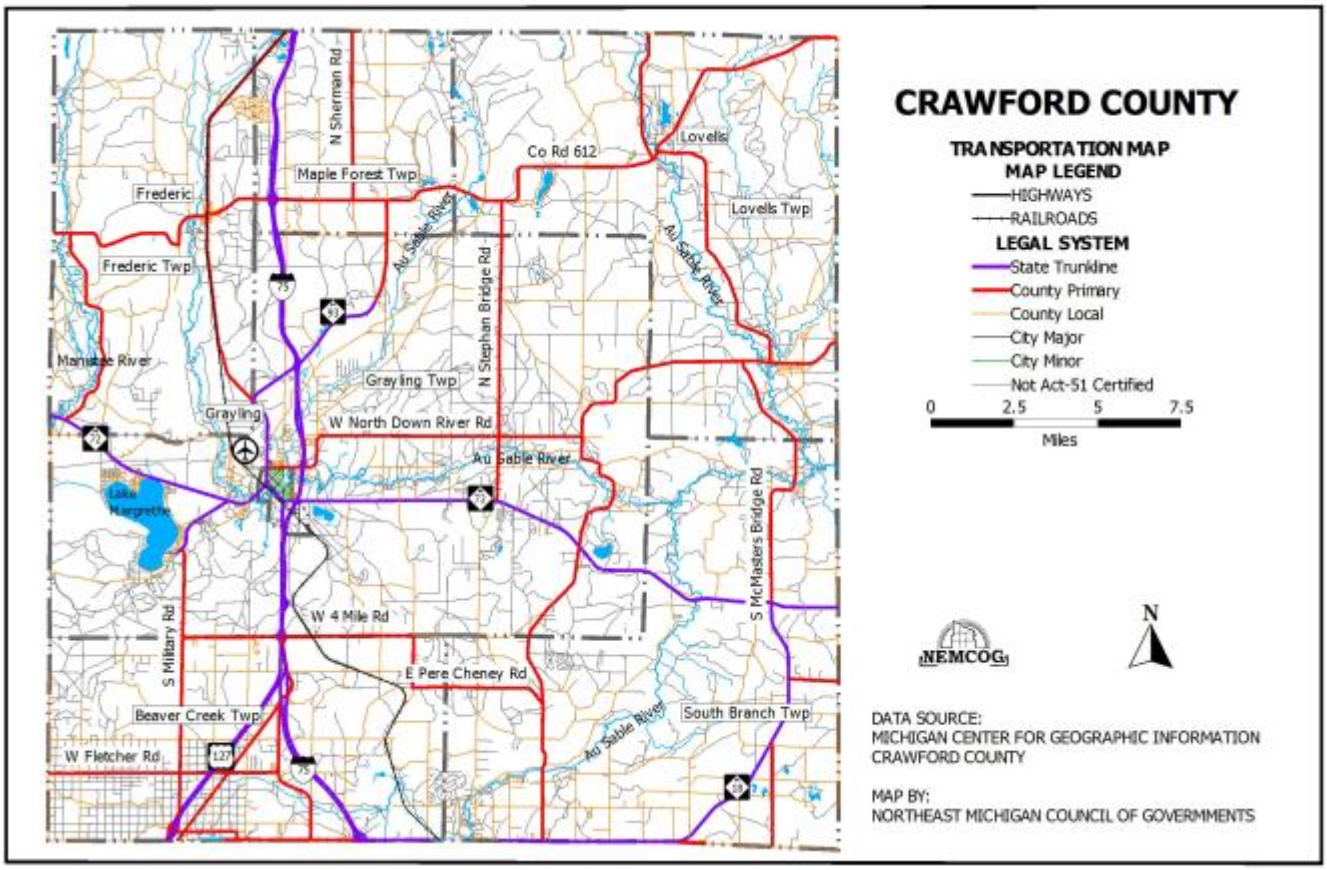
Range 40 Complex includes an air-to-ground bombing range and an artillery range. A Multi-Purpose Range Complex includes MLRS/RRPR, miller drop zone, AT-4, TOW and dragon ranges, M-2 50 caliber MG Range, Jones lake base camp, tracked vehicle maneuver areas, wheeled vehicle maneuver areas and a MATES facility. Grayling Army Airfield has 60 helipad tie down areas, an air traffic control tower, a flight operations center, a cantonment Area, VOR/NDB/VASI/REIL, a hangar facility, and runway lighting system. The South (Main Camp) is the post headquarters, with housing/barracks areas, ARF range, combat pistol range, shotgun/MG ranges, mortar range, demolition range, LANES training areas, maneuver training areas, and NBC gas chamber.

Roads and Highways

The transportation system in Crawford County is depicted in **Figure 2.7**. Interstate 75 is the major north-south highway in Crawford County, and goes through the City of Grayling. Crawford County's major east-west route is M-72, which also comes through the City of Grayling.

Other major roads include US-127 that runs north-south and connects with I-75 in Beaver Creek Township. M-18 runs north-south on the eastern edge of Crawford County and connects with M-72. County Road 612 runs east-west along the northern portion of the County connecting the

Village of Frederic and Lovells. Old-27 parallels I-75 through Crawford County and connects the Village of Frederic and the City of Grayling. North Other County Primary roads include North Down River Road, W. 4 Mile Road, E. Pere Cheney Road, W. Fletcher Road, Chase Bridge Road, S. Military Road, S. McMaster Bridge Road, Lovells Road, N. Sherman Road, County Road 502, Old 144 Road, N. Higgins Lake Road, Grayling Road, Manistee River Road, and Twin Bridge Road.



Public Transportation

The Crawford County Transportation Authority (CCTA) is the only transit service available in Crawford County. It services the City of Grayling and Crawford County with 26 employees running 17 vehicles. CCTA is located on 4276 W. North Down River, Grayling, MI 49738, Phone: (989) 348-8215. See **Table 2.8** for system profile.

Rail Service

An active railroad runs 29 miles north-south across the western parts of the County. Lake State Railway Company (LSRC) currently operates their Mackinac Subdivision, which runs parallel to Michigan's I-75 corridor between Bay City and Gaylord.

Airports

The Grayling AAF Airport is a multiple runway airport located on the Grayling Army Airfield and is the only airport in Crawford County. This airport is owned and operated by the U.S. Government

and serves the City of Grayling and Crawford County. Address: Grayling Army Airfield, Grayling, MI 49739, Phone: (989) 344-4301.

Table 2.8
Transit System Profile

The Crawford County Transportation Authority has been providing safe, dependable transit services to the citizens of Crawford County and the City of Grayling since 1976. It is one of the first countywide systems in Michigan. The system prides itself on providing an extremely high level of service to a relatively low, sparsely populated county, which results in a high per capita level of ridership.

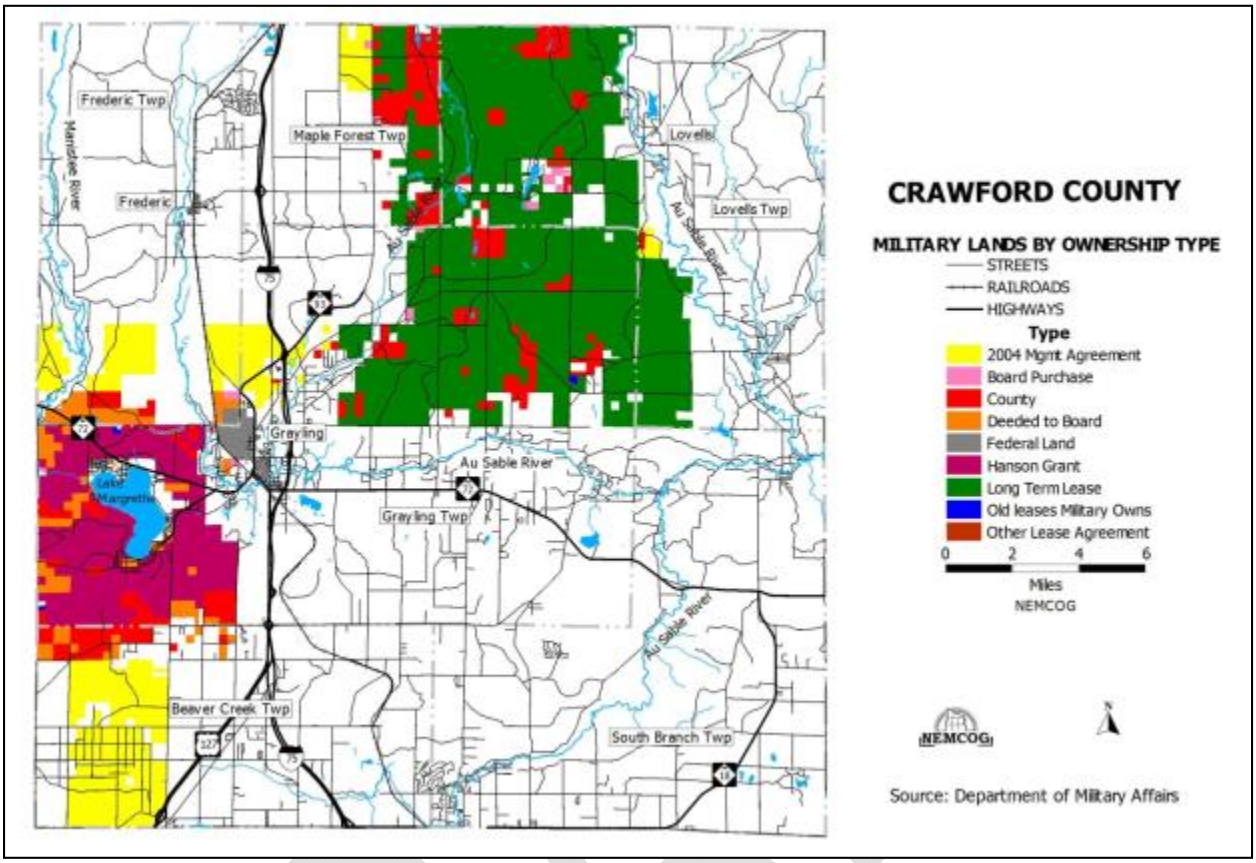
System Characteristics	
Days/Hours of Operations:	M-F 6:00 a.m. - 6:00 p.m.
Total vehicles:	17
Lift-equipped vehicles:	16
Population Served:	14,226
Employees:	26
FY 2010 System Data	
Miles:	446,412
Vehicle Hours:	23,485
Passengers:	100,833
Total Eligible Expenses:	$1,393,965
Source: Michigan Department of Transportation	

Governmental Facilities (Camp Grayling)

Camp Grayling is an important component of the Crawford County community landscape. Camp Grayling, with its 147,000 acres, is the largest military installation east of the Mississippi River, and the nation's largest National Guard training site. This state owned and operated facility accommodates a wide variety of training opportunities ranging from small arms to heavy artillery. It is home to a new "state of the art" Multi-Purpose Range Complex (MPRC) and a MATES facility that houses (527) tracked vehicles, including (77) M1 tanks. **Figure 5.2** shows lands under Camp Graying's jurisdiction.

Training is conducted here all year round with active and reserve units of the Army, Navy, Air Force, and Marine Corps all making use of Camp Grayling's unique combination of training resources. Training at Camp Grayling focuses on heavy vehicles and larger units.

Camp Grayling has 427 buildings for troop use located at both the main installation grounds and Grayling Army Airfield. Quarters available can house 725 officer and 6,144 enlisted personnel. In addition, tentage availability includes GP large, GP medium and GP small, along with 150 Arctic's with capability of housing 6,780 personnel. Total housing capacity is 13,649 personnel. There are fifteen battalion and higher headquarter buildings for administrative and supply support needs. The camp has an Ammunition Supply Point (ASP) on post, which can handle all ordnance requirements. Bulk fuel sites are operational providing JP-8 and diesel fuels. Seven vehicle buildings with a total of 14 bays can be utilized for maintenance support.



Helicopter/helicopter door gunnery and anti-armor gunneries are also conducted at Camp Grayling. The installation also operates a multi-purpose range complex (MPRC) for tank, TOW, door gunneries and infantry assaults with automated target scenarios. To coincide with all range assets is maneuver land for training tactics. The installation also conducts air-to-ground munitions delivery for fixed wing aircraft with drops up to 500 pounds.

Figure 5.2

Range 40 Complex includes an air-to-ground bombing range and an artillery range. A Multi-Purpose Range Complex includes MLRS/RRPR, miller drop zone, AT-4, TOW and dragon ranges, M-2 50 caliber MG Range, Jones lake base camp, tracked vehicle maneuver areas, wheeled vehicle maneuver areas and a MATES facility. Grayling Army Airfield has 60 helipad tie down areas, an air traffic control tower, a flight operations center, a cantonment Area, VOR/NDB/VASI/REIL, a hangar facility, and runway lighting system. The South (Main Camp) is the post headquarters, with housing/barracks areas, ARF range, combat pistol range, shotgun/MG ranges, mortar range, demolition range, LANES training areas, maneuver training areas, and NBC gas chamber.

Community Events

Event and Date

Grayling: Annual Christmas Walk, November 20
Men Who Cook, May 19
Mercy Hospital Lights of Love, December 7
AuSable River Marathon, last full weekend of July

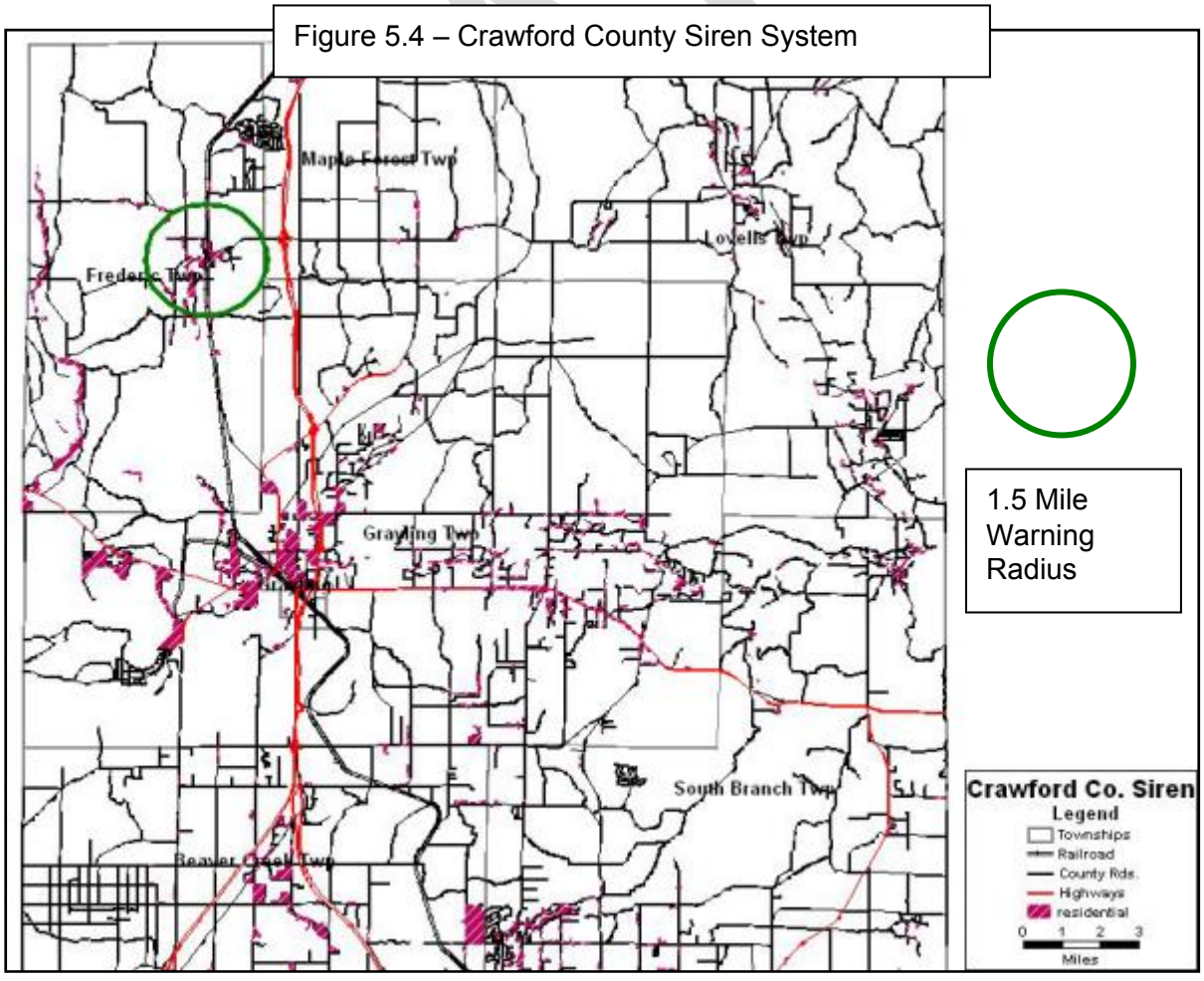
Independence Day Celebration, July 4
Thanksgiving Dinner @ AAF, Thanksgiving Day

Early Warning & Siren Systems

There is currently only one active siren located in Crawford County. **(Figure 5.4),** located in the Village of Frederic. There are no siren warning systems functioning in the City of Grayling. However, there is currently on file with the State of Michigan a request for grant money to erect 10 warning sirens around the county.

The County warning system is also integrated into the National Weather Service's NOAA Weather Radio alert system and the National Emergency Alert System. Signal coverage In Crawford County is comprehensive, covered from the NOAA transmitter in Otsego County to the North. As indicated in **Appendix F**, the Crawford Emergency Management Office has distributed a number of weather alert radios to schools, medical facilities, emergency services, and governmental centers across the County. The Emergency Alert System also broadcasts over every radio and television station in the area. But this coverage is compromised since many of the county's rural residents receive their TV programming via satellite, which in many cases does not broadcast local information.

Figure 5.4 – Crawford County Siren System



Chapter 6 - Hazard Identification & Local Risk Assessment

Overview

Crawford County is vulnerable to a wide range of natural, technological and human-related hazards. Managing these many varied threats, and protecting life and property, are challenges faced by emergency management officials at all levels of government. In order to attain an effective emergency management capability to mitigate, prepare for, respond to, and recover from all types of hazards, an understanding of the multitude of hazards that confront the County must first be obtained. The first step is to identify potential hazards within a community. Next, the hazards are ranked according to the relative risk to the community. The final step in the process will be to assess the level of vulnerability for each identified hazard.

When coupled with relevant community profile information, hazard identification and vulnerability assessment becomes a powerful planning tool that can enable emergency management officials to set priorities and goals for resource allocation and mitigation and preparedness activities. This process should not be considered a reliable predictor of the occurrence of any hazard. Hazards have always had an uncanny way of occurring when least expected. This section can give communities a realistic base by which to plan for mitigation, preparedness, response and recovery activities.

High Priority Hazards in Crawford County

Fire Hazards

Wildfire

Wildfire is defined as an uncontrolled fire in grass, brush lands, or forested areas. The most immediate dangers from wildfires are the destruction of homes and timber, wildlife, and injury or loss of life to persons who live in the affected area or who are using recreational facilities in the area. Long-term effects can be numerous and include scorched and barren land, soil erosion, landslides/mudflows, water sedimentation, and loss of recreational opportunities. Forests cover approximately one-half of Michigan's total land base. As a result, much of the state is vulnerable to wildfire. In addition, development in and around forests and grasslands is increasing rapidly, making public safety a primary consideration in wildfire mitigation and suppression efforts.

Table 6.1
Number of Wildfires by County in Northeast Michigan, 2001-May of 2012
(MDNR jurisdiction only)

County	Number of Wildfires	Acres Burned
Otsego	**231**	**329**
Alcona	135	376
Alpena	135	303
Cheboygan	136	328
Crawford	224	11,819
Montmorency	110	416
Oscoda	61	256
Presque Isle	74	424

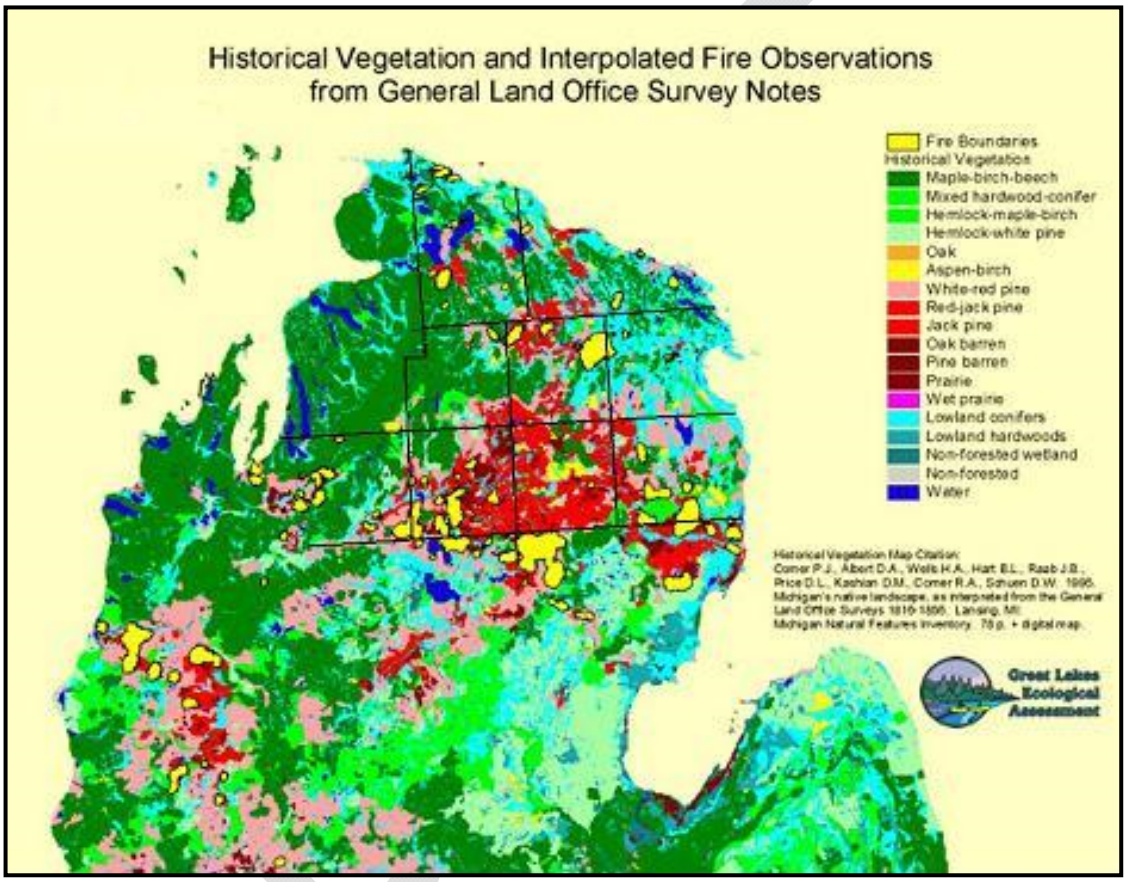
Source: Michigan Department of Natural Resources, Forest Management Division

Almost 91 percent of Crawford County is forested. Forest types vary depending upon the soils, moisture and past activities such as logging, fires and land clearing. Jack pine, aspen-birch and oak are the most common forest types. According to the MIRIS Land Cover/Use Inventory, the most

prevalent forest type is jack pine, covering over 24.8 percent of the county, with dry land oaks covering 21%. The draughty, low fertility sandy soils, found in outwash plains and channels, supported pre-settlement jack pine forests that for thousands of years were perpetuated by wildfires. A review of the pre-settlement vegetation of Crawford County shows extensive areas were covered with pine and oak forests.

Figure 6.1 was compiled by the Great Lakes Ecological Assessment project. The map shows historical vegetation and interpolated fire observations (in yellow) for northern Michigan. Approximate county boundaries were drawn on the maps as a reference. As can be seen on

Figure 6.1, Historic Vegetation/Fire Observations



this map, most of Crawford County was covered with forests prone to wildfires, and wildfires were common. The current distribution of Pine-Oak forest type in Crawford County is depicted in **Figure 6.2**.

Information from the Michigan Department of Natural Resources shows there were 224 wildfires from 2001 to May of 2012 in the county that resulted in 11,819 acres burned. **(Table 6.1)** *It should be noted that the figures shown in the table do not include those wildfires suppressed by local volunteer fire departments or the U.S. Forest Service.* If records from those sources were readily available, the number of wildfires and acres burned would be higher. Nevertheless Crawford County ranks very high among Northeast Michigan counties. The relatively high number of wildfire occurrences in Crawford County during this time may be partially explained by the proximity of population centers and high recreational use within the wildfire prone

pine/oak forests of the County. A review of data provided by the MDNR found between 2001 and 2012 there were seven wildfires greater than 50 acres in size. On April 24 of 2008, a 1,345 acre fire burned to the southern boundary of the community of Grayling. The largest fire in recent history was the Meridian Boundary Fire, which occurred on May 18, 2010, consumed 8,586 acres. **Figure 6.3** shows the location of wildfires in Crawford County from 2001 to May of 2012. **Table 6.2** is a listing of large fires in the Crawford County Area. The table shows number of acres burned and structures lost.

Table 6.2
Large Fire Incidents near Grayling MI

Year	Name	Acres Burned	Structures Damaged or Lost
1980	Mack Lake Fire	over 24,790 acres	1 Fire Fighter Killed 44 homes destroyed
1990	Billman Fire (i.e; Indian Glens)	615 acres	5 houses and 15 outbuildings
1990	Stephan Bridge Fire	5,916 acres	76 houses and 125 outbuildings
	Note- Stephan Bridge and Indian Glens Fires occurred simultaneously, Stephan fire burned over an 8 mile stretch in less than 4 hours		
1992	Luzerne Fire	687 acres	Destroyed several homes
2000	No Pablo Fire	5,200 acres	No structure lost
? 2000	Sunrise Fire	180 acres	1 out building
2001	Jacobs Fire		
2006	Hughes Lake Fire Suppression costs over 1 million	6,000 acres	23 structures
2008	Four Mile Road Fire note this fire closed I-75 for a period and interfaced with the City of Grayling	1,345 acres	4 houses,
2008	Staley Lake Fire	80 acres	0 structures
2010	Meridian Boundary Fire	8,586 acres	12 houses and 39 outbuildings
2010	Range #9 Fire	1,040 acres	4 houses, 3 commercial buildings, 1 outbuilding
	Note, Meridian and Range 9 Fires burned simultaneously		
2011	Howes Lake Fire heavy interface with residential area much potential for loss of homes with this fire	817 acres	2 outbuildings
	Refuge fire		
	Mech Fire		
	Damon Fire		

Source: MDNR | Note, between 1981 and 2000, MDNR recorded 351 wildfires in Kalkaska County, 519 wildfires in Otsego County, 698 wildfires in Crawford County, and 371 wildfires in Roscommon County

Currently, about 2% 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 property, timber, wildlife, and injury or loss of life to persons who live in the affected area or who are using recreational facilities in the area.

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 as residential development continues to expand into the same historic wildfire prone areas. A 60% increase in the number of rural homes since 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. The large number of permanent and seasonal homes in northeastern Michigan, coupled with increased tourism during driest, and therefore most vulnerable, times of the year greatly increases the risk from wildfires.

Scrap Tire Fires

Any instance of uncontrolled burning scrap tire storage or recycling site. Each year in the U.S., an estimated 250 million vehicle tires have to be disposed of. Michigan alone generates 7.5-9 million scrap tires annually. Many of these scrap tires end up in disposal sites (legal or illegal), some of which may have several hundred thousand tires. Michigan currently has more than 24 million scrap tires at disposal sites scattered across the state. Tire disposal sites can be fire hazards due to the large quantity of "fuel" onsite, coupled with the fact that the shape of a tire allows air to flow into the interior of a tire pile, rendering standard firefighting practices nearly useless. Flowing burning oil released by the burning tires spreads the fire to adjacent areas. Some scrap tire fires have burned for months, creating acrid smoke and an oily residue that can leach into the soil, creating long-term environmental problems. Scrap tire fires differ from conventional fires in several respects: 1) even relatively small scrap tire fires can require significant resources to control and extinguish; 2) the costs of fire management are often far beyond that which local government can absorb; 3) the environmental consequences of a major tire fire can be significant; and 4) the extreme heat from the fire converts a standard passenger vehicle tire into about two gallons of oily residue, which can then leach into the soil or migrate to streams. There are no known tire storage sites in Crawford County.

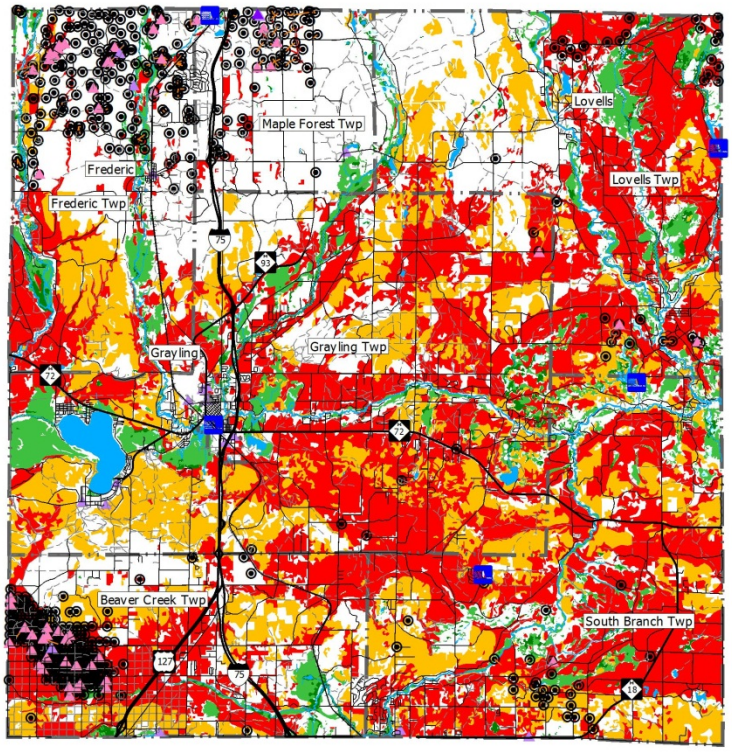


Figure 6.2

CRAWFORD COUNTY

HAZARDS MAP

crawford_fire_forest
Oil/Gas Wells
Crawford_part_615
Crawford_part_201
Contamination Sites
Unimproved Roads
Streets
Railroads
Highways
Dams

NATIONAL WETLANDS INVENTORY

Aquatic Bed
Emergent
Forested
Scrub-Shrub
Unconsolidated Bottom
Unconsolidated Shore
Other

FIRE PRONE FORESTS

Central Hardwood
Pine

0 2 4 6
Miles

NEMCOG

N

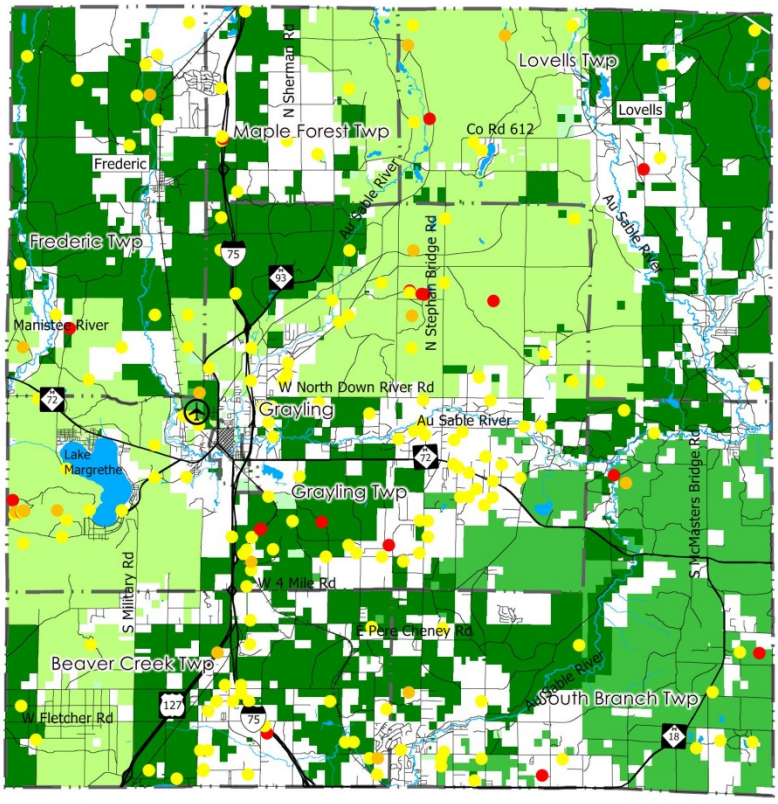


Figure 6.3

CRAWFORD COUNTY

WILDFIRES LOCATION MAP

MICHIGAN
MILITARY
USA
OTHER PUBLIC
STREETS
RAILROADS
HIGHWAYS

WILDFIRES 2001-2012

LESS THAN 5 ACRES
5 to 10 ACRES
GREATER THAN 10 ACRES

0 2.5 5 7.5
Miles

N

DATA SOURCE:
MICHIGAN CENTER FOR GEOGRAPHIC INFORMATION
CRAWFORD COUNTY

MAP BY:
NORTHEAST MICHIGAN COUNCIL OF GOVERMMENTS

Structural Fires

Any instance of uncontrolled burning which results in structural damage to residential, commercial, industrial, institutional, or other properties in developed areas. 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 U.S., fires result in approximately 5,000 deaths and 300,000 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. Particularly devastating are large urban conflagrations in which multiple structures are damaged or destroyed. Not surprisingly, Michigan's structural fire experience mirrors the national figures. The State Fire Marshal estimates that a structural fire occurs every 24 minutes in Michigan. The total number of all fires in Crawford County during 2003 was 70, with a total property/contents loss of $318,650.

Crawford County, unlike some of the more rural neighboring counties relays on a combination of paid and non-paid fire departments. **(See Chapter 5)** This provides the county with an excellent array of firefighting services available to the respective communities. Lack of full-time professional fire fighters in outlying rural townships means less time available to conduct fire inspections and take other preventive measures necessary to lessen structural fire threat. Out of necessity, efforts in these communities are directed more at fire suppression. This typical scenario in rural areas of the state poses great challenges for maintaining a sustainable fire prevention and inspection program. Crawford County also benefits from firefighting support from Camp Grayling.

Another major challenge facing Michigan fire service is the lack of a state-mandated fire safety code and code enforcement program for all occupancies. The State enforces fire safety codes in schools, dormitories, health care facilities, and correctional facilities, plus some businesses; the remainder of the job is left to local officials. Since there is no uniform, mandated fire safety code at the state level, a variety of local ordinances have emerged. Some communities may not have fire safety codes. This problem manifests itself more seriously in rural areas and small towns, which typically have few, if any, paid full-time fire fighters. Even if a mandated fire safety code were instituted statewide, it wouldn't totally solve the problem of structural fire prevention because the costs of compliance in existing buildings would often be prohibitive for business owners. Such a measure would, however, help ensure that new construction doesn't compound the problem.

High Priority Technological Hazards

Hazardous Materials Incident -- Fixed Site

A hazardous materials incident is defined as any uncontrolled release of hazardous materials from a fixed site, capable of posing a risk to health, safety, property and the environment. Hazardous materials are present in quantities of concern in business and industry, agriculture, universities, hospitals, utilities, and other community facilities. Hazardous materials are materials or substances, which, because of their chemical, physical, or biological nature, pose a potential threat to life, health, property and the environment if they are released. Examples of hazardous materials include corrosives, explosives, flammable materials, radioactive materials, poisons, oxidizers, and dangerous gases. Hazardous materials are highly regulated by the government to reduce risk to the general public, property and the environment. Despite precautions taken to ensure careful handling during the manufacture, transport, storage, use and disposal of these materials, accidental releases are bound to occur. Areas at most risks

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

The world's deadliest hazardous material incident occurred on December 4, 1984, in Bhopal, India. A cloud of methyl isocyanate gas, an extremely toxic chemical, escaped from a Union Carbide chemical plant, killing 2,500 people and injuring tens of thousands more. This incident triggered historical Federal legislation intended to minimize such disasters from occurring in the United States.

There are currently six 302 sites located in Crawford County.

Verizon Roscommon/Skyline Central Office. 4279 Skyline Rd. Grayling, MI. Battery Sulfuric Acid.
Shell Western E&P, Frederic 2 CPF, 11700 Newman Rd. Frederic, MI. Hydrogen Sulfide
Northern Pure Ice Company, 427 S- I-75 Business Loop, Grayling, MI. Ammonia, NH_3.
Weyerhaeuser Company, 4111 W. Four Mile Rd. Grayling, MI
Grayling Generating Station, 4400 W. Four Mile Rd. Grayling, MI.
Georgia-Pacific Resins, Inc, 4113 W. Four Mile Rd. Grayling, MI.

There are also three 302 sites located on Camp Grayling property and fall under the mitigative jurisdiction of the Federal Government.

Hazardous Material Incident – Transportation

Transportation related hazardous material incidents are defined as an uncontrolled release of hazardous materials during transport, capable of posing a risk to health, safety, property or the environment. All modes of transportation - highway, railroad, seaway, airway, and pipeline - are carrying thousands of hazardous material 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. The U.S. Department of Transportation regulates the transportation and shipping of over 18,000 different materials. Areas most at risk are within a 1-5 mile radius of a major transportation route along which hazardous material shipments move. All areas in Michigan are potentially vulnerable to a hazardous material transportation incident, although the heavily urbanized and industrialized areas in southern Michigan are particularly vulnerable due to the highly concentrated population.

A complex of transportation routes cross Crawford County. These include a major regional East-West state highway,M-18, M-72, and North-South Interstate I-75, and its junction with U.S.127 in Beaver Creek Township. **(Figure 6.4)**The large volume of hazardous material shipments that pass through the County on a daily basis focus on the City of Grayling and leave the area vulnerable to incidents involving hazardous material.

Air, Land and Water Transportation Accidents

A crash or accident involving an air, land or water-based commercial passenger carrier resulting in death or serious injury. Vulnerable areas would include: 1) communities with, or near, an airport offering commercial passenger service; 2) communities with railroad tracks on which commercial rail passenger service is provided; 3) communities in which commercial intercity passenger bus or local transit bus service is provided; 4) communities with school bus service; and 5) communities in which commercial marine passenger ferry service is provided. A serious accident involving any of the above modes of passenger transportation could result in a mass casualty incident, requiring immediate life-saving community response. In addition, a marine

transportation accident would require a water rescue operation, possibly under dangerous conditions on the Great Lakes.

In terms of commercial passenger transportation service, Michigan has: 1) approximately 19 airports that offer commercial air passenger service; 2) 130 certified intercity passenger bus carriers providing service to 220 communities; 3) 72 local bus transit systems serving 85 million passengers; 4) 19 marine passenger ferry services; and 5) 3 intercity rail passenger routes operating on 568 miles of track, along 3 corridors, serving 22 communities.
The Grayling AAF Airport is a multiple runway airport located on the Grayling Army Airfield and is the only airport in Crawford County. This airport is owned and operated by the U.S. Government but serves the City of Grayling and Crawford County private air traffic (**Figure 6.5).** Although Crawford County does not have a commercial airport, passenger rail service, commercial marine passenger service. School bus transportation and specialized public transit service do exist in the county. Accidents on either system could result in injuries and loss of life.

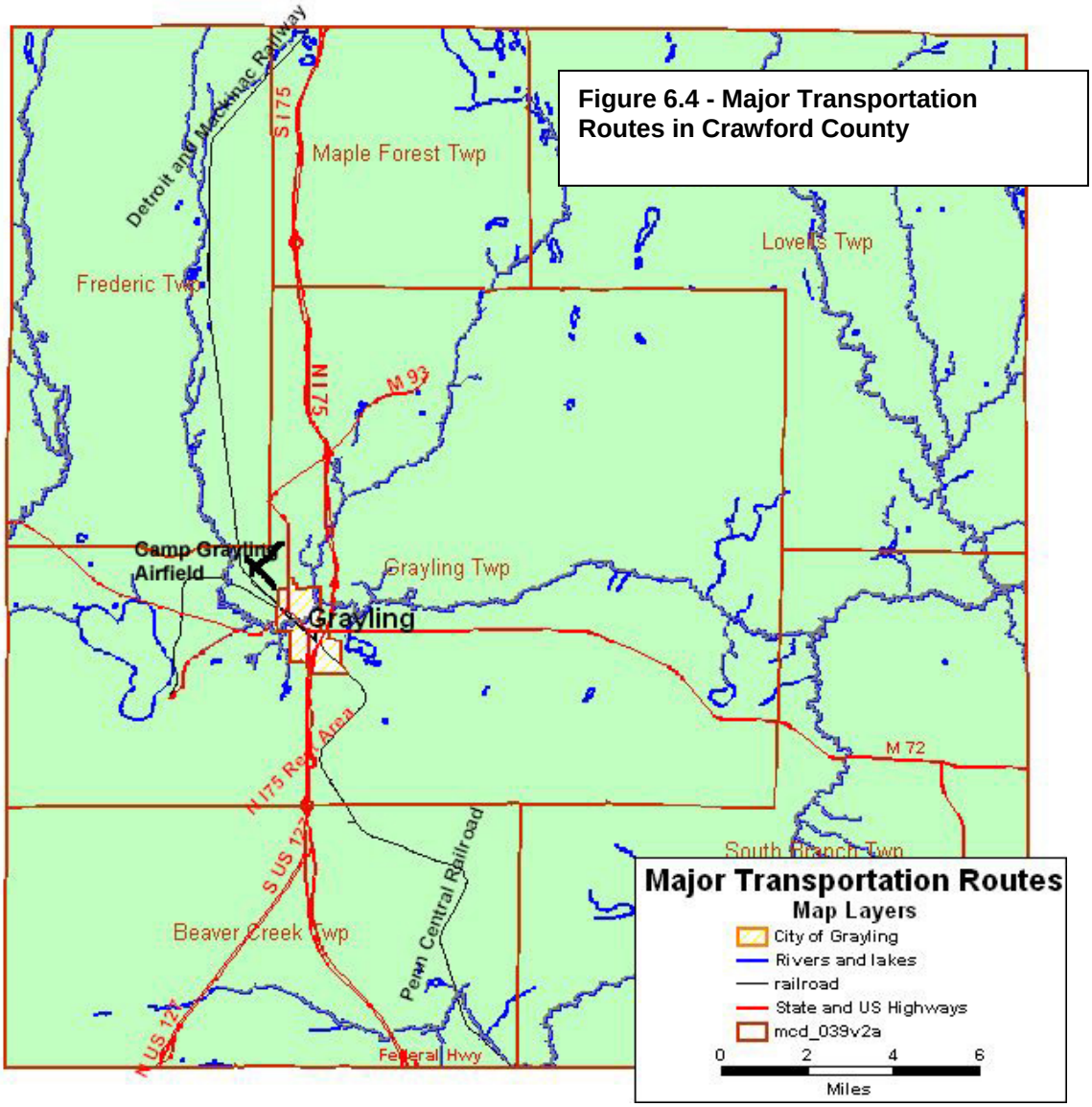
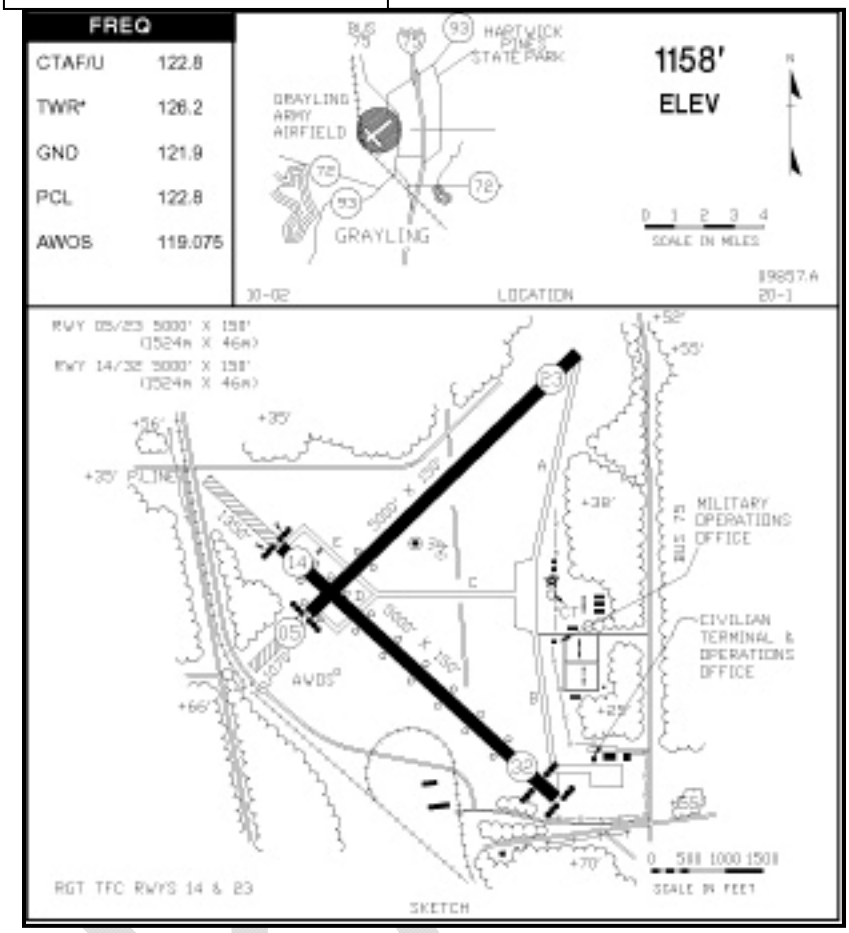


Figure 6.4 - Major Transportation Routes in Crawford County

Figure 6.5
Camp Grayling Airfield



Infrastructure Failures

Infrastructure failure is defined as failure of critical public or private utility infrastructure resulting in a temporary loss of essential functions and/or services. Such interruptions could last for periods of a few minutes to several days or more. Public and private utility infrastructure provides essential life supporting services such as electric power, heating and air conditioning, water, sewage disposal and treatment, storm drainage, communications, and transportation. When one or more of these independent, yet inter-related systems fails 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.

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. All of these situations can lead to disastrous public health and safety consequences if immediate mitigation steps are not taken. Typically, it is the most vulnerable segments of society - the elderly, children, ill or frail individuals, etc., that are 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 even regions can be negatively impacted.

Oil and Gas Pipeline Accidents

The potential for an uncontrolled release of oil or gas, or the poisonous by-product hydrogen sulfide, from a pipeline exists in Crawford County. As a major oil and gas consumer in the United States, vast quantities of oil and natural gas are transported through and stored in Michigan. Though often overlooked as a threat because much of the oil and gas infrastructure in the state is located underground, oil and gas pipelines can leak, erupt or explode, causing property damage, environmental contamination, injuries and loss of life. In addition to these hazards, there is also a danger of hydrogen sulfide release. Hydrogen sulfide is an extremely poisonous gas that is also explosive when mixed with air temperatures of 500 degrees or above. In addition to pipelines, these dangers can be found around oil and gas wells, pipeline terminals, storage facilities, and transportation facilities where the gas or oil has a high sulfur content.

Smaller lines from a delivery network that supplies natural gas to homes and businesses. Another network of extractive lines is associated with the 950 oil and gas wells that have been drilled in the county. Of these wells, 412 are producing, 182 are plugged and restored, and 290 have terminated permits. Oil wells account for 222 of the wells, while 220 are gas wells. Lines connect each well to a small processing/compressor facility. Brine and moisture is removed from the natural gas, and then the gas is transmitted through high pressure lines to major processing and storage facilities. There are no documented major incidents, however, with the miles of pipelines associated with extractive and delivery systems the potential of hazardous incidents does exist.

Oil and Gas Well Accidents

Oil and natural gas are produced from fields scattered across 63 counties in the Lower Peninsula. Since 1925, over 44,000 oil and natural gas wells have been drilled in Michigan, of which roughly half have produced oil and gas. To date, Michigan wells have produced approximately 1.4 billion barrels of crude oil and 4 trillion cubic feet of gas. The petroleum and natural gas industry is highly regulated and has a fine safety record, but the threat of accidental releases, fires and explosions still exists.

According to information provided by the MDEQ, there are 412 producing oil and gas wells located around the periphery of Crawford County**. (Figure 6.6**) Most of these wells are located in the northwest quadrant of the County in Frederic and Maple Forest Townships, with another cluster of wells located in the southwest corner of the county in Beaver Creek Township. Numerous small, low-pressure gas lines connect wells to the small processing facilities. Brine and moisture is removed from the natural gas, and then the gas is transmitted through high-pressure lines to major processing and storage facilities. There are no documented major incidents, however, with the miles of pipelines associated with extractive and delivery systems the potential of hazardous incidents does exist.

In addition to these hazards, many of Michigan's oil and gas wells contain extremely poisonous hydrogen sulfide (H2S) gas. Hydrogen sulfide is a naturally occurring gas mixed with natural gas or dissolved in the oil or brine and released upon exposure to atmospheric conditions. Over 1,300 wells in Michigan have been identified as having H2S levels exceeding 300 parts per million (ppm). As the table below indicates, at concentrations of 700 ppm, as little as one breath of hydrogen sulfide can kill. Although hydrogen sulfide can be detected by a "rotten egg" odor in concentrations from .03 ppm to 150 ppm, larger concentrations paralyze a person's olfactory nerves so that odor is no longer an indicator of the hazard. Within humans, small concentrations can cause coughing, nausea, severe headaches, irritation of mucous membranes, vertigo, and loss of consciousness. Hydrogen sulfide forms explosive mixtures

with air at temperatures of 500 degrees Fahrenheit or above, and is dangerously reactive with powerful oxidizing materials. Hydrogen sulfide can also cause the failure of high-strength steels and other metals. This requires that all company and government responders be familiar not only with emergency procedures for the well site, but also with the kinds of materials that are safe for use in **sour gas well** response. Currently there is a hydrogen sulfide well listed as a 302 site for Crawford County.

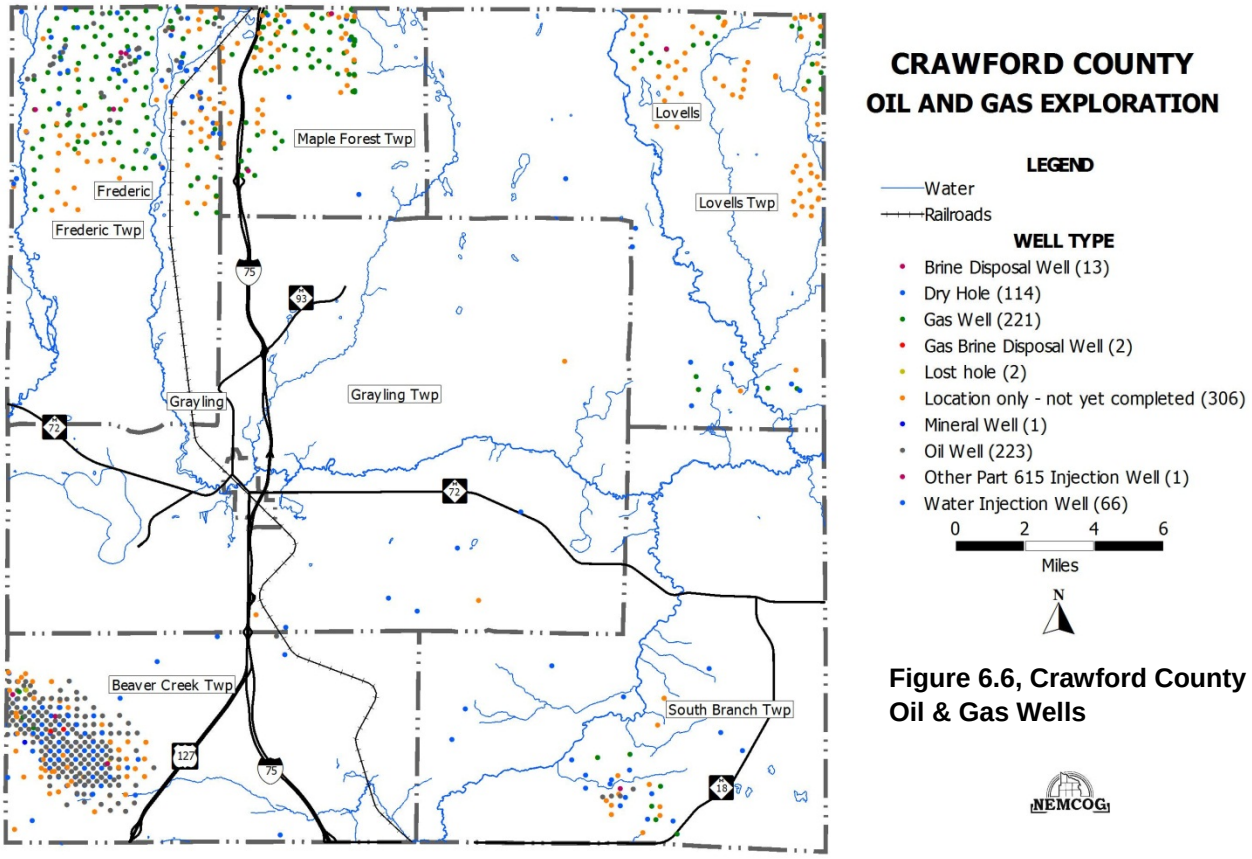


Figure 6.6, Crawford County Oil & Gas Wells

Natural Hazards

Severe Summer Weather Hazards

Although potential for violent storms is not predictable and can occur anywhere in the county, more densely populated urbanized sections of the county provide the greatest human/property risk and require the most concentrated mitigative consideration and action.

Hailstorms:

Hailstorms develop in a condition where atmospheric water particles from thunderstorms form into rounded or irregular lumps of ice that fall to the earth. Hail is a 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, however, 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. Hailstones range in size from a pea to a golf ball, but hailstones larger than

baseballs have occurred in the most severe thunderstorms. Hail is formed when strong updrafts within the storm carry water droplets above the freezing level, where they remain suspended and continue to grow larger, until their weight can no longer be supported by the winds. They finally fall to the ground, battering crops, denting autos, and injuring wildlife and people. Large hail is a characteristic of severe thunderstorms, and it often precedes the occurrence of a tornado.

> *According to the Michigan Hazard Analysis Plan: A line of severe thunderstorms that ravaged northern Lower Michigan during the weekend of September 26-27, 1998 produced hail up to 2" in diameter in Manistee County, destroying an estimated 30,000-35,000 bushels of apples at area farms. The same storm system produced tennis ball size hail north of the town of Gladwin, which damaged several homes and vehicles. In Arenac County, near Sterling, 3.5" diameter hail damaged crops and injured some livestock at area farms, and damaged several homes, satellite dishes, and vehicles.*

The National Weather Service began recording hail activity in Michigan in 1967. Statistics since that time indicate that approximately 50% of the severe thunderstorms that produce hail have occurred during the months of June and July, and nearly 80% have occurred during the prime-growing season of May through August. As a result, the damage to crops from hail is often extensive.

The incidence of hail follows the incidence of severe thunderstorms. Therefore, those areas of the state most prone to severe thunderstorms are also the area's most prone to large and damaging hail. Generally, severe thunderstorms that produce hail occur more frequently in the southern half of the Lower Peninsula than any other area of the state. However, damaging hail has occurred in every part of Michigan. The National Weather Service forecasts of severe thunderstorms usually provide sufficient warning time to allow residents to take appropriate action to reduce the effects of hail damage to vehicles and some property. However, little can be done to prevent damage to crops.

The National Climate Data Center reports 25 hail events in Crawford County since July 7, 1980, or an average of one storm each year. The largest diameter hailstone recorded in the County was 1.75 inches, and was recorded for three events during the same period.

Tornadoes:

A tornado is defined as a violently whirling column of air extending downward to the ground from a cumulonimbus cloud. The funnel cloud associated with a tornado may have winds up to 300 miles per hour and an interior air pressure that is 10-20 percent below that of the surrounding atmosphere. The typical length of a tornado path is approximately 16 miles, but tracks much longer than that - some even up to 200 miles - have been reported. Tornado path widths are generally less than one-quarter mile wide. Historically, tornadoes have resulted in the greatest loss of life of any natural hazard, with the mean national annual death toll being 111 persons. Property damage from tornadoes is in the hundreds of millions of dollars every year. Michigan averages approximately 16 tornadoes per year, most occurring in the southern Lower Peninsula. On average, one tornado is reported every 3.4 years in Crawford County.

Although relatively rare, tornadoes have occurred in Crawford County and have caused extensive damage. Michigan is located on the northeast fringe of the Midwest tornado belt. The lower frequency of tornadoes occurring in Michigan may be, in part, the result of the colder water of Lake Michigan during the spring and early summer months, a prime period of tornado activity. Michigan averages approximately 15 tornadoes per year. Over the past 31 years, 9

tornadoes have been recorded in Crawford County. Tornadoes are most common in the afternoon although 2 of the tornadoes in Crawford County occurred during the A.M. In Northern Michigan tornadoes are most likely in the summer months, although tornadoes have occurred in the spring and fall. In Crawford County, a tornado did occur on April 19, 1975, but the remainder were during the summer months. The Fujita Scale ranks tornadoes from F0 to F6 based on wind speed and intensity. F0 and F1 tornadoes are described as weak tornados with wind speeds from 40 to 112 mph, F2 and F3 are strong tornados with wind speeds from 113-206 mph, F4 and F5 are violent tornados with wind speeds from 207 to 318 mph and an F6 is an inconceivable tornado with wind speeds above 319 mph. Of the 9 tornadoes that have been recorded in Crawford County since May 20, 1975, two were F0, five were F1 and two were F0. Tornadoes occurred at a rate of about 1 each 10 years. The total accumulated reported damage of all these storms was $353,000.

Severe Winds (Windstorm)

According to the National Weather Service, winds in excess of 58 miles per hour are classified as a windstorm. Windstorms are a fairly common occurrence in many areas in Michigan. Along the Great Lakes shoreline, strong winds occur with regularity, and gusts of over 74 miles per hour (hurricane velocity) do occasionally occur in conjunction with a storm front. Severe windstorms can cause damage to homes and businesses, power lines, trees and agricultural crops, and may require temporary sheltering of individuals without power for extended periods of time. Some severe windstorms that have struck Lower Michigan are summarized in (**Table 6.3).**

Lightning:

The discharge of electricity from within a thunderstorm. Although lightning is often perceived as a minor hazard, it damages many structures and kills and injures more people in the U.S. 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 that lightning presents. *Michigan ranks second in the nation in both lightning-related deaths and lightning-related injuries.*
The following information is compiled in the Michigan Hazard Analysis Plan: 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:

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

Gender of Victims: 84% are male; 16% are female
Months of Most Strikes: July (30%); August (22%); June (21%)
Days of Most Strikes: #1 – Sunday; #2 – Wednesday; #3 – Saturday
Time of Most Strikes: • 2:00 PM – 6:00 PM
Number of Victims: • One victim (91%); two or more victims (9%)

Table 6.3 – Severe Windstorms in Northern Michigan	
Location	**Summary of Impact**
West Michigan	On April 6-7, 1997, an intense early spring low pressure system moving across the Great Lakes brought gale force winds to much of Lower Michigan. Wind gusts of 50-70 miles per hour created 10-15 foot waves on the Lake Michigan shoreline, causing widespread wind damage and lakeshore beach erosion. Private damage was estimated at $5 million, most of that occurring in a handful of West Michigan counties. The winds downed numerous trees and power lines across the region, causing roof damage to many structures and power outages for nearly 200,000 Consumers Energy electrical customers. No deaths or injuries were reported in this severe wind event.
Lower Michigan	On April 30, 1984 a windstorm struck the entire Lower Peninsula, resulting in widely scattered damage, 1 death, and several injuries. Wind gusts measured up to 91 miles per hour in some areas. Damage was widely scattered, but extensive, with 6,500 buildings, 300 mobile homes, and 5,000 vehicles being damaged. Over 500,000 electrical customers lost power. In addition, 10-16 foot waves on Lake Michigan caused severe shore erosion, collapsing some cottages and driving many boats aground.
Northern Lower Michigan	Sept. 26-27, 1998: During the weekend of September 26-27, 1998, severe thunderstorms ravaged northern Lower Michigan, producing strong winds that damaged or destroyed homes, businesses and public facilities, and downed trees and power lines. Otsego County, and specifically the city of Gaylord, was hardest hit, although damage was also reported in Crawford and Charlevoix counties as well. The storm front, which ran along and north of the M-32 corridor from East Jordan to Alpena, was approximately 12 miles wide and 15 miles long. When the front slammed into Gaylord, wind speeds had reached hurricane force of 80-100 miles per hour. The wind was accompanied by brief heavy rainfall and golf ball size hail. The storm lasted only a few minutes in Gaylord, but the damage was tremendous. Thousands of trees were snapped off at waist level, homes and businesses were torn apart, power lines were downed, and several public facilities were substantially damaged – including the Otsego County Courthouse, which lost half of its roof. Approximately 818 homes were damaged throughout Otsego County, including 47 that were destroyed and 92 that incurred major damage. In addition, the storm injured 11 persons – none seriously. Region-wide, about 12,000 electrical customers lost power. A Governor's Disaster Declaration was granted to the county to provide state assistance in the debris cleanup effort.
West-Central and Central Michigan	On May 31, 1998, a line of severe thunderstorms passed through west-central and central Michigan, producing in some areas hurricane and tornado-force winds that damaged or destroyed 1,500 homes and 200 businesses, severely damaged numerous public facilities, and downed thousands of trees and power lines throughout the 15 county affected area. The downed power lines left nearly 900,000 electrical customers without power, some for up to one week. The storms directly and indirectly caused four fatalities and injured over 140 more. The severe winds were measured at speeds of up to 130 miles per hour in some areas – equivalent to an F2 tornado or strong hurricane. Damage to homes and businesses were estimated at $16 million, while public damage totaled another $36 million. A Presidential Major Disaster Declaration was granted for 13 of the 15 counties, making available both public and hazard mitigation assistance to affected local jurisdictions. In addition, Small Business Administration disaster loans were made available to 11 of the 15counties to help rebuild homes and businesses damaged in the storms.
Statewide	Nov. 10-11, 1998:One of the strongest storms ever recorded in the Great Lakes moved across Michigan on the 10th and 11th of November, 1998, producing strong, persistent winds that damaged buildings, downed trees and power lines, killed one person, and left

	over 500,000 electrical customers in the Lower Peninsula without power. Wind gusts of 50-80 miles per hour were common, and a peak gust of 95 miles per hour was reported on Mackinac Island. Damage was widespread but relatively minor for a storm of that intensity. However, there were several pockets of significant damage across the state. The U.S. Forest Service reported that at least $10 million worth of timber was lost in the Ottawa and Hiawatha National Forests.

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

Unfortunately, lightning has taken a tremendous toll on Michigan's citizens in terms of injury and loss of life. Since 1959 when the National Weather Service began keeping such records, Michigan has incurred 99 lightning deaths, 693 lightning injuries, and 792 lightning casualties (deaths and injuries combined) – consistently ranking it near the top of the nation in all three categories. During the period 1959-1994 (the last period for which composite statistics are available), Michigan was ranked 2nd nationally (behind Florida) in lightning injuries, 12th nationally in lightning deaths, and 2nd nationally (again, behind Florida) in lightning casualties. Undoubtedly, the fact that Michigan is an outdoor recreation-oriented state contributes heavily to its high lightning death and injury tolls. As the table below indicates, Michigan's lightning deaths and injuries are fairly consistent with the national trends in terms of location of deadly or injury-causing strikes: **(Table 6.4).** The National Climatic Data Center reports 3 lightning events in Crawford County, injuring 2 people since September 10, 1993

Table 6.4 -- Lightning-Related Deaths in Michigan: 1959-July 2001

Number of Deaths	Location	Percent of Total
28	Open fields, ball fields	28%
26	Under trees (not golf)	27%
11	Boats/water related	11%
10	Golf Course	10%
4	Near tractors/heavy equipment	4%
2	At telephone	2%
18	Other locations/unknown	18%

Source: Storm Data, National Climatic Data Center

Other Natural Hazards in Crawford County

Drought

According to the Michigan Hazard Analysis, drought is a normal part of the climate of Michigan and of 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 in that 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 multi-faceted nature of the hazard makes it difficult to define a drought and assess when and where one is likely to occur.

Droughts can cause many severe impacts to a wide range of communities and economic activity across the Crawford County, 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; and 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. Some other drought related economic impacts are reflected in **(Table 6.4).**

In response to the 1988 drought, Michigan communities instituted temporary water use restrictions. To stem the potential for wildfire in Michigan, the Governor issued (in June, 1988) a statewide outdoor burning ban. The summer of 1998 drought / heat wave from Texas to the Carolinas caused an estimated $6-9 billion in damage. The summer of 1999 drought / heat wave caused over $1 billion in damage – mainly to agricultural crops in the Eastern U.S. The summer of 2000 drought / heat wave in the South-Central and Southeastern U.S. resulted in over $4 billion in damages and costs. The drought / heat wave that struck Michigan during the summer of 2001 damaged or destroyed approximately one-third of the state's fruit, vegetable and field crops, resulting in a U.S. Department of Agriculture Disaster Declaration for 82 of the state's counties.

In addition, the drought / heat wave caused water shortages in many areas in Southeast Michigan, forcing local officials to issue periodic water usage restrictions. In Crawford County, impacts from extended drought increased potential for wildfires, reduction in timber production, and loss of tourism and decreased watercraft access large inland lakes.

Severe Winter Weather Hazards

Winter weather hazards consisting of heavy snow from winter storms, freezing rain and blizzards are prevalent natural hazards that occur uniformly across Crawford County and can be expected to occur several times every year. Since January, 1993, 43 heavy snow or ice events have been recorded in Crawford County. Over the past 10 years the county has averaged 4.0 severe winter weather hazards each year. The number and intensity of winter weather hazards can fluctuate dramatically from year to year. According to the National Weather Service, since 2006 there have been 24 winter storm events, with nine classified as heavy snow events.

<u>Ice and Sleet Storms:</u>

A storm that generates sufficient quantities of ice or sleet to result in hazardous conditions and/or property damage. Sleet storms differ from ice storms in that sleet is similar to hail (only smaller) and can be easily identified as frozen rain drops (ice pellets) that bounce when hitting the ground or other objects. Sleet does not stick to trees and wires, but sleet in sufficient depth does cause hazardous driving conditions. Ice storms are the result of cold rain that freezes on contact with the surface, coating the ground, trees, buildings, overhead wires, etc. with ice, sometimes causing extensive damage. When electric lines are downed, inconveniences are felt in households and economic loss and disruption of essential services is often experienced in

affected communities. Michigan has had numerous damaging ice storms over the past few decades. From 1994 to 2004, Crawford County has experienced three freezing rain events as recorded by the National Climatic Data Center of the National Oceanic and Atmospheric Administration.

Table 6.4 -- Economic Impact of Drought	
Costs and losses to agricultural producers	Annual and perennial crop losses Damage to crop quality Income loss for farmers due to reduced crop yields Reduced productivity of cropland Insect infestation and Plant disease Wildlife damage to crops Increased irrigation costs Cost of new or supplemental water supply
Costs and losses to livestock producers	Reduced productivity of rangeland Reduced milk production Forced reduction of foundation stock Closure/limitation of public lands to grazing High cost/unavailability of water for livestock Cost of new or supplemental water supplies High cost/unavailability of feed for livestock Increased feed transportation costs High livestock mortality rates Disruption of reproduction cycles (delayed breeding, more miscarriages) Decreased stock weights Increased predation
Loss from timber production	Wildland fires Tree disease Insect infestation Impaired productivity of forest land Direct loss of trees, especially young ones
Loss from fishery production	Damage to fish habitat Loss of fish and other aquatic organisms due to decreased flows
General economic effects	Decreased land prices Loss to industries directly dependent on agricultural production. Unemployment from drought-related declines in production Strain on financial institutions Revenue losses to federal, state, and local governments Reduction of economic development Fewer agricultural producers
Loss to recreation and tourism	Loss to manufacturers and sellers of recreational equipment Losses related to curtailed activities: hunting and fishing, bird watching, etc.
Energy-related effects	Increased energy demand and reduced supply because of drought-related power curtailments Costs to energy industry and consumers associated with substituting more expensive fuels (oil) for hydroelectric power
Transportation	Loss from impaired navigability of streams, rivers, and canals
Food Production decline	Increase in food prices Increased importation of food (higher costs)
Source: National Drought Mitigation Center, University of Nebraska, Lincoln	

Snowstorms:

A period of rapid accumulation of snow often accompanied by high winds, cold temperatures, and low visibility. Blizzards are the most dramatic and perilous of all snowstorms, characterized by low temperatures and strong winds bearing enormous amounts of snow. Most of the snow accompanying a blizzard is in the form of fine, powdery particles of snow, which are wind-blown in such great quantities that, at times, visibility is reduced to only a few feet. Blizzards have the potential to result in property damage and loss of life. Just the cost of clearing the snow can be enormous. As a result of being surrounded by the Great Lakes, Michigan experiences large differences in snowfall in relatively short distances. The annual mean accumulation ranges from 30 to 170 inches of snow. The highest accumulations are in the northern and western parts of the Upper Peninsula. Since winter storms tend to move from west to east, the western parts of the state usually have greater amounts of snow than the eastern parts. The highest seasonal snowfall recorded in Crawford County was 172.1 inches during the 1989-90 season**. (Table 6.5)**

Northern Michigan, with its extensive Great Lakes coastline is also susceptible to lake-effect snow. There are several main ingredients required to produce lake effect snow. The first is a relatively warm body of water supplied by the Great Lakes. The second ingredient is a source of cold air. In the Great Lakes Region, that source comes from the high latitudes of North America where arctic air masses often "spill southward" over those warm bodies of water. Heat and moisture from the warm lakes rises into the "modified" arctic air where it then cools and condenses into snow clouds. The third ingredient is prevailing wind direction, which determines where the snow will occur. Often these blinding local snowfalls can cause major disruption to automobile traffic. Figure 6.7 is a map that shows lake effect snow vulnerability associated with winter winds from the northwest.

Table 6.5:Crawford County Snowfall Extremes 1991-2010

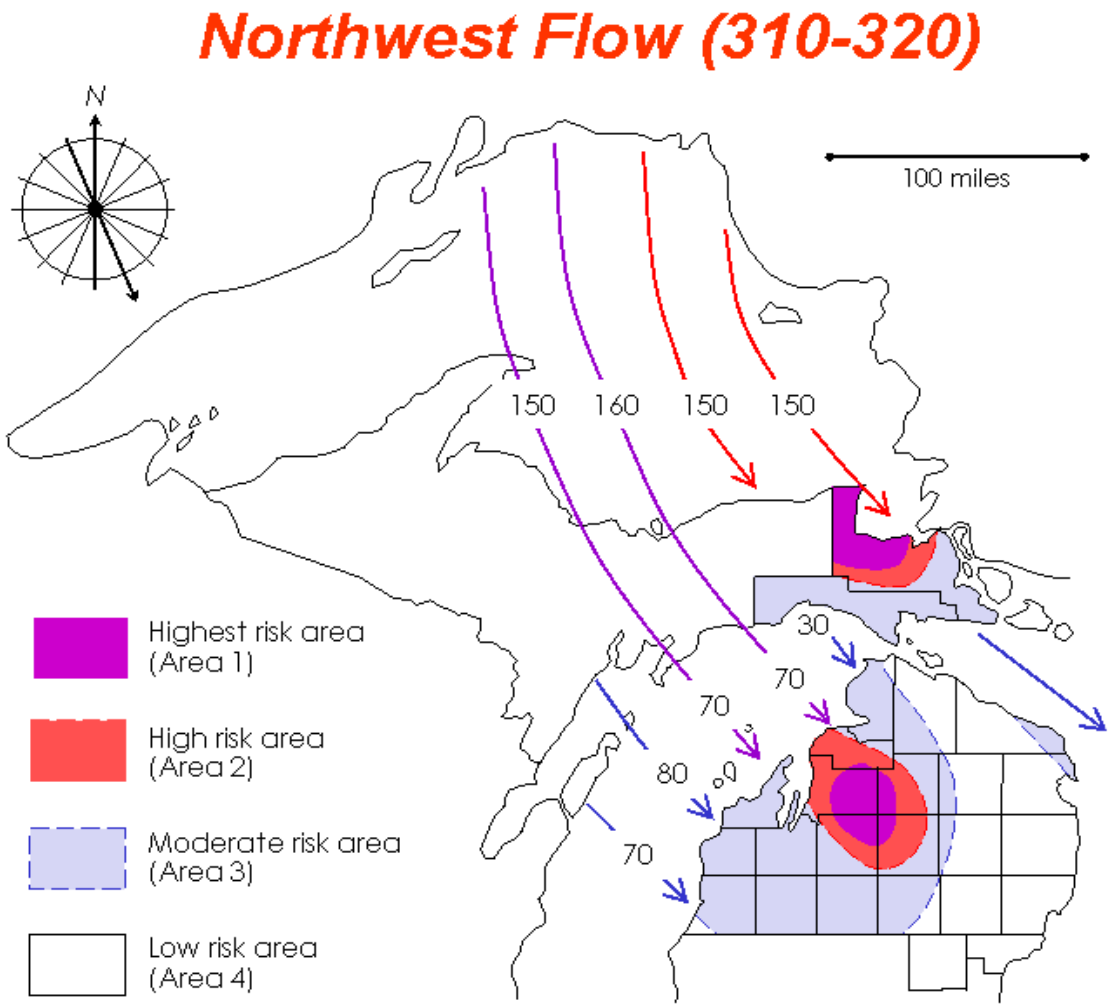
Month	High (in)	Year
January	59.9	1990
February	39.6	2006
March	23.9	1997
April	17.5	1985
May	1.0	1984, 1990, 1996
June	-	-
July	-	-
August	-	-
September	-	-
October	7.8	1992
November	47.8	1995
December	54.3	2008

Recorded at Station: Grayling
Source: Midwest Regional Climate Center

Extreme Temperatures:

Prolonged periods of very high or very low temperatures, often accompanied by other extreme meteorological conditions such as high humidity, lack of rain (drought), high winds, etc. Extreme temperatures - whether it is extreme heat or extreme cold - share a commonality in that they both primarily affect the most vulnerable segments of society such as the elderly, children, impoverished individuals, and people in poor health. The major threats of extreme heat are heatstroke (a major medical emergency), and heat exhaustion. Extreme heat is a more serious problem in urban areas, where the combined effects of high temperature and high humidity are more intense. The major threats of extreme cold are hypothermia (also a major medical emergency) and frostbite. Crawford County is subject to both temperature extremes. The historic low temperature recorded on Feb. 6, 1895 of –38F, and high of 104 F, on Aug. 6, 1946. Monthly extreme temperatures from 1980 and 2010 are shown in **(Table 6.6)**

Figure 6.7, Lake Effect Snow Vulnerability from Northwest Flow
Source: NOAA, Gaylord Michigan



Synoptic Pattern: NW Flow is perhaps the most "classic" of all lake effect snow flow regimes. The surface flow is typically cyclonic, with embedded surface troughs.

Eastern Upper: The west half of Chippewa county is most susceptible. It is often a very close call as to whether heavy snow will extend as far east as Sault Ste Marie. With strong winds, Mackinac county can also receive heavy snow.

Northern Lower: Areas around Charlevoix, Mancelona, Gaylord, Kalkaska, and Grayling are most susceptible. Since low level trajectories into the Traverse City, Manistee, and Cadillac areas don't extend back into central Lake Superior, snowfall in these areas is often less. Snowfall amounts generally decrease rapidly to the east and south of Otsego and Crawford counties. If winds are strong, the heavy snow can extend into northern Roscommon county. An offshore wind component will generally keep intense LES banding offshore from Presque Isle and Alpena counties.

Table 6.6:
Extreme Temperatures – 1980 - 2010

Month	Year*	Maximum High °F		Month	Year*	Minimum Low °F
JAN	1996	53		JAN	1994	-34
FEB	1984	60		FEB	1996	-37
MAR	2000	78		MAR	1982	-25
APR	1990	87		APR	2003	-3
MAY	2006	92		MAY	1983 & 1987	18
JUN	1995	98		JUN	1982	26
JUL	1995	98		JUL	1987	33
AUG	2001, 2006, 2007	96		AUG	1986	26
SEP	2002	92		SEP	1989	16
OCT	2007	87		OCT	1986	11
NOV	1990, 1999, 2008	73		NOV	2005	-4
DEC	2001	64		DEC	1983	-26

Recorded at Station: Grayling
Source: Midwest Regional Climate Center

Earthquakes:
A sudden motion or trembling in the earth caused by an abrupt release of slowly accumulating strain, which results in ground shaking, surface faulting, or ground failures. Most areas of the United States are subject to earthquakes including parts of Michigan, and they occur literally thousands of times per year. Northeastern Michigan to date has been out of known earthquakes impact areas and Crawford County is located in an area with less than a 2%g (peak acceleration) and has a relatively low seismic risk.

Subsidence:
Geologic subsidence can cause depressions, cracks, and sinkholes in the ground surface, which can threaten people and property. Subsidence depressions, which normally occur over many days to a few years, may damage structures with low strain tolerances, such as dams, nuclear reactors, and utility infrastructure. The sudden collapse of the ground surface to form sinkholes poses an immediate threat to life and property. Such ground movements may continue for several days, weeks, months or even years, until the walls stabilize. The population most at risk would be in areas where industrial or residential development has occurred above active or abandoned mines where underground cavities are present near the surface, as well as areas where an extensive amount of groundwater has been withdrawn. The population most at risk would be in areas where industrial or residential development has occurred above active or abandoned mines where underground cavities are present near the surface, as well as areas where an extensive amount of groundwater has been withdrawn. The most prevalent subsidence features in Northern Michigan are Karst sinkholes. Collapse of a sink is usually a localized natural hazard. Karst subsidence also offers the threat of exposing groundwater to rapid contamination in certain circumstances. There is no known karst activity in Crawford County.

Societal Hazards

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

At this point, attack-planning guidance prepared by the Federal government in the late 1980s still provides the best basis for a population protection strategy for Michigan. That guidance identified potential target areas using the following categories: 1) commercial power plants; 2) chemical facilities; 3) counterforce military installations; 4) other military bases; 5) military support industries; 6) refineries; and 7) political targets. For each of these target areas, detailed plans have been developed for evacuating and sheltering the impacted population, protecting critical resources, and resuming vital governmental functions in the post-attack environment. The Camp Grayling and the airbase would have been identified as one of the targets.

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

Public Health Emergencies
A widespread and/or severe epidemic, incident of contamination, or other situation that presents a danger to or otherwise negatively impacts the general health and well-being of the public. Public health emergencies can take many forms: 1) disease epidemics; 2) large-scale incidents of food or water contamination; 3) extended periods without adequate water and sewer services; 4) harmful exposure to chemical, radiological or biological agents; or 5) large-scale infestations of disease-carrying insects or rodents. Public health emergencies can occur as

primary events by themselves, or they may be secondary events another disaster or emergency, such as 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 threat would be the intentional release of a radiological, chemical or biological agent with the potential to adversely impact a large number of people. Such a release would most likely be an act of sabotage aimed at the government or a specific organization or segment of the population. Fortunately, to date Michigan has not experienced such a release aimed at mass destruction. However, Michigan has experienced hoaxes and it is probably only a matter of time before an actual 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.

Civil Disturbances
A public demonstration or gathering (such as a sports event), or a prison uprising, that results in a disruption of essential functions, rioting, looting, arson or other unlawful behavior. Large-scale civil disturbances rarely occur, but when they do they are usually an offshoot or result of one or more of the following events: 1) labor disputes where there is a high degree of animosity between the two dissenting parties; 2) high profile/controversial judicial proceedings; 3) the implementation of controversial laws or other governmental actions; 4) resource shortages caused by a catastrophic event; 5) disagreements between special interest groups over a particular issue or cause; or 6) a perceived unjust death or injury to a person held in high esteem or regard by a particular segment of society.

Areas subject to civil disturbances may encompass large portions of a community. Types of facilities that may be subject to or adversely impacted by civil disturbances may include government buildings, military bases, Community College, businesses, and critical service facilities such as our hospital, police and fire facilities. Civil disturbances (including jail uprisings) often require the involvement of multiple community agencies in responding to and recovering from the incident. There have been no recorded incidences of civil disturbances in recent history.

Nuclear Power Plant Accidents
An actual or potential release of radioactive material at a commercial nuclear power plant or other nuclear facility, in sufficient quantity to constitute a threat to the health and safety of the off-site population. Such an occurrence, though not probable, could affect the short and long-term health and safety of the public living near the nuclear power plant, and cause long-term environmental contamination around the plant. As a result, the construction and operation of nuclear power plants are closely monitored and regulated by the Federal government.

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

Flooding Hazards

Dam Failures
The collapse or failure of an impoundment resulting in downstream flooding. Dam failures can result in loss of life and extensive property or natural resource damage for miles downstream from the dam. Failure of a dam does not only occur during flood events, which may cause overtopping of a dam. Failure can also result from miss-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 278 dam failures in Michigan. There are no critical dams in Crawford County

Riverine and Urban Flooding:
Riverine flooding is defined as the periodic occurrence of overbank flows of rivers and streams resulting in partial or complete inundation of the adjacent floodplain. Riverine floods generally caused by prolonged, intense rainfall, snowmelt, ice jams, dam failures, or any combination of these factors. 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. Riverine flooding is not a common occurrence in Crawford County.

Pre-existing homes and businesses, though, could remain as they were. Owners of many of these older properties could obtain insurance at lower, subsidized, rates that did not reflect the property's real risk. In addition, as the initial flood risk identified by the NFIP has been updated over the years, many homes and businesses in areas where the revised risk was determined to be higher have also received discounted rates. This "Grandfathering" approach prevented rate increases for existing properties when the flood risk in their area increased.

In 2012, the U.S. Congress passed the Flood Insurance Reform Act of 2012 which calls on the Federal Emergency Management Agency (FEMA), and other agencies, to make a number of changes to the way the NFIP is run. As the law is implemented, some of these changes have already occurred, and others will be implemented in the coming months. Key provisions of the legislation will require the NFIP to raise rates to reflect true flood risk, make the program more financially stable, and change how Flood Insurance Rate Map (FIRM) updates impact policyholders. The changes will mean premium rate increases for some – but not all -- policyholders over time.

Flood Insurance Rate Maps (FIRM) were developed for Crawford County. *A review of the State of Michigan database found no incidents of repetitive loss properties in Crawford County.*

Mitigation Planning Sectors

The hazard mitigation planning approach being used is to divide Crawford County into geographic sub-parts (sectors) for the purpose of developing a more detailed, targeted hazard analysis and set of mitigation, preparedness, and response and recovery strategies. Sectoring is being accomplished by using existing municipal boundaries. Each planning sector has a map of the area showing community facilities and infrastructure and some general information on population, housing and land use. Information received from the communities was used to help define the potential hazards the community may encounter.

Beaver Creek Township

- 2010 population 1,736; 1,317 housing units, 733 occupied, 524 seasonal. 24.6% of housing units are 40+ years old.
- Predominant land cover is upland forest, large tracts of jack pine and oak.
- Oil/gas wells located in the west side of the township.
- Township bisected by I-75, junction with M-127.

Potential Hazards
Natural: Wildfire.
Technological: Transportation (air/land/rail), military accident, structural fire.
Societal: Terrorism/sabotage

City of Grayling

- 2010 Population: 1,884. 890 Housing units, 764 occupied, 66.7% are 40+ years old.
- City is bisected by Lake State Rail line, M-72 and I-75.
- Adjacent to Air National Guard Base. Predominant land cover is residential.

Potential Hazards
Natural: Wildfire**.**
Technological: Transportation accident (vehicle/train/aircraft, infrastructure failure, structural fire.
Societal: Terrorism/sabotage, public health,

Grayling Township

- 2010 population 5,827; 4,289 housing units, 2,464 occupied, 1,629 seasonal. 33.7%% of housing units are 40+years old.
- Township is bisected by I-75, M-72 and Lake State Rail line. Home to Camp Grayling training facility and ranges.
- Predominant land cover is upland forest consisting of large tracts of jack pine.

Potential Hazards
Natural: Wildfire
Technological: Transportation accident (vehicle/train/aircraft), military accident, infrastructure failure, structural fire.
Societal: Terrorism/sabotage

Frederic Township

- 2010 population 1,341; 1,231 Housing units, 576 occupied, 586 seasonal. 31.9% housing units 40+ years old
- Lake state rail line, Manistee river and North Branch of AuSable bisect the township. Weyerhaeuser and large numbers of oil/gas wells located in north half of township.
- Predominant land cover is upland forest with large tracts of jack pine and oak in south half of township.

Potential Hazards
Natural: Wildfire
Technological: Transportation accidents (air/rail/land) military ranges, oil/gas wells, industrial/structural fire
Societal: Sabotage/Terrorism

Maple Forest Township

- 2010 population 653; 470 housing units, 263 occupied, 181 seasonal 24.3% of housing units are 40+ years old.
- Predominant land cover is upland forest, mostly hardwoods, largest concentration of agricultural land use in the county.
- Military range located in north east corner of the township.

Potential Hazards
Natural: Wildfire
Technological: Transportation accident (air/land/rail), military accident, structural fire
Societal: Terrorism/sabotage

Lovells Township

- 2010 population 626; 1,034 housing units, 315 occupied, 694 seasonal. 36.9% of housing units are 40+ years old
- Predominant land cover is upland forest, large tracts of jack pine and oak.
- Military range located in northwest corner of the township.
- Bisected by three rivers, confluence in south west portion of township.

Potential Hazards
Natural: Wildfire.
Technological: Transportation accident (air, land), military accident, structural fire.
Societal: Terrorism/sabotage.

South Branch Township

- 2010 population 2,007; 1,861 housing units, 901 occupied, 901 seasonal. 30.2% of housing units are 40+ years old.
- Predominant land cover is upland forest, large tracts of jack pine and oak.
- Military range located in north west corner of the township.
- North portion of township bisected by AuSable River, confluence with South Branch.

Potential Hazards
Natural: Wildfire.
Technological: Transportation (air/land), military accident.
Societal: Terrorism/sabotage.

Figure 6.8

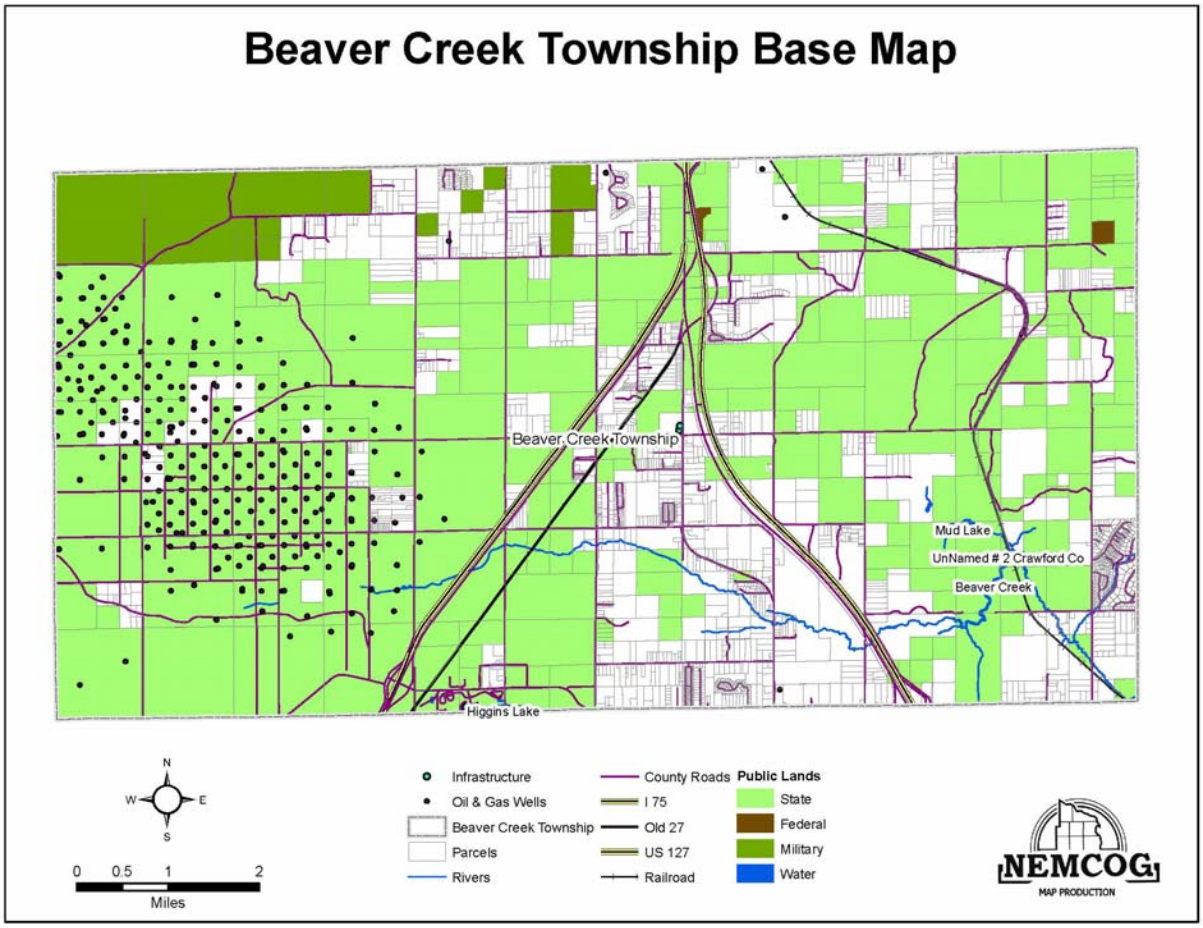
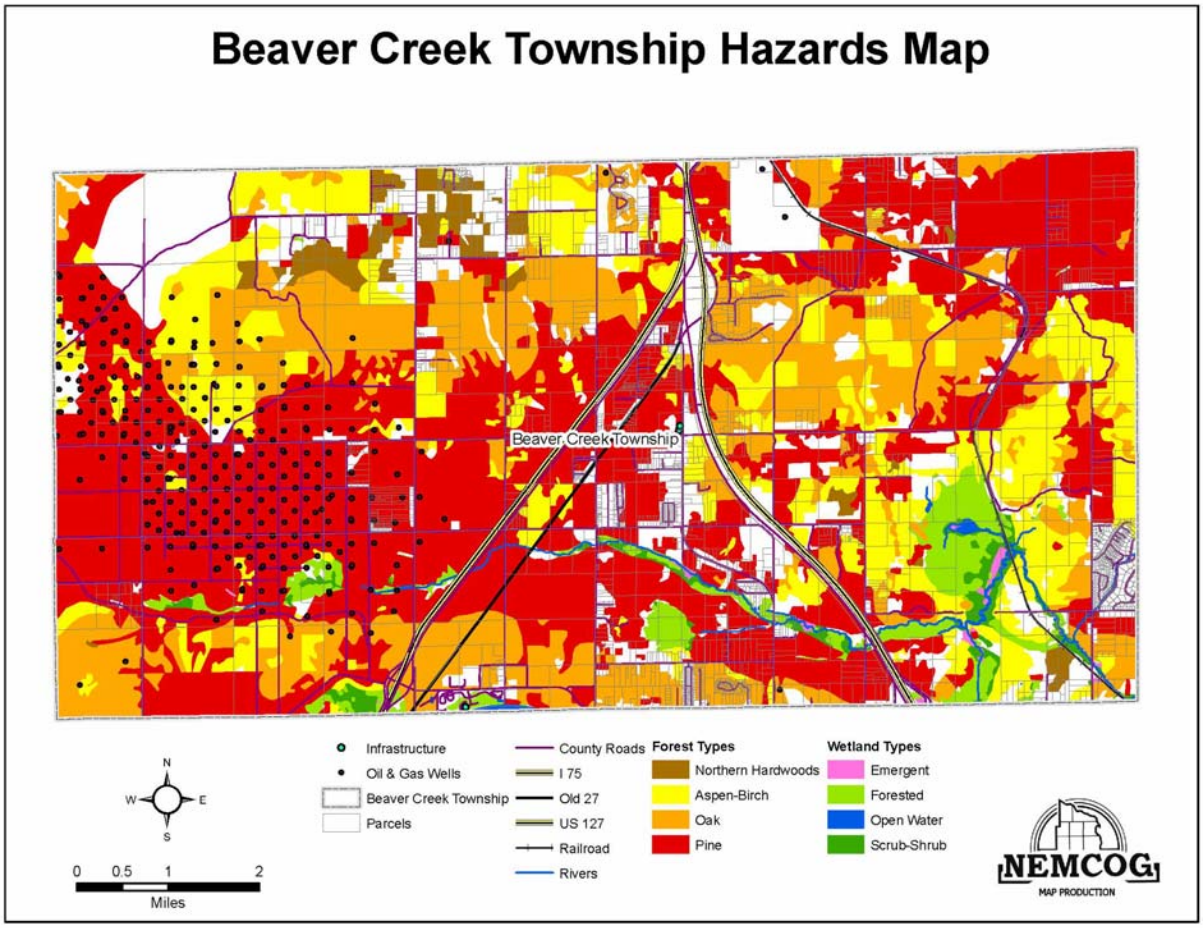


Figure 6.9


Beaver Creek Township Hazards Map
Beaver Creek Township
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Infrastructure
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Beaver Creek Township
Parcels
County Roads
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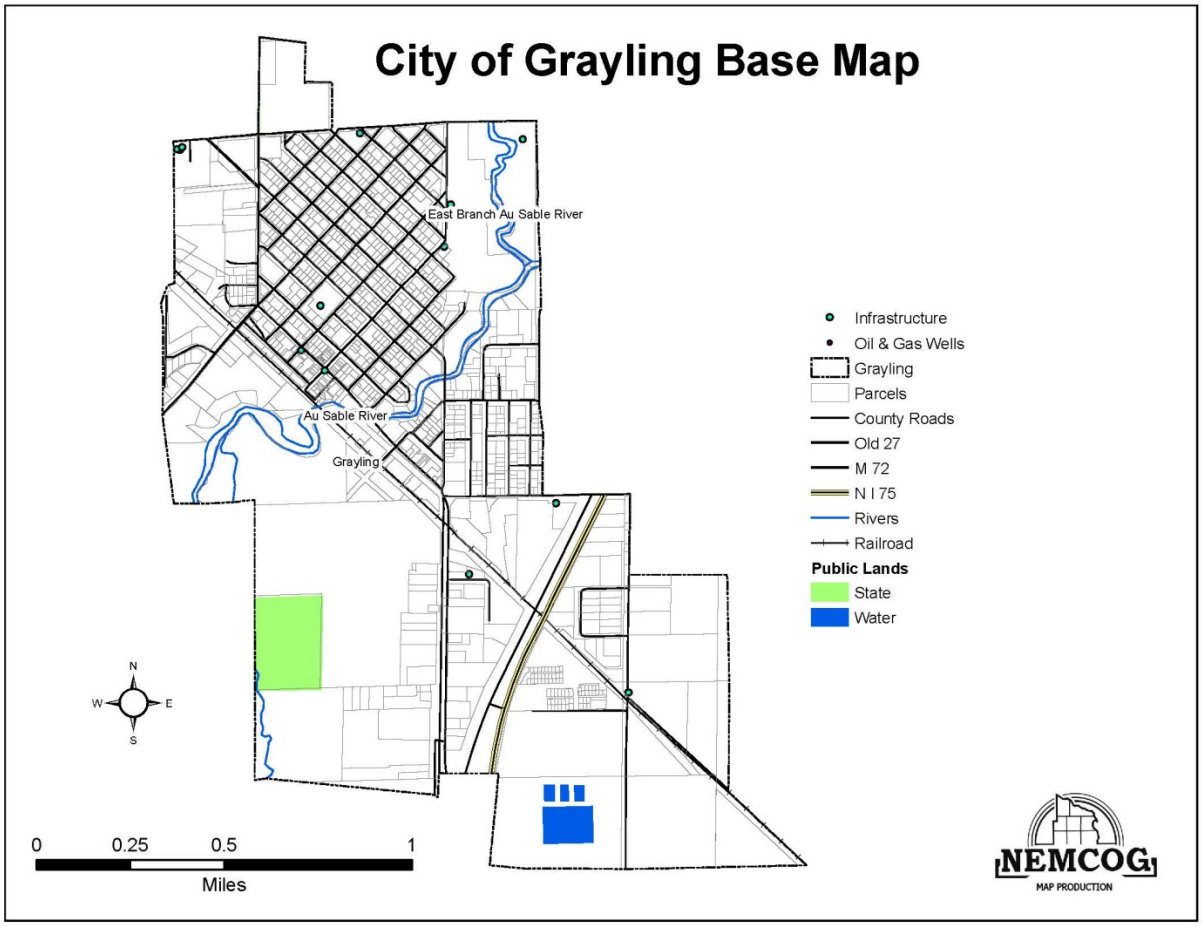
US 127
Railroad
Rivers
Forest Types
Northern Hardwoods
Aspen-Birch
Oak
Pine
Wetland Types
Emergent
Forested
Open Water
Scrub-Shrub
NEMCOG
MAP PRODUCTION


City of Grayling Base Map
East Branch Au Sable River
Au Sable River
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Oil & Gas Wells
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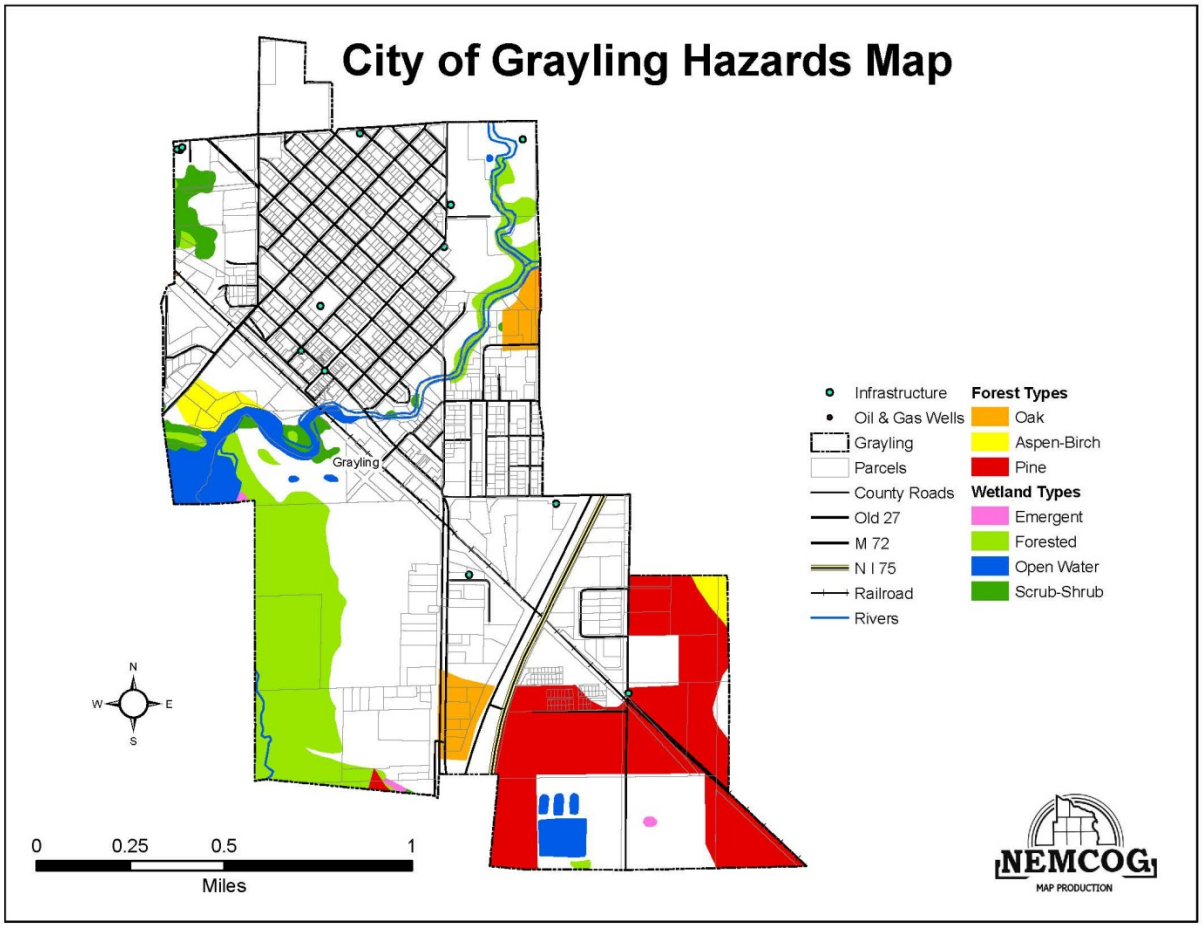
MAP PRODUCTION

Figure 6.10


City of Grayling Hazards Map
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County Roads
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Rivers
Forest Types
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Figure 6.12

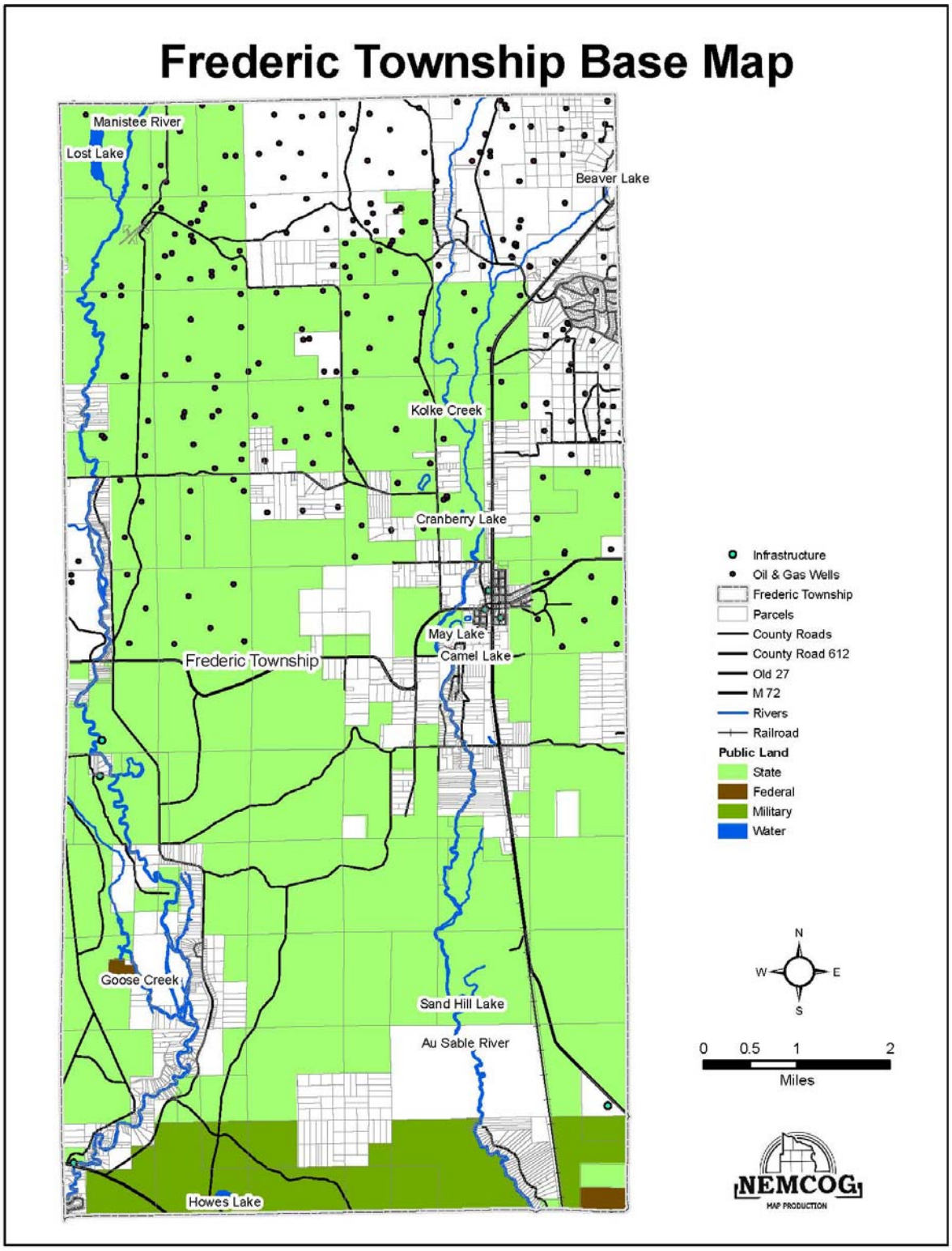
Frederic Township Base Map
Manistee River
Lost Lake
Beaver Lake
Kolke Creek
Cranberry Lake
May Lake
Camel Lake
Frederic Township
Goose Creek
Sand Hill Lake
Au Sable River
Howes Lake
Infrastructure
Oil & Gas Wells
Frederic Township
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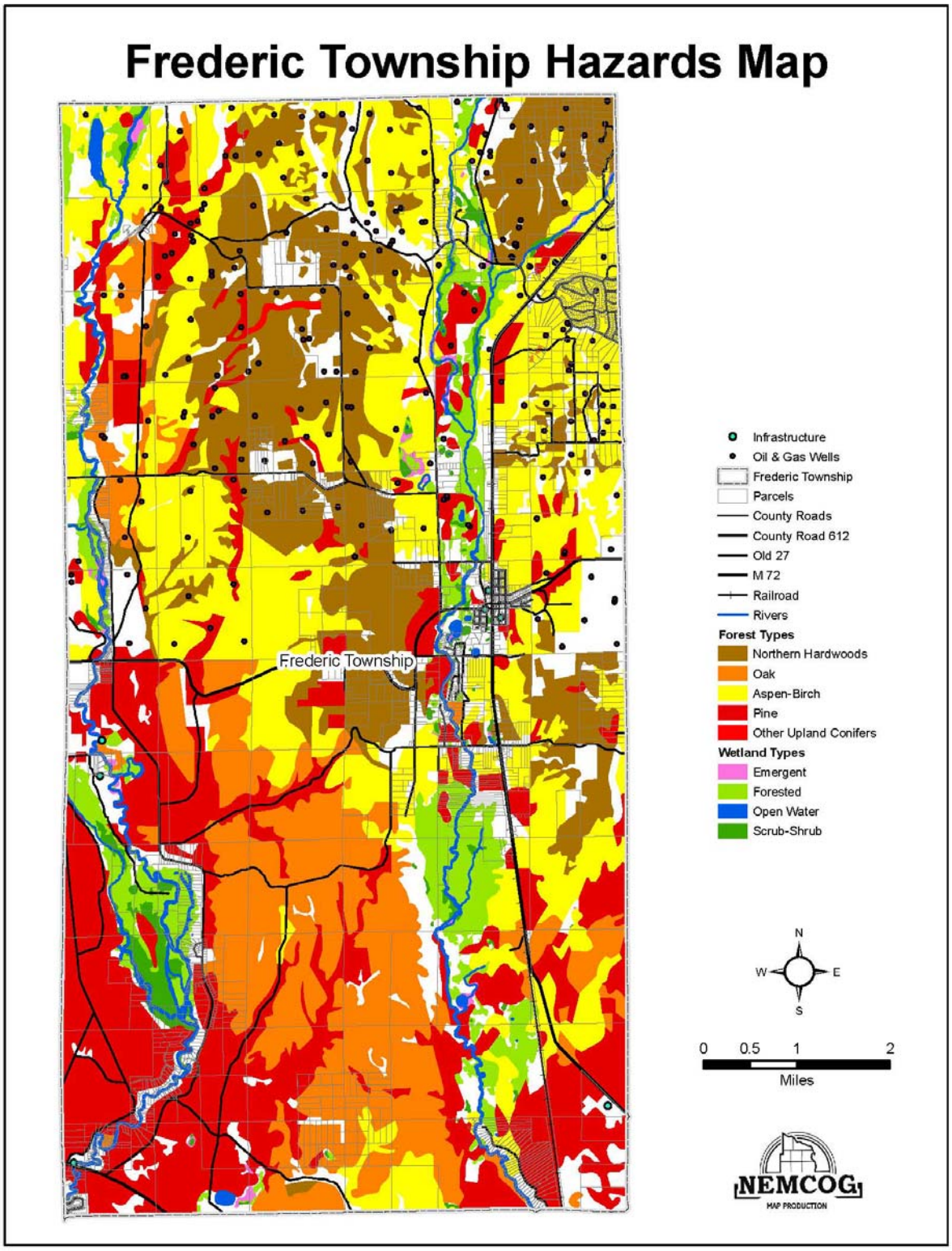
Figure 6-13


Frederic Township Hazards Map
Frederic Township
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Forest Types
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Pine
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Wetland Types
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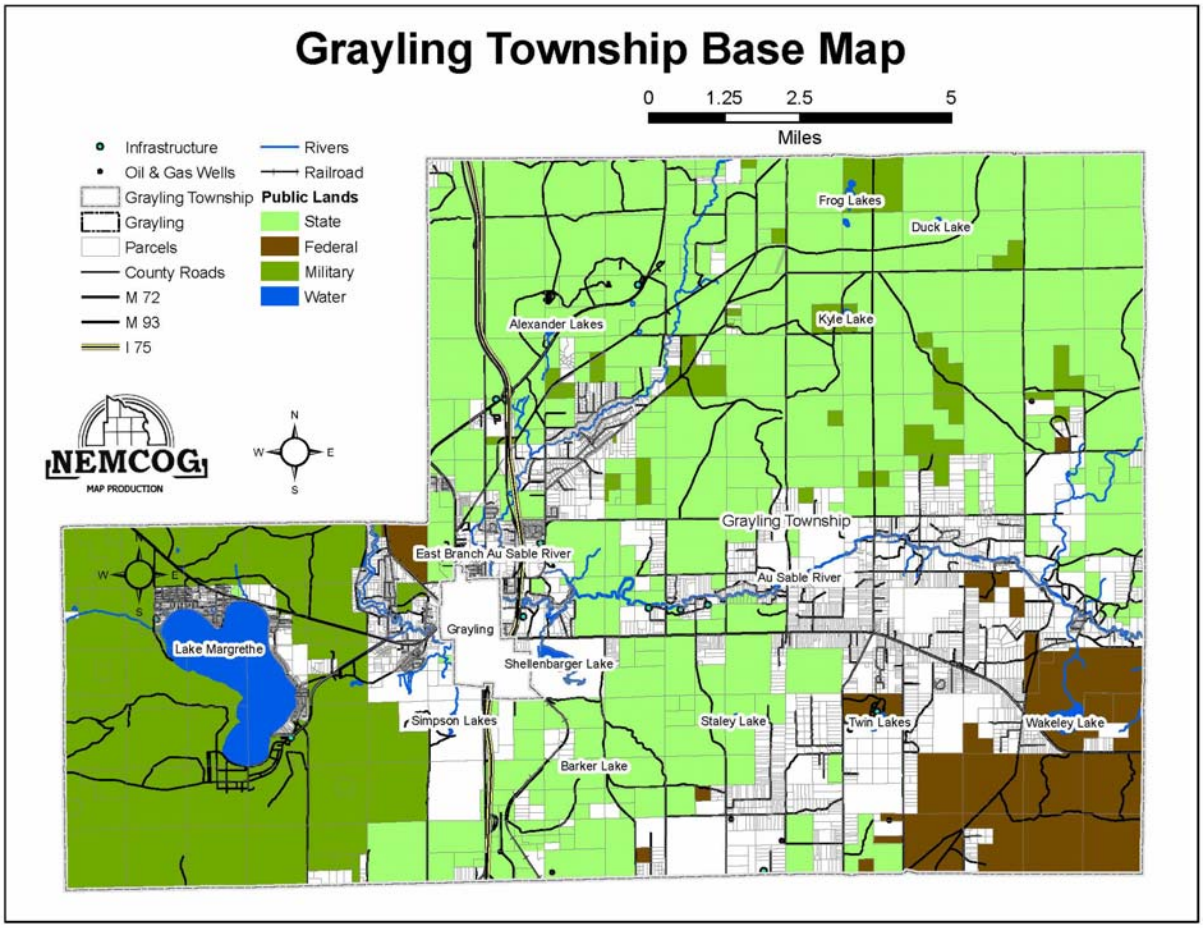
Figure 6-14


Grayling Township Base Map
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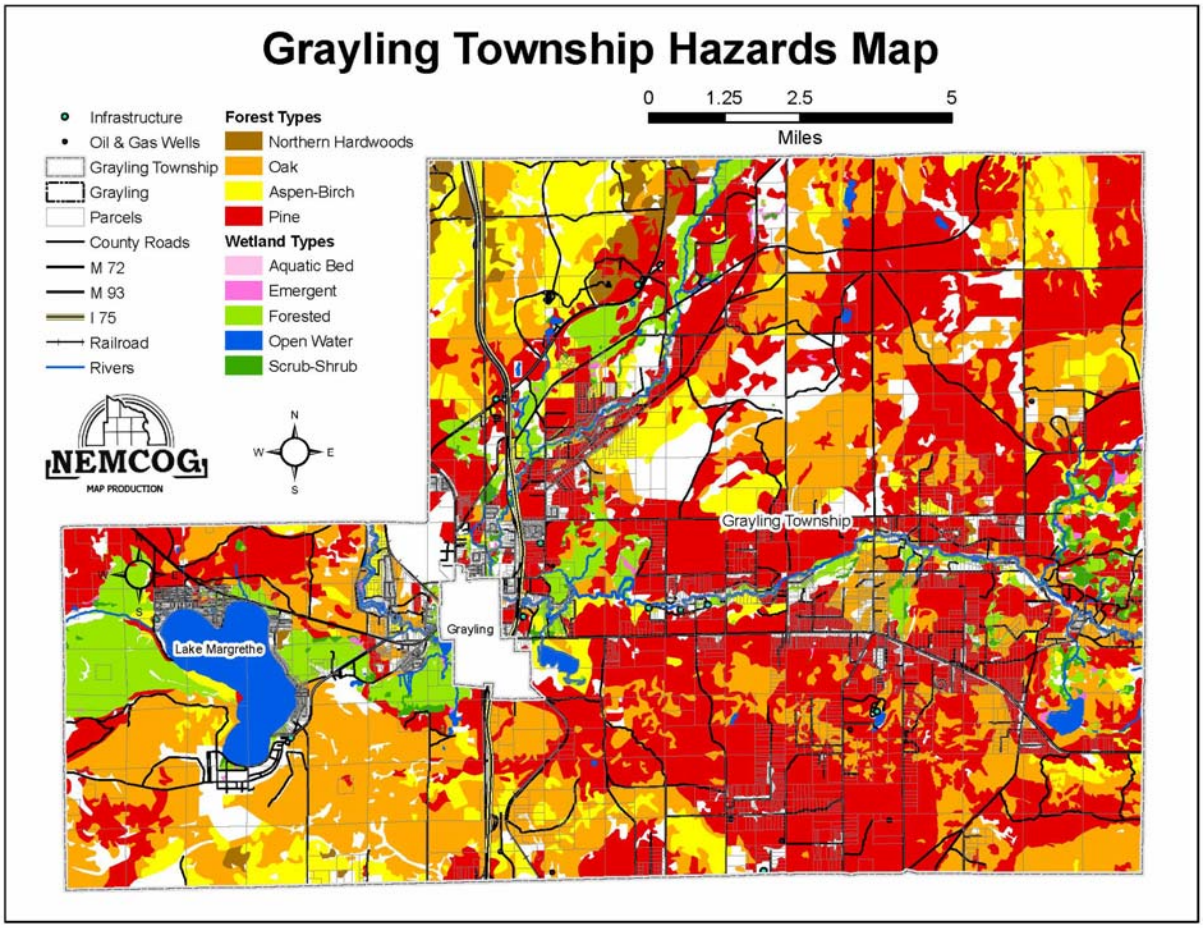
Duck Lake
Alexander Lakes
Kyle Lake
Grayling Township
East Branch Au Sable River
Au Sable River
Grayling
Lake Margrethe
Shellenbarger Lake
Simpson Lakes
Staley Lake
Twin Lakes
Wakeley Lake
Barker Lake

Figure 6-15


Grayling Township Hazards Map
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Wetland Types
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Grayling Township
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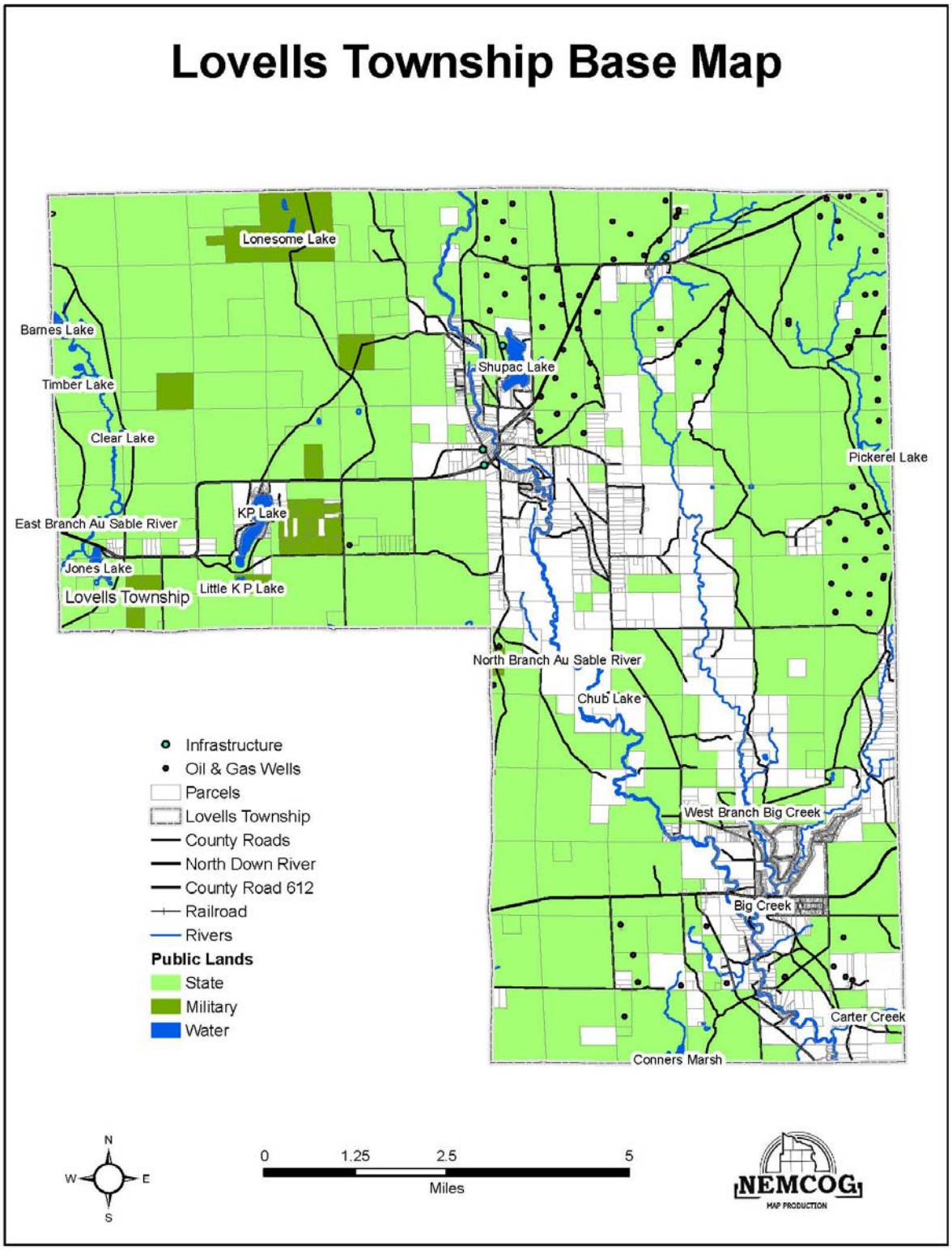
Lake Margrethe

Figure 6-16


Lovells Township Base Map
Lonesome Lake
Barnes Lake
Timber Lake
Clear Lake
Shupac Lake
Pickerel Lake
KP Lake
East Branch Au Sable River
Jones Lake
Little K P Lake
Lovells Township
North Branch Au Sable River
Chub Lake
West Branch Big Creek
Big Creek
Carter Creek
Conners Marsh
Infrastructure
Oil & Gas Wells
Parcels
Lovells Township
County Roads
North Down River
County Road 612
Railroad
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MAP PRODUCTION

Figure 6-17

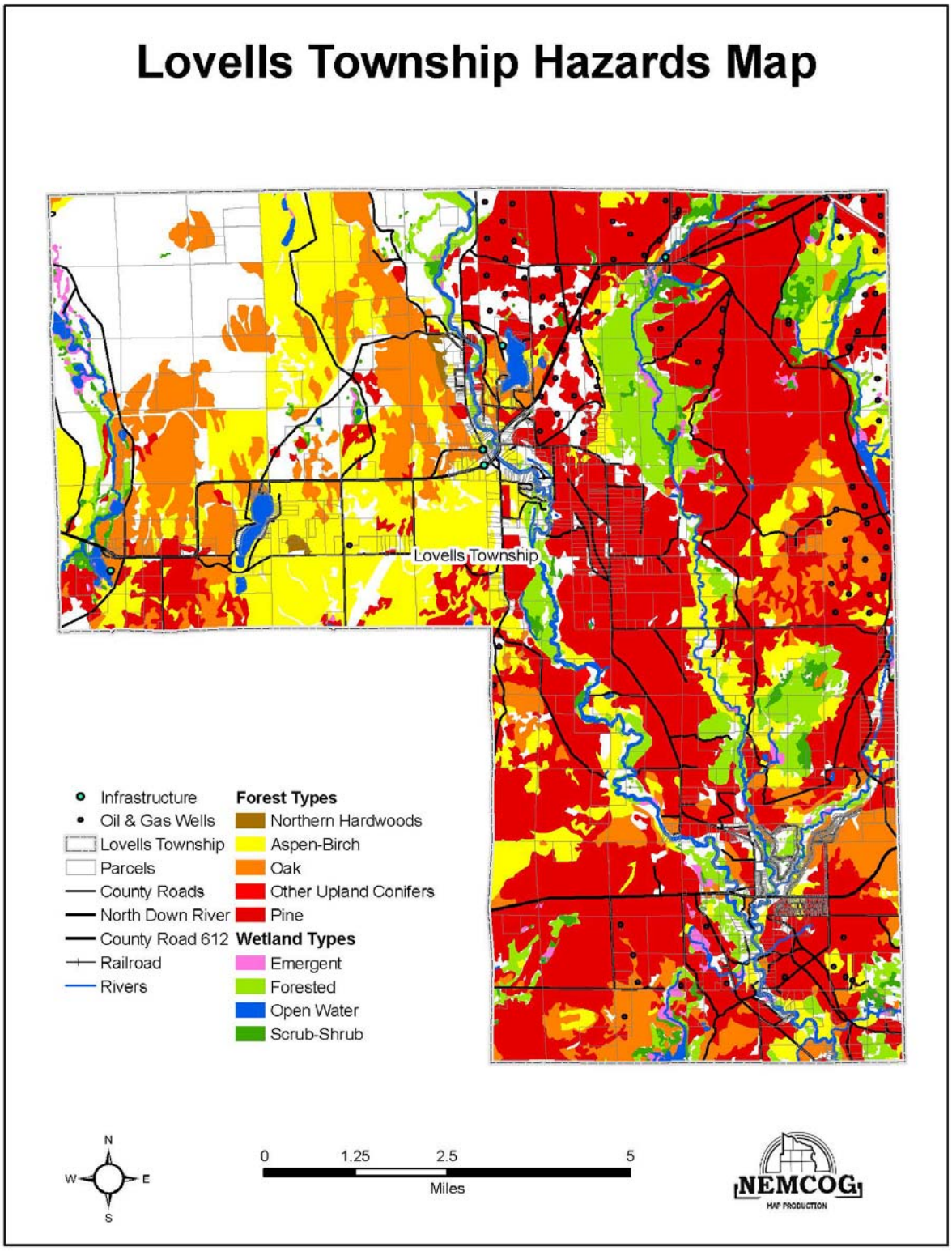
Lovells Township Hazards Map
Lovells Township
Infrastructure
Oil & Gas Wells
Lovells Township
Parcels
County Roads
North Down River
County Road 612
Railroad
Rivers
Forest Types
Northern Hardwoods
Aspen-Birch
Oak
Other Upland Conifers
Pine
Wetland Types
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Figure 6-18

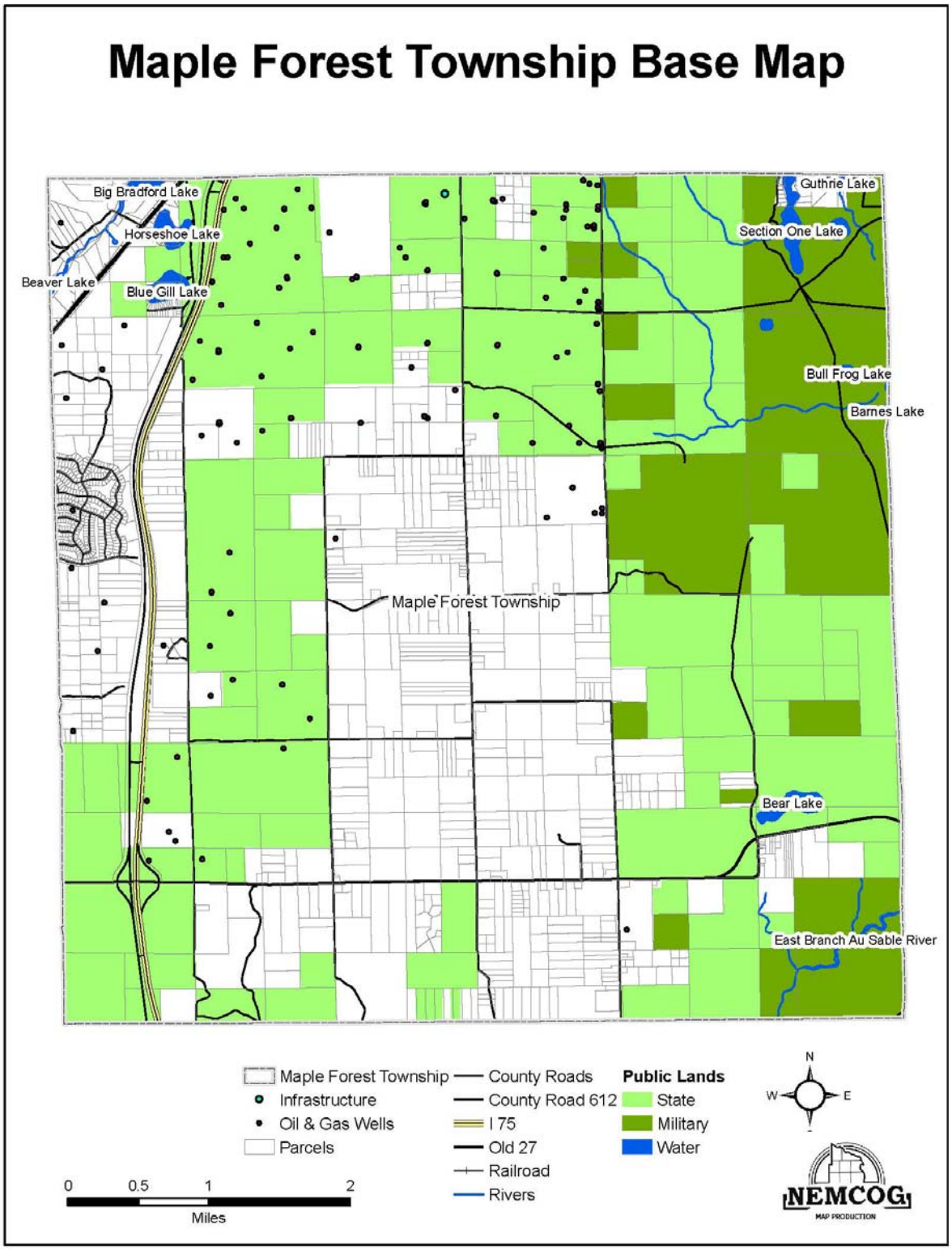
Maple Forest Township Base Map
Big Bradford Lake
Horseshoe Lake
Beaver Lake
Blue Gill Lake
Guthrie Lake
Section One Lake
Bull Frog Lake
Barnes Lake
Maple Forest Township
Bear Lake
East Branch Au Sable River
Maple Forest Township
Infrastructure
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Figure 6-19

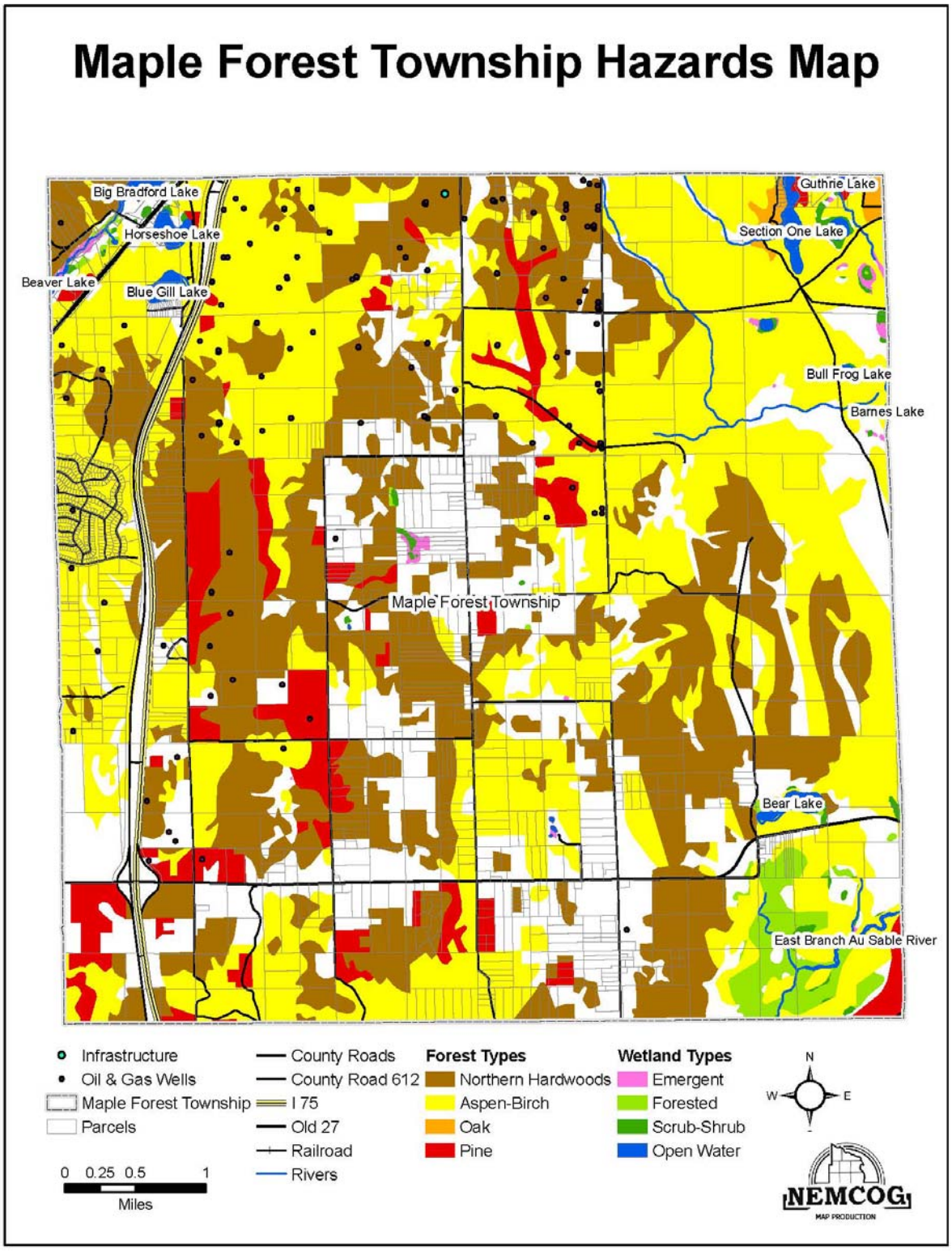
Maple Forest Township Hazards Map
Big Bradford Lake
Horseshoe Lake
Beaver Lake
Blue Gill Lake
Guthrie Lake
Section One Lake
Bull Frog Lake
Barnes Lake
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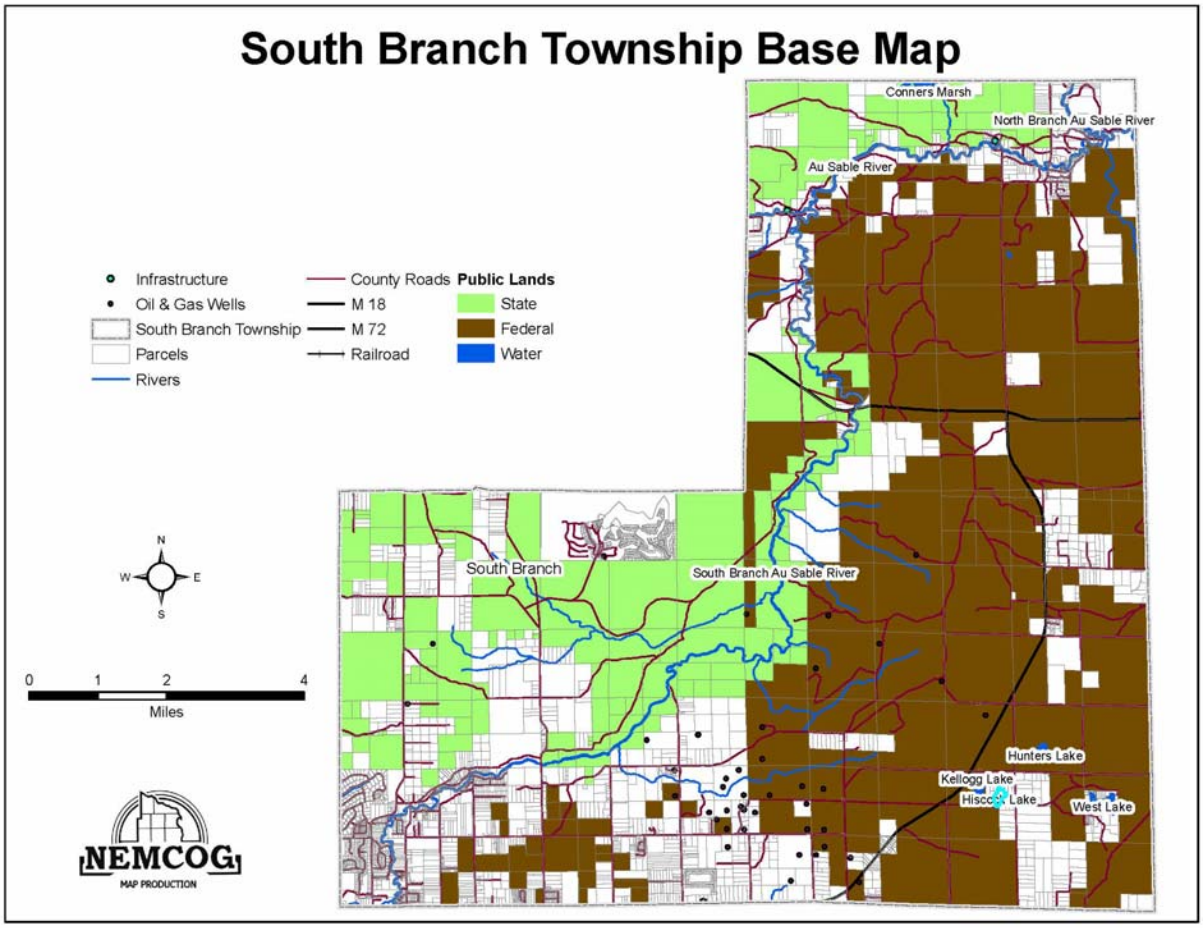
Figure 6-20


South Branch Township Base Map
Conners Marsh
North Branch Au Sable River
Au Sable River
Infrastructure
Oil & Gas Wells
South Branch Township
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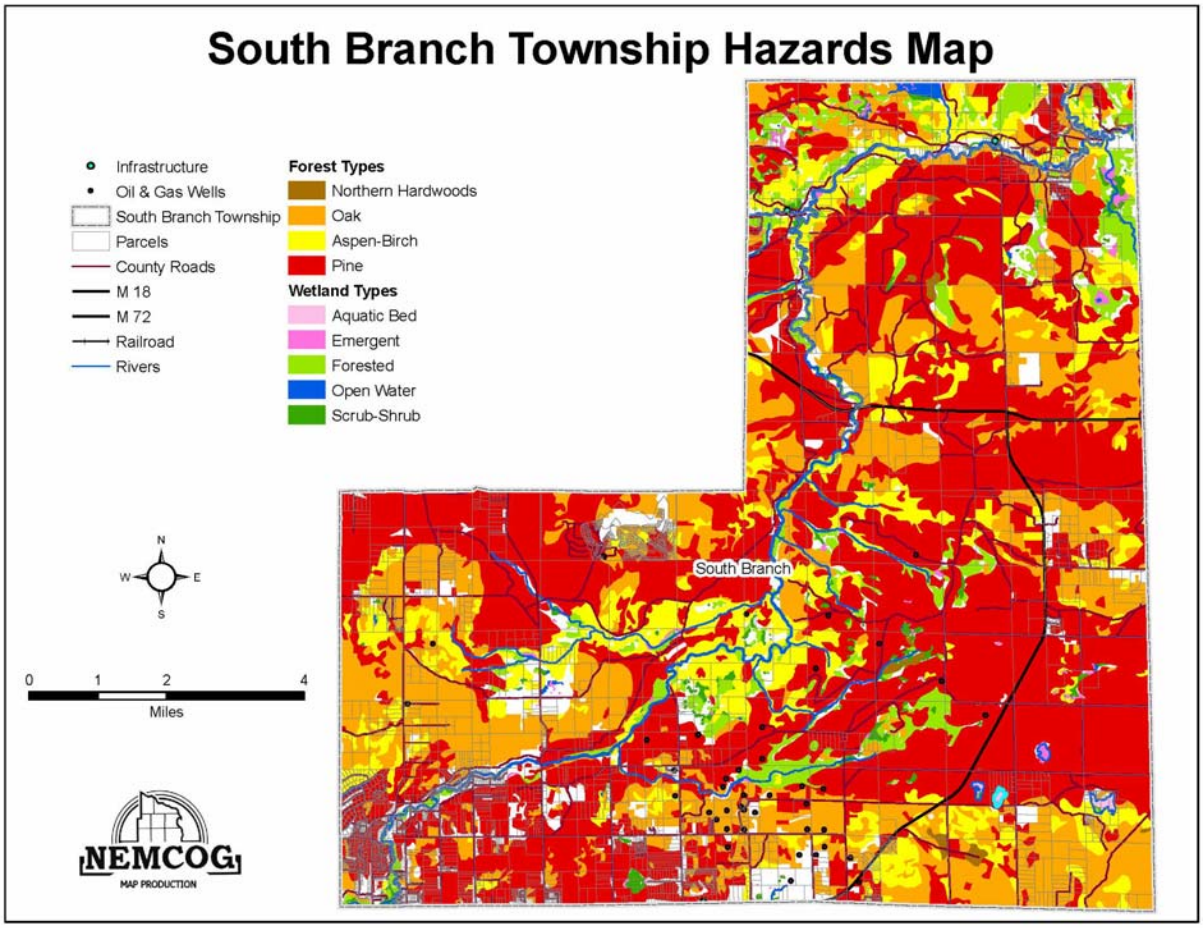
Kellogg Lake
Hisco Lake
West Lake
NEMCOG
MAP PRODUCTION

Figure 6-21



Chapter 7 - Risk and Vulnerability Assessment

Hazard Ranking Methodology

After a thorough review of the community profile, a county hazard ranking was completed using a three-step process. The first step was selecting evaluation criteria, the second step assigned relative weights to each of the rating criteria, and the third step assigned point values in each of the selected criteria for each of the hazards.

Evaluation Criteria

Selection of evaluation criteria was accomplished by determining what aspects of the hazards were of most concern to the community. This process was completed by assigning a level of importance ranging from "Always Important" to "Not Worth Considering" to each hazard aspect. **Table 7.1** shows a complete list of all aspects considered and level of importance assigned by the committee.

Table 7.1
Crawford County
Hazard Evaluation Criteria

Hazard Aspect	Always Very Important	Usually Important	Sometimes Important	Rarely of Importance	Not worth Considering
Historical Occurrence	X				
Size of Affected Area		X			
Speed of Onset				X	
Population Impact	X				
Negative Economic effects	X				
Duration of Threat				X	
Seasonal Risk Pattern				X	
Predictability of Hazard			X		
Collateral Damage			X		
Availability of Warning System		X			
Ability to Mitigate	X				
Percent of Population Affected		X			
Environmental Impact			X		
Capacity to Cause Damage	X				
Public Awareness		X			
OtherConsiderations					

Each evaluation criteria was then assigned a "weight" to express the level of importance each criteria will have in ranking hazards. The sum of weights of all of evaluation criteria must equal 100%. Each criterion was then assigned a percentage value based on the relative importance that criterion would have in ranking the selected hazards. Point values of 1-10 were assigned using the scoring parameters as outlined in the Evaluation Measure Benchmark Factors shown

below. Using a spreadsheet, values were entered and calculated to provide a hazard ranking as shown in **Table 7.2**.Hazard Analysis Evaluation Measures

Hazard Analysis Evaluation Measures

The committee chose to use a common set of 7 evaluation measures to evaluate each hazard facing the community. Those measures are: 1) likelihood of occurrence; 2) potential for damage; 3) effected area; 4) ability to mitigate; 5) population effected; 6) number of casualties and 7) economic impact. Each corresponding benchmark factor has been assigned a specific point value (10, 7, 4 or 1 point), based on each factor's relative severity and negative impacts. Since some factors need to be given more consideration than others, each criterion was weighted. A percentage value has been assigned to each measure based on the relative significance of the measure. The sum of all of measures must equal 100 percent. The following is a synopsis of each hazard evaluation measure, weight and benchmark factor used in this analysis:

Likelihood of Occurrence

Likelihood of occurrence measures the frequency with which a particular hazard occurs. The more frequently a hazard event occurs, the more potential there is for damage and negative impact on a community.

Capacity to Cause Physical Damages

The capacity to cause physical damages refers to the destructive capacity of the hazard. While destructive capacity of some hazard events, such as floods and tornadoes, is often immediate and readily apparent, some hazards may have significant destructive capacity that is less obvious as it may occur over an extended period of time such as extreme temperatures or drought.

Size of Effected Area
Each hazard affects a geographic area. For example, a blizzard might affect an entire state or even several states, while a flood might only affect a portion of a county or municipality. Although size of the affected area is not always indicative of the destructive potential of the hazard (a tornado is a good example), generally the larger the affected area, the more problematic the hazard event is on a community.

Mitigative Potential
Mitigative potential refers to the relative ease with which a particular hazard event can be mitigated against through the application of structural or non-structural (or both) mitigation measures. Generally, the easier a hazard event is to mitigate against, the less of a future threat it may pose to a community in terms of loss of life and property.

Percent of Population Affected
Percent of Population affected refers to the percent of the county population that may be effected directly or indirectly by the hazard event.

Potential for Causing Casualties
Potential for causing casualties refers to the number of casualties (deaths and injuries) that can be expected if a particular hazard event occurs.

Economic Effects

Economic effects are the monetary damages incurred from a hazard event, and include both public and private damage. Direct physical damage costs as well as indirect impact costs such as lost business and tax revenue are included as part of the total monetary damages.

Evaluation Measure Benchmark Factors

Likelihood of Occurrence	
Excessive Occurrence	10 pts
High Occurrence	7 pts
Medium Occurrence	4 pts
Low Occurrence	1 pt

Affected Area	
Large Area	10 pts
Small Area	7 pts
Multiple Sites	4 pts
Single Site	1 pt

Population Impact	
High Impact	10 pts l
Medium Impact	7 pts
Low Impact	4 pts
No Impact (none)	1 pt

Mitigative Potential	
Easy to Mitigate	10 pts
Possible to Mitigate	7 pts
Difficult to Mitigate	4 pts
Impossible to Mitigate	1 pt

Economic Effects	
Significant Effects	10 pts
Medium Effects	7 pts
Low Effects	4 pts
Minimal Effects	1 pt

Percent of Population Affected	
60% to 100%	10 pts
30% to 60%	7 pts
15% to 30%	4 pts
15% or less	1 pts

Damage Capacity	
High Capacity	10 pts
Medium Capacity	7 pts
Low Capacity	4 pts
No Capacity	1 pt

Table 7.2
Crawford County Hazard Rating - Evaluation Criteria

	Chance of Occurrence	Amount of Damage	Area Affected	Population Affected	Number of Casualties	Economic Effect	Ability to Mitigate		
WEIGHT =========>	20%	15%	10%	10%	20%	10%	15%	100%	
Hazard								Score	Rank
Wildfire	9	9	8	9	7	8	8	8.25	1
Fixed Site Hazmat	8	7	5	5	8	5	8	6.95	2
Structural Fire	9	9	3	3	7	3	8	6.65	3
Transportation Hazmat	8	8	5	5	7	3	7	6.55	4
Severe Winds	9	8	8	8	4	8	2	6.50	5
Infrastructure Failure	7	7	4	8	3	7	8	6.15	6
Tornados	5	8	2	5	8	7	2	5.50	7
Winter Weather Hazard	9	4	8	8	1	7	4	5.50	7
Public Health	5	3	5	6	5	6	6	5.05	8
Terrorism/Sabotage/WMD	1	8	7	7	7	7	1	5.05	8
Extreme Temperature	8	3	8	8	1	4	5	5.00	9
Hail	9	7	7	7	1	5	0	4.95	10
Transportation Accident	9	1	1	2	9	1	5	4.90	11
Oil/Gas Well Incident	8	1	4	4	2	3	4	3.85	12
Nuclear Attack	0	4	5	8	4	8	0	3.5	13
Lightning	9	2	1	1	3	1	0	3.00	14
Pipeline Accident	8	2	1	1	1	4	1	2.85	15
Dam Failure	1	3	3	2	1	3	7	2.70	16
Riverine Flooding	1	3	3	2	1	3	7	2.70	16
Drought	2	1	7	7	1	1	1	2.40	17
Civil Disturbance	1	2	1	1	1	3	8	2.40	17
Scrap Tire Fire	1	1	2	1	1	3	8	2.35	18
Earthquake	0	2	4	5	2	6	0	2.20	19
Subsidence	1	2	1	1	1	1	1	1.15	20
Shoreline Flooding	1	1	1	1	0	1	3	1.10	21

A summary of the hazard rankings derived from the hazard evaluation process is shown in (Table 7.3), below.

Table 7.3, Summary Hazard Rankings for Crawford County	
High Rankings	**Score**
Wildfire	8.25
Fixed Site Hazmat	6.95
Structural Fire	6.65
Transportation Hazmat	6.55
Severe Winds	6.50
Infrastructure Failure	6.15
Moderate Ranking	
Tornados	5.50
Winter Weather Hazard	5.50
Public Health	5.05
Terror/sabotage/WMD	5.05
Extreme Temperatures	5.00
Hail	4.95
Low Ranking	
Transportation Accidents	4.90
Oil/Gas Well incident	3.85
Nuclear Attack	3.50
Lightning	3.00
Pipeline Accident	2.85
Dam Failure	2.70
Riverine Flooding	2.70

Risk Assessment and Vulnerability Assessment Summary

Risk Assessment

The goals of risk assessment are to determine where hazards exist, and develop an understanding of how often they will arise and how much harm they cause. Based on the weighted hazard ranking process recommended in the Michigan Hazard Analysis workbook, a composite of hazards and their relative risk are presented below. This list will be used as the foundation for developing hazard mitigation goals and strategies in subsequent chapters.

- **High Risk:** -- very likely to occur during hazard mitigation planning horizon of 20 years, and/or effect all or most of the county.

- **Medium Risk:** -- somewhat likely to occur during hazard mitigation planning horizon of 20 years, and/or effect a significant area of the County.

- **Low Risk:** -- means it is not likely to occur, or cover only a limited area within county.

Vulnerability Assessment

This step looks at such points as population concentrations, age-specific populations, development pressures, types of housing (older homes, mobile homes), presence of agriculture, sprawl (spreading resources too thin), and other issues that may make Crawford County more vulnerable to specific hazards. The following criteria were used to rank vulnerability as low, medium or high for each hazard. Further, analysis of hazards ranked as high risk, relies on information presented in earlier chapters.

- **High Vulnerability:** -- If an event occurred it would have severe impacts over large geographic areas or more densely populated areas and have a serious financial impact on County residents and businesses.

- **Medium Vulnerability:** -- If an event occurred it would have confined impacts on the safety of residents but would have a financial impact on County residents and businesses.

- **Low Vulnerability:** -- If an event occurred it would have very minimal impact on the safety of County residents and minimal financial impact on County residents and businesses.

Based on the weighted hazard ranking process recommended in the Michigan Hazard Analysis workbook, the 2002 Crawford County Hazard Analysis and community input, a composite of hazards and their relative risk and vulnerability are presented in Table 7.4. This list will be used as the foundation for developing hazard mitigation goals and strategies in subsequent chapters

Vulnerable Situations in Crawford County

Wildfire

By far the most significant hazard facing Crawford county comes from wildfire. As indicated in Figure 2-3, dispersed residential development and extensive jack pine/red oak forest cover present a major threat to population and property in the county.

The large number of permanent and seasonal homes in northeastern Michigan, coupled with the increase in tourists during the most dry (and therefore most vulnerable) times of the year, greatly increases the risk from wildfires.

> "The threat of life and property losses related to wildfires is a significant issue for federal, state and local fire and planning agencies who consider the mix of residential areas and wildlands. The wildland fire threat is part of the more general consideration of human development encroaching wildlands. The March, 2000, edition of the Journal of Forestry reflects this with urban encroachment and wildland fragmentation the principal subject with residential fire one of the specific issues. (Cohen 2000). Presently, the wildland fire threat to homes influences fire management and protections policies at national and local levels." (Jack D. Cohen, "What is the Wildland Fire Threat to Homes?)

Current research indicates lowering building ignition potential will significantly reduce chances of home destruction without extensive wildland fuel reduction. This becomes an issue of homeowner education and community involvement. Community/homeowner understanding of the methods of

lowering home ignition potential is the primary mitigative action to reduce wildland fire threat to residential areas.

As part of a nationwide effort to identify communities at high risk the following federal agencies developed a list of urban wildland interface communities in the vicinity of Federal lands that are at high risk from wildfire: Forest Service, Department of Agriculture; Bureau of Indian Affairs, Bureau of Land Management, Fish and Wildlife Service, and National Park Service, Department of the Interior. This was published in the **Federal Register** / Vol. 66, No. 160 / Friday, August 17, 2001; Urban Wildland Interface Communities within the Vicinity of Federal Lands that are at High Risk from Wildfire. State of Michigan, along with many other states, felt the urban wildland interface is not limited to communities in the vicinity of Federal land and developed a comprehensive state list of communities at risk.

Below is a list of Crawford County locations identified in the document.

- Beaver Creek Township
- Frederick Township
- City of Grayling
- Grayling Township
- Lovells Township
- S. Branch Township

Community centers and dispersed rural residential development interfaces with these high risk forest types of pine, oak and aspen. Therefore, with the exception of Maple Ridge Township, much of the remainder of Crawford County is highly vulnerable to wildfire hazards.

To adequately institute practices of lowering home ignitability it will require changing relationships between homeowners and local fire services. Instead of all fire protection responsibilities being with fire agencies, homeowners should take primary responsibility for adequately lowering home ignitability. The role of fire protection agencies becomes that of a community partner to provide homeowners the technical assistance needed to reduce home ignitability. To be successful, this partnership arrangement must be shared and implemented equally by homeowners and fire services. Projects designed to mitigate the threat of wild fire should evolve from the concepts and materials represented by “Firewise”. Firewise is an cooperative effort among federal, state, and private agencies and organizations to promote fire safety in the wildland/urban interface. The primary FireWise tenet is that it is unnecessary to lose homes or other buildings in wildfires if those homes or buildings are built and maintained according to simple FireWise principles. Firefighters cannot be everywhere when a wildfire occurs, but if homeowners follow FireWise suggestions, homes and buildings will survive wildfires without any firefighters being there to protect them. The Firewise program addresses the risk to homes in the wildland/urban interface to wildland fire and provides a potential vehicle upon which a partnership between homeowners and fire services can develop

Riverine and Urban Flooding:

Riverine flooding is defined as the periodic occurrence of overbank flows of rivers and streams resulting in partial or complete inundation of the adjacent floodplain. Riverine floods generally caused by prolonged, intense rainfall, snowmelt, ice jams, dam failures, or any combination of these factors. 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.

National Flood Insurance Program

In 1968, Congress created the National Flood Insurance Program (NFIP). Since most homeowners' insurance policies did not cover flood, property owners who experienced a flood often found themselves financially devastated and unable to rebuild. The NFIP was formed to fill that gap. To ensure the program did not take on unnecessary risks, one of the key requirements to participate in the program was that communities had to adopt standards for new construction and development.

Pre-existing homes and businesses, though, could remain as they were. Owners of many of these older properties could obtain insurance at lower, subsidized, rates that did not reflect the property's real risk. In addition, as the initial flood risk identified by the NFIP has been updated over the years, many homes and businesses in areas where the revised risk was determined to be higher have also received discounted rates. This "Grandfathering" approach prevented rate increases for existing properties when the flood risk in their area increased.

In 2012, the U.S. Congress passed the Flood Insurance Reform Act of 2012 which calls on the Federal Emergency Management Agency (FEMA), and other agencies, to make a number of changes to the way the NFIP is run. As the law is implemented, some of these changes have already occurred, and others will be implemented in the coming months. Key provisions of the legislation will require the NFIP to raise rates to reflect true flood risk, make the program more financially stable, and change how Flood Insurance Rate Map (FIRM) updates impact policyholders. The changes will mean premium rate increases for some – but not all -- policyholders over time.

In April of 2012 FEMA completed a Countywide Flood Insurance Study and DFIRM (Digital Firm) Status for Crawford County. Beaver Creek, Frederic, Grayling, Lovells, Maple Forest, and South Branch Townships and the City of Grayling are participating in the NFIP.

A review of the State of Michigan database found no incidents of repetitive loss properties in Crawford County.

Table 7.4, Crawford County Risk and Vulnerability Assessment Summary		
Hazards in Crawford County	**Risk Assessment**	**Vulnerability Assessment**
Wildfire	**High**	**High**
Severe Summer Storm Hazards Severe Winds, Tornados, Lightening & Hail	**High**	**High**
Infrastructure Failure	**High**	**High**
Severe Winter Storm Hazards	**High**	**High**
Structural Fires	**High**	**Medium**
Hazardous Materials Fixed Site	**High**	**Medium**
Transportation of Hazardous Materials	**Medium**	**Medium**
Extreme Temperatures	**Medium**	**Medium**
Public Health	**Medium**	**Medium**
Riverine Flooding	**Medium**	**Medium**
Terrorism/Sabotage/WMD	**Medium**	**Medium**
Drought	**Medium**	**Medium**
Dam Failures	**Medium**	**Medium**
Petroleum and Natural Gas Pipeline Accidents	**Medium**	**Medium**
Oil and Gas Wells Accidents	**Medium**	**Low**
Transportation Accidents	**Medium**	**Low**
Nuclear Attack	**Low**	**High**
Civil Disturbance	**Low**	**Low**
Scrap Tire Fire	**Low**	**Low**
Shoreline Flooding	**Low**	**Low**
Earthquakes	**Low**	**Low**
Subsidence	**Low**	**Low**

Chapter 8 - Goals and Objectives

Overview

The purpose of this chapter is to establish the goals and objectives that will guide hazard mitigation efforts in Crawford County. In developing community goals and objectives, it is important to analyze existing community characteristics such as social and economic conditions, services and facilities, environmental conditions, and existing land use. Furthermore, hazard analysis and vulnerability assessment must be considered. Preceding chapters of this hazard mitigation plan have documented these items.

Public meetings were announced to invite local county officials to participate in meetings to define goals and objectives for the Crawford County Hazard Mitigation Plan. The purpose was to present community profiles, discuss hazards and vulnerability, and define and discuss potential goals and objectives. Draft copies of the plan were sent to all communities. The goals and objectives were discussed at a meeting, held by the Crawford County LEPC meeting on October 11, 2013.

Crawford County Goals and Objectives

Goals are general guidelines that explain what a community wants to accomplish. Goals are usually long-term and represent broad visions for the community. Objectives, on the other hand, define strategies or implementation steps necessary 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:

- Provide community wide hazard warning systems.
- Provide information and resources to increase hazard awareness.
- Maintain existing resources and provide necessary training.
- Identify and obtain necessary resources and equipment to prevent or limit hazard effects.

GOAL 2: Minimize Damage to Public and Private Property

Objectives:

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

GOAL 3: Maintain Essential Services

Objectives:

- Aggressively 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: Manage growth/development

Objectives:

- Develop hazard resistant growth policies.
- Prevent development in high hazard areas.
- Integrate hazard mitigation planning into land use planning
- Encourage sustainable development
- Protect natural resources.

GOAL 5: Build partnerships to support emergency response services and hazard mitigation activities on a regional basis.

Objectives:

- Continue to work cooperatively with agencies and communities in Alpena County.
- Continue to work cooperatively with agencies and communities in northern Michigan.
- Develop regional grant applications for hazard mitigation implementation.
- Continue to participate in the Region 7 Homeland Security Board.

Chapter 9 - Mitigation Strategies and Priorities

The next step in the hazard mitigation planning process is to identify mitigation actions suitable to the community, evaluate the effect the action will have on the specified mitigation objective and prioritize actions to decide what sequence or order these actions should be pursued.

Mitigation Categories

Mitigation actions can be grouped into six broad categories:
1. Prevention: Government administrative or regulatory actions or processes that influence the way land and buildings are developed and built. These actions also include public activities to reduce hazard losses. Examples include planning and zoning, building codes, capital improvement programs, open space preservation, and storm water management regulations.

2. Property Protection: Actions that involve modification of existing buildings or structures to protect them from a hazard, or removal from the hazard area. Examples include acquisition, elevation, relocation, structural retrofits, storm shutters, and shatter-resistant glass.

3. Public Education and Awareness: Actions to inform and educate citizens, elected officials, and property owners about the hazards and potential ways to mitigate them. Such actions include outreach projects, real estate disclosure, hazard information centers, and school-age and adult education programs.

4. Natural Resource Protection: Actions that, in addition to minimizing hazard losses, also preserve or restore the functions of natural systems. These actions include sediment and erosion control, stream corridor restoration, watershed management forest and vegetation management, and wetland restoration and preservation.

5. Emergency Services: Actions that protect people and property during and immediately after a disaster or hazard event. Services include warning systems, emergency response services, and protection of critical facilities.

6. Structural Projects: Actions that involve construction of structures to reduce the hazard impact. Such structures include dams, levees, floodwalls, seawalls, retaining walls, and safe rooms.

Identification of Mitigation Actions

Members of the LEPC met on June 31, 2012 to review hazard analysis and update mitigation actions. The following tables provide a prioritized list of the mitigation actions identified at the meeting.

Evaluation and Prioritization of Mitigation Actions

Members of the LEPC met on June 31, 2012 to re-evaluate and prioritize the list of mitigation actions. The committee identified level of government, agencies and organizations that would be responsible for completing the prioritize projects, as well as identifying possible funding sources. This information is included in the tables of Chapter 9. In addition, during the prioritization process each project was evaluated with regard to its: social impact, technical feasibility, administrative potential, political impact, legal ramification, environmental impact, overall benefit and cost effectiveness.

A prioritized listing of mitigation projects and actions for significant hazards follows. The first listing covers mitigation actions that can apply to more than one hazard. The remaining lists are presented as the hazards were ranked for Crawford County.

Review and Updating Hazard Mitigation Action Items

The Committee reviewed the 2006 Mitigation Strategies and made necessary changes. Several action items were eliminated or combined. Actions that have been completed were eliminated. Time lines were altered on mitigation strategies. The 2006 mitigation strategies list is attached to show changes in the document.

Changes in local land development have been negligible given the 2007 nationwide recession. The committee did not identify areas with significant land development since the last plan was completed and therefore made no changes to the plan in relation to new development.

Most activities in the hazard mitigation plan that the community has worked on are related to on-going mitigation actions.

The committee made changes in priorities related to Public Health, severe winter weather and nuclear attacks.

Mitigation Actions & Implementation Strategies **A. Multi-Hazard Actions, #1**	Priority	Responsible Agency	Funding Sources	Application	Progress	Original Status	New Status
1. Identify feasible sites for public early warning systems and networks and seek funding.	High	A.B.C.D.O.Q.S	T	Countywide	Reverse 911 system acquired & being implemented	Mid-term	Short term
2. Continue to develop Emergency Response Team program to help prepare for all hazard events in the county.	High	A.B.C.D.Q	A. H. T.	Countywide	Minor progress. Focus at regional level	Mid-term	Mid-term
3. Provide trained, equipped, and prepared search and rescue teams.	High	A.B.C.D.Q.P	A. H. T.	Countywide	In place, CERT is very active	Mid-term	Mid-term
4. Review and develop site emergency plans for schools, factories, office buildings, shopping malls, hospitals, correctional facilities, etc. to cover all potential hazards.	High	A.B.C.D.E.K.M.N.R	T	Countywide	Major progress, schools, factories & hospital	Short-term	Ongoing
5. Develop and implement a public education program for all natural hazards that threaten the community.	Medium	A.D.H.I.O.Q	B.C.T.	Countywide	In place, handouts, and presentations	Ongoing	Ongoing
6. Ensure that the County and individual communities have adequate equipment, staff, and training to respond to transportation-related accidents specific to their needs.	Medium	A.B.C.E.T.Q.S	B.C.T.	Countywide	Beaver Creek Twp has HAZMAT Team and CRC has traffic control	Mid-term	Mid-term
7. Develop plans to identify and inform persons of "Safe Areas" during festivals/events. (include signs and directions to shelters)	High	A.B.C.D.E.N.Q	T	Countywide	Minor progress	Short-term	Short-term
8. Review current status and provide back-up generators to maintain community infrastructure at acceptable operating levels during extended power failures.	Medium	A.B.C.P.Q	B.C.T.	Countywide	Combined with #10	Mid-term	Mid-term
9. Encourage continuation of house numbering program	High	A.B.C.E.D.Q.W	T	Countywide	In place	Ongoing	Ongoing
10. Communities will acquire and maintain an adequate level of emergency power generators to supply emergency water needs, wastewater processing, emergency communications, emergency health care, and shelters.	Medium	A.B.C.D.Q.S	Q.B.C.T	Countywide	Progress made, City DPW has portable generators	Mid-term	Mid-term
11. Conduct workshops at community gatherings to encourage residents to develop a Family Disaster Plan, which includes the preparation of a Disaster Supplies Kit.	Medium	A.B.C.I.Q.S	B.C.H.T.I.N	Countywide	Presentations made by Fire Dept. and county – materials available	Long-term	On-going
12. Organize outreach program to vulnerable populations during and after hazard events, including wildfires, extreme winter and summer weather events, periods of extreme temperatures, public health emergencies, and other hazards that can impact the community.	Medium	A.B.C.D.E.I.J.N.P	B.C.T.I	Countywide	Commission on Aging & County EMS maintains lists and contacts	Short-term	Short-term
13. Build the capabilities of the county GIS program to function as a tool to address multiple hazards. This effort would require the creation/updating of datasets such as parcels/ownership, location of all structures, driveways with ingress/egress conditions, roads, forest types, ownership types, floodplains, utilities (power lines, gas lines and water lines), wetlands, water features, bridges and culverts, (SARA III sites)	High	A.B.C.D.E.J.P	B.C.Q.T	Countywide	Major progress made, GIS program in place	On-going	On-going
14. Review and improve strategy for providing public with emergency telephone numbers	Medium	A.B.C.D.W	T	Countywide	In place, material and handouts available	Long-term	Long-term
15. Review and improve program to provide regular maintenance and equipment checks of all critical equipment.	Medium	A.B.C.D.E.P	T	Countywide	In place, each department responsible	Ongoing	Ongoing
16. Explore methods to provide NOAA radios at cost or as reward for completing "Family disaster Plan"	Medium	A.B.C.O.Q.S	T	Countywide	In place, provided radios to facilities and individuals	Long-term	Long-term

Mitigation Actions & Implementation Strategies **A. Multi-Hazard Actions, #2**	Priority	Responsible Agency	Funding Sources	Application	Progress	Original Status	New Status
17. Compile a listing of homes and facilities with vulnerable residents such as elderly, infirmed and disabled individuals; and establish outreach procedures for assisting residents after severe winter storm events	High	A.B.C.H.I.N.T	C.H.T	Countywide	In place, Commission on Aging and County EMS maintain and update lists	Short-term	Ongoing
18. Produce and distribute family emergency preparedness information relating to all natural hazards affecting the County.	High	A.B.C.D.J.O.Q	A.C.D.R	Countywide	Materials available and distributed	Short-term	Short-term
19. To address multiple hazards in the county improve tree trimming and maintenance efforts to prevent limb breakage and safeguard nearby utility lines. The end goal is to create and maintain a disaster-resistant landscape in public rights-of-way.	Low	A.B.C.E.P	P	Countywide	Consumer's Power has program	Long-term	Long-term
20. Where feasible and cost effective (more densely populated areas) bury and protect power and utility lines.	Low	A.B.C.P.U	P	Countywide	Limited costs prohibitive	Long-term	Long-term
21. Increase usage of NOAA Weather Radio by subsidizing purchase and distribution of radios to county residents, organizations and businesses. Use NOAA radios as a community emergency alert system to inform on hazard events.	Low	A.B.C.D.K.O.R.U	Q.T	Countywide	In place	Mid-term	Mid-term
22. Enforce a balanced system of ordinances that protect the community as-a-whole while respecting the rights of individuals.	Low	B.C.Q.W	C	Countywide	Progress made, communities active	Long-term	Long-term
23. Identify optimal staffing levels for County and community needs – seek funding to meet optimal levels	Low	A.B.C.E	B.C	Countywide	Ongoing funding limiting	Long-term	Long-term
24. Acquire portable/changeable message signs to direct crowds and provide information.	Low	A.B.C.D.E.W	B.Q	Countywide	Minor activity	Mid-term	Mid-term
25. Individual communities should prepare future land use plans and capital improvement programs to plan for their future hazard mitigation needs.	High	A.B.C.D.F	C	Countywide	Progress made & Ongoing	Short-Term	Short-Term
26. Communities will work with the Federal Emergency Management Agency (FEMA) to refine flood plains mapping.	Medium	A.B.C.Q.S	T	Countywide	Refining maps	Mid-term	Mid-term
27. Encourage key gasoline stations to have the capacity to pump gasoline during power outages.	Low	A.M.W	M	Countywide	Identified, table top exercise, sent letters to all service stations	Long-term	Long-term
28. Pre-planning for debris management staging and storage areas	Low	A.B.C.D.E.Q	A.B.C	Countywide	Identified sites	Mid-term	Mid-term
29. Expand community awareness of evacuation plans.	Low	A.B.C	A.B.C	Countywide	Progress made	Long-term	Long-term
30. Promote and implement solutions for keeping roads and driveways accessible to vehicles and fire equipment.	High	A.B.C.D.E.F.J.U	A.B.C.D	Countywide	Progress made through Firewise program	On-going	On-going
31. Identify escape routes and emergency snow routes.	Low	A.B.C.E.Q	A.B.C.E	Countywide	No activity	Mid-term	Mid-term
32. Explore and implement plan for distribution of NOAA radios throughout community	Low	A.B.C.O	A.B.C	Countywide	Combined with 21	Long-term	Long-term
33. Encourage residents to develop a Family Disaster Plan that includes the preparation of a Disaster Supplies Kit.	Low	A.B.C.D.I	A.B.C	Countywide	Combined with 11	Ongoing	Ongoing

A. County Emergency Management Office	**G.** MSU Extension	**M.** Local Businesses	**S.** Medical
B. County	**H.** District Health Dept.	**N.** Civic Gr.& Churches	**T.** Federal Government
C. Local Units of Gov.	**I.** American Red Cross	**O.** National Weather Service	**U.** landowners
D. Local Fire Dept.	**J.** USFS & MDNR	**P.** Utility Company	**V.** Salvation Army
E. County Road Commission	**K.** Insurance Companies	**Q.** State	**W.** Police
F. NEMCOG	**L.** Real Estate Co.	**R.** Schools	

Mitigation Actions & Implementation Strategies **B. Wildfire**	Priority	Responsible Agency	Funding Sources	Application	Progress	Original Status	New Status
1. Provide strict enforcement of open burning regulations	High	A.B.C.D.J.W	D. Q. T	Countywide	In place, fire departments issue tickets	Short-term	Short-term
2. Promote and implement fuel management by thinning of flammable vegetation, creation of fuel breaks, use of fire-retardant materials/vegetation and selective thinning	High	A.D.J.Q	B.Q.T	Countywide	In progress – USFS and MDNR	New	Short-term
3. Implement the Crawford County Community Wildfire Protection Plan by pursuing grants.	High	A.D.J.Q.U	Q.T	Countywide	In progress plan completed in 2013	New	Short-term
4. Implement a countywide Firewise program as outlined in the Community Wildfire Protection Plan, through a cooperative effort of local fire departments, and state and federal agencies.	High	A.D.J.Q.U	B.C.D.J.Q.T	Countywide	In progress	New	Short-term
5. Develop a wildfire evacuation plan for residential areas and high use recreational areas such as the AuSable River Corridor, ORV trails and campgrounds	High	A.D.J.Q	B.C.D.J.Q.T	Countywide	Progress made	Short-term	Short-term
6. Continue to build partnerships with local fire departments, MDNR, USFS and National Guard to address wildfire mitigation and suppression.	High	A.B.C.D.J.X	B.C.D.J.Q.T	Countywide	In place	New	Short-term
7. Develop a program to utilize National Guard Helicopters for supplying water for fire suppression	Medium	D.J.X	J.Q.T	Countywide	In place	New	Mid-term
9. Implement Reverse 911 System to selectively notify homeowners in areas threatened by a wildfire.	High	B	B	Countywide	Purchased and implementing	New	Short-term
10. Establish procedures for notifying campground and canoe liveries	High	A. B. D. J	B,C,D,J	Countywide	Reverse 911 and send out emergency units	New	Short-term
11. Implement Firewise development strategies in local master plans and zoning ordinance.	High	B. C	B.C	Countywide	IN progress – South Branch Twp taking lead	New	Short-term
12. Promote media broadcasts of fire weather and fire warnings	Medium	A.B.C.D.J	B.C.J.T	Countywide	In place, USFS & MDNR, EMS Facebook	Mid-term	Mid-term
13. Promote proper disposal of woody debris at designated sites in the county to reduce burning of brush piles.	Medium	A.B.C.D.U.	B,C,D	Countywide	Co-Gen plant atkes materials	New	Long-term
14. Work with insurance companies to provide wildfire safety information to area residents.	Medium	A.B.C.D.K.L.Q.U	Q.T	Countywide	In progress	Mid-term	Mid-term
15. Develop program to inspect campsites in public forest areas to insure safe open fires, where allowed.	Medium	A.B.C.D.J.W	J	Countywide	In place – MDNR and USFS	Mid-term	Mid-term
16. Review and develop a regional base for air-firefighting wildfire support at Camp Grayling Airport.	Medium	A.D.J.Q	J.Q.T	Countywide	Some progress made	Long-term	Long-term
17. Study and develop GIS layers to include water supply location, Tier II sites, gas and oil wells, etc.	Medium	A.B.C.D.J.Q	B.C.J.Q.T	Countywide	In place and ongoing	Mid-term	Mid-term

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E. County Road Commission	**K.** Insurance Companies	**Q.** State	**W.** Police
F. NEMCOG	**L.** Real Estate Co.	**R.** Schools	

Mitigation Actions & Implementation Strategies **C. Fixed Site Hazmat**	Priority	Responsible Agency	Funding Sources	Application	Progress	Original Status	New Status
1. Review and/or implement strategy to train, equip, and prepare site and local hazardous material emergency response teams.	High	A.C.D.M.Q	T	Countywide	Ongoing and yearly review, Beaver Creek Twp has HAZMAT Team	Mid-term	Mid-term
2. Educate public and implement steps to encourage "shelter in place" response to Hazmat incidents.	High	A.B.C.D.U	T	Countywide	Minor progress	Short-term	Short-term
3. Continue Brownfield cleanup activities.	High	B.C	Q.T	Countywide	In place some progress made	Ongoing	Ongoing
4. Develop and/or improve public warning systems and networks for hazardous material releases.	Medium	A.B.C.D.Q.S	T	Countywide	Reverse 911	Mid-term	Mid-term
5. Maintain site emergency plans and community response plans as required under SARA Title III.	Medium	A.B.C.D.M	T	Countywide	In place	New	Ongoing
6. Inform public and support pollution control, enforcement and cleanup; proper disposal of chemicals and scrap materials.	Medium	A.B.C.D	H.T	Countywide	In place, household hazardous waste collection program	Mid-term	Mid-term
7. Training in and compliance with all safety procedures and systems related to the manufacture, storage, transport, use, and disposal of hazardous materials.	Medium	A.D.M.Q.U	Q.T	Countywide	In place, 302 sites	Mid-term	Mid-term
8. Reinforce planning emphasis on proper separation and buffering between industrial areas and other land uses.	Medium	B.C.L.M.N.R.T.U	B.C	Countywide	In place through zoning	Mid-term	Mid-term
9. Emphasize locating industrial areas away from schools, nursing homes, and hospitals, in future planning.	Medium	B.C.L.M.N.R.T.U	B.C	Countywide	In place under zoning	Long-term	Long-term
10. Provide inventory and secure debris, yard items or stored objects (including oil, gasoline and propane tanks, and paint and chemical barrels) in flood plain that might pose hazard.	Medium	A.B.C.D.M.U	C	Countywide	Minor activity	Mid-term	Mid-term
11. Continue emphasis on policies and training stressing importance of safety above other considerations.	Medium	A.D.H.Q.T.U	A.B.C	Countywide	In place & ongoing	Ongoing, short-term	Ongoing, short-term

A. County Emergency Management Office	**G.** MSU Extension	**M.** Local Businesses	**S.** Medical
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E. County Road Commission	**K.** Insurance Companies	**Q.** State	**W.** Police
F. NEMCOG	**L.** Real Estate Co.	**R.** Schools	

Mitigation Actions & Implementation Strategies **D. Structural Fire**	Priority	Responsible Agency	Funding Sources	Application	Progress	Original Status	New Status
1. Review and develop programs to raise community awareness on proper installation and maintenance of heating systems.	High	A.C.D	D.T	Countywide	In place, fire dept and EMS awareness programs	Ongoing,	Ongoing,
2. Promote homeowner pre-emergency plan such as evacuation route and congregation spot.	High	A.B.C.D	A.B.C.D	Countywide	In place, fire dept and EMS awareness programs	Short-term	Short-term
3. Develop information and programs about safe and responsible use of electric and "space" heaters.	High	A.D.K	D.T	Countywide	In place, fire dept and EMS awareness programs	Ongoing, Short-term	Ongoing, Short-term
4. Develop public education and school programs related to the use of stoves, heaters, fireworks, matches/lighters, etc.	Medium	A.D	D.T	Countywide	In place, fire dept and EMS awareness programs	Mid-term	Mid-term
5. Communicate to residents information related to handy household items that can be used as fire tools.	Medium	A.D.K	D	Countywide	In place, fire dept and EMS awareness programs	Mid-term	Mid-term
6. Increase volunteer recruitment, and study offering paid training.	Medium	A.B.C.D	D	Countywide	Ongoing	Long-term	Long-term

Mitigation Actions & Implementation Strategies **E. Transportation & Transportation of HAZMAT**	Priority	Responsible Agency	Funding Sources	Application	Progress	Original Status	New Status
1. Provide more training for fireman, police and first responders to school bus and commercial bus accidents.	High	A.B.D.E.R.W	T	Countywide	Ongoing	Mid-term	Mid-term
2. Encourage and enforce use of designated truck routes, and strict enforcement of weight and travel restrictions for truck traffic.	High	A.B.C.E.Q	T	Countywide	Some progress made towards identifying routes	Short-term	Short-term
3. Study and support pre-arranged shelters for stranded motorists/travelers, and others.	High	A.I.N.R	B.C.H.T	Countywide	In place Red Cross responsible	Mid-term	Mid-term
4. Provide more training for airfield emergencies involving all county fire departments.	Medium	A.B.C.D.W	T	Countywide	Developing partnership with Grayling and National Guard, includes equipment and staffing	Mid-term	Mid-term
5. Develop and implement improved design, routing, and traffic control at problem roadway areas.	Medium	A.B.C.W	T	Countywide	Some progress	Long-term	Long-term
6. Review and enhance airport maintenance, security, and safety programs.	Medium	A.B.C	Q.T	Countywide	In place, military provides at airbase	Long-term	Long-term
7. Acquire portable signs to inform motorists of high wind area, potential whiteout road hazards and road glazing areas on major highways.	Medium	A.B.C.E.O.Q. S.W	Q	Countywide	Minor activity	Mid-term	Mid-term

A. County Emergency Management Office	**G.** MSU Extension	**M.** Local Businesses	**S.** Medical
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Mitigation Actions & Implementation Strategies **F. Severe Winds**	Priority	Responsible Agency	Funding Sources	Application	Progress	Original Status	New Status
1. Review current and proposed improvements to wind engineering measures and construction techniques to strengthen public and private structures against severe wind damage	High	A.B.C	T	Countywide	Minor progress	Short-term	Short-term
2. Encourage securing loose materials, yard and patio items indoors or where winds cannot blow them about.	High	A.B.C	T	Countywide	Minor progress	Mid-term	Mid-term
3. Review regulations and implement necessary changes to insure proper anchoring of manufactured homes and exterior structures…	Medium	A.B.C	B.Q.T	Countywide	In place	Mid-term	Mid-term

Mitigation Actions & Implementation Strategies **G. Infrastructure Failure**	Priority	Responsible Agency	Funding Sources	Application	Progress	Original Status	New Status
1. Review and develop strategies to insure redundancies in utility and communications systems, especially “lifeline” systems.	High	A.B.C.D.H.N.O.W	P	Countywide	Ongoing and progress made		Mid-term
2. Review and develop strategies to identify and employ generators for backup power at critical facilities.	High	A.B.C.M.P.R.T	A.B.C	Countywide	Progress made		Mid-term
3. Identify sites and obtain support to improve critical road/stream crossings.	Medium	A.B.C.E.J	Q.T	Countywide	In place, as funding allows		Mid-term

Mitigation Actions & Implementation Strategies **H. Summer Weather Hazards Actions**	Priority	Responsible Agency	Funding Sources	Application	Progress	Original Status	New Status
1. Develop or update emergency response plans for schools, campgrounds, fairgrounds, parks, community events etc.	High	A.B.C.R	C. T	Countywide	Major progress, schools, factories & hospital	Mid-term	Mid-term
2. Require new mobile home parks to have tornado/wind shelters	High	A.B.C.O	T	Countywide	No activity	Mid-term	Mid-term
3. Continue training and increased use of weather spotters.	Medium	A.O	O	Countywide	US Weather Service summer and winter weather spotters training	Mid-term	Mid-term
4. Continue pre-planning efforts for debris management staging and storage areas	Medium	A.B.C.E	A.B.C.E	Countywide	Identified sites	Mid-term	Mid-term

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D. Local Fire Dept.	**J.** USFS & MDNR	**P.** Utility Company	**V.** Salvation Army
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Mitigation Actions & Implementation Strategies **I. Winter Weather Hazards**	Priority	Responsible Agency	Funding Sources	Application	Progress	Original Status	New Status
1. Study and improve location and design and maintenance of water and sewer systems (to include insulation of critical components to prevent damage from ground freeze)	High	C.P	Q. T	Countywide	Identified and ongoing	Long-term	Long-term
2. Establish pre-arranged shelters for stranded motorists/travelers, and others.	High	A.B.C.I.N.R	B.C.H. T	Countywide	In place and ongoing	Mid-term	Mid-term
3. Continue to support use of emergency shelters	High	A.B.C.I.D	B.C.H. T	Countywide	In place and ongoing	Short-term	Short-term
4. Inventory problem sections of roads. Place snow fences or "living snow fences" (rows of trees or vegetation) to limit blowing and drifting of snow over critical roadway segments	Medium	A.B.C.E.O	E. Q. T	Countywide	Ongoing	Mid-term	Mid-term
5. Acquire portable signs to inform motorists of high wind area, potential whiteout road hazards and road glazing areas on major highways.	Low	A.B.C.E.O.Q. S.W	Q	Countywide	Minor activity	Short-term	Short-term
6. Produce and distribute family emergency preparedness information relating to severe winter weather hazards	Low	A.I.N	A.Q	Countywide	Ongoing materials available	Mid-term	Mid-term

Mitigation Actions & Implementation Strategies **J. Extreme Temperatures**	Priority	Responsible Agency	Funding Sources	Application	Progress	Original Status	New Status
1. Identify location and organize outreach to vulnerable populations during periods of extreme temperatures…	High	A,B,C,I,N,	T	Countywide	In place, County EMS and Commission on Aging	Short-term	Short-term
2. Improve and/or enact landlord/tenant ordinances.	Medium	B,C	Q, T	Countywide	Minor progress	Mid-term	Mid-term
3. Develop housing/landlord codes for heating requirements.	Medium	B,C	Q, T	Countywide	Minor progress	Mid-term	Mid-term

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Mitigation Actions & Implementation Strategies **K. Public Health Emergencies**	Priority	Responsible Agency	Funding Sources	Application	Progress	Original Status	New Status
1. Encourage residents to receive immunizations against communicable diseases	High	H. I. N. Q. S.	H.T	Countywide	In place	Ongoing	Ongoing
2. Maintain a community public health system with sufficient disease monitoring and surveillance capabilities to adequately protect the population from large-scale outbreaks	High	H. Q. S. T.	H. T	Countywide	In place	New	Mid-term
3. Increase public awareness of the causes, symptoms, and protective actions for disease outbreaks and other potential public health emergencies	High	H. N. R. S.	H. T	Countywide	In place	Ongoing	Ongoing
4. Inform public and support pollution control, enforcement and cleanup; proper disposal of chemicals and scrap materials	Med	A. B. H. M. Q. R. T.	H. T	Countywide	In place	New	Ongoing
5. Expand community support of free or reduced-expense clinics and school health services	Med	B. C. H. N. Q. S.	H	Countywide	In place	New	Ongoing
6. Increase public awareness of radon dangers and the prevention efforts that can be taken to reduce concentrations of radon in homes and buildings	Low	H. Q.	H	Countywide	In place	Ongoing	Ongoing
7. Demolish and clear vacant condemned structures in populated areas to prevent rodent infestations	Low	C. B. H.	B.C	Countywide	In place	Ongoing	Ongoing
8. Coordinate with health department and local communities to assure proper location, installation, cleaning, monitoring, and maintenance of septic tanks	Low	C. H.	H	Countywide	In place	Ongoing	Ongoing
9. Seek support and funding to clean up sites of environmental contamination	Low	B. M. Q. T.	Q.T	Countywide	In place	New	Ongoing
Review and insure community water and sewer infrastructure is maintained at acceptable operating standards.				County wide	Removed	Ongoing	Removed
Continue to provide free Radon kits to public.				County wide	Removed	Ongoing	Removed
Protect public contact with contaminated sites or waters (including flood waters)				County wide	In place	Ongoing	Removed

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Chapter 9 - Mitigation Strategies and Priorities

The next step in the hazard mitigation planning process is to identify mitigation actions suitable to the community, evaluate the effect the action will have on the specified mitigation objective and prioritize actions to decide what sequence or order these actions should be pursued.

Mitigation Categories

Mitigation actions can be grouped into six broad categories:
1. Prevention: Government administrative or regulatory actions or processes that influence the way land and buildings are developed and built. These actions also include public activities to reduce hazard losses. Examples include planning and zoning, building codes, capital improvement programs, open space preservation, and storm water management regulations.

2. Property Protection: Actions that involve modification of existing buildings or structures to protect them from a hazard, or removal from the hazard area. Examples include acquisition, elevation, relocation, structural retrofits, storm shutters, and shatter-resistant glass.

3. Public Education and Awareness: Actions to inform and educate citizens, elected officials, and property owners about the hazards and potential ways to mitigate them. Such actions include outreach projects, real estate disclosure, hazard information centers, and school-age and adult education programs.

4. Natural Resource Protection: Actions that, in addition to minimizing hazard losses, also preserve or restore the functions of natural systems. These actions include sediment and erosion control, stream corridor restoration, watershed management forest and vegetation management, and wetland restoration and preservation.

5. Emergency Services: Actions that protect people and property during and immediately after a disaster or hazard event. Services include warning systems, emergency response services, and protection of critical facilities.

6. Structural Projects: Actions that involve construction of structures to reduce the hazard impact. Such structures include dams, levees, floodwalls, seawalls, retaining walls, and safe rooms.

Identification of Mitigation Actions

Members of the LEPC met on June 31, 2012 to review hazard analysis and update mitigation actions. The following tables provide a prioritized list of the mitigation actions identified at the meeting.

Evaluation and Prioritization of Mitigation Actions

Members of the LEPC met on June 31, 2012 to re-evaluate and prioritize the list of mitigation actions. The committee identified level of government, agencies and organizations that would be responsible for completing the prioritize projects, as well as identifying possible funding sources. This information is included in the tables of Chapter 9. In addition, during the prioritization process each project was evaluated with regard to its: social impact, technical feasibility, administrative potential, political impact, legal ramification, environmental impact, overall benefit and cost effectiveness.

A prioritized listing of mitigation projects and actions for significant hazards follows. The first listing covers mitigation actions that can apply to more than one hazard. The remaining lists are presented as the hazards were ranked for Crawford County.

Review and Updating Hazard Mitigation Action Items

The Committee reviewed the 2006 Mitigation Strategies and made necessary changes. Several action items were eliminated or combined. Actions that have been completed were eliminated. Time lines were altered on mitigation strategies. The 2006 mitigation strategies list is attached to show changes in the document.

Changes in local land development have been negligible given the 2007 nationwide recession. The committee did not identify areas with significant land development since the last plan was completed and therefore made no changes to the plan in relation to new development.

Most activities in the hazard mitigation plan that the community has worked on are related to on-going mitigation actions.

The committee made changes in priorities related to Public Health, severe winter weather and nuclear attacks.

Mitigation Actions & Implementation Strategies **A. Multi-Hazard Actions, #1**	Priority	Responsible Agency	Funding Sources	Application	Progress	Original Status	New Status
1. Identify feasible sites for public early warning systems and networks and seek funding.	High	A.B.C.D.O.Q.S	T	Countywide	Reverse 911 system acquired & being implemented	Mid-term	Short term
2. Continue to develop Emergency Response Team program to help prepare for all hazard events in the county.	High	A.B.C.D.Q	A. H. T.	Countywide	Minor progress. Focus at regional level	Mid-term	Mid-term
3. Provide trained, equipped, and prepared search and rescue teams.	High	A.B.C.D.Q.P	A. H. T.	Countywide	In place, CERT is very active	Mid-term	Mid-term
4. Review and develop site emergency plans for schools, factories, office buildings, shopping malls, hospitals, correctional facilities, etc. to cover all potential hazards.	High	A.B.C.D.E.K.M.N.R	T	Countywide	Major progress, schools, factories & hospital	Short-term	Ongoing
5. Develop and implement a public education program for all natural hazards that threaten the community.	Medium	A.D.H.I.O.Q	B.C.T.	Countywide	In place, handouts, and presentations	Ongoing	Ongoing
6. Ensure that the County and individual communities have adequate equipment, staff, and training to respond to transportation-related accidents specific to their needs.	Medium	A.B.C.E.T.Q.S	B.C.T.	Countywide	Beaver Creek Twp has HAZMAT Team and CRC has traffic control	Mid-term	Mid-term
7. Develop plans to identify and inform persons of "Safe Areas" during festivals/events. (include signs and directions to shelters)	High	A.B.C.D.E.N.Q	T	Countywide	Minor progress	Short-term	Short-term
8. Review current status and provide back-up generators to maintain community infrastructure at acceptable operating levels during extended power failures.	Medium	A.B.C.P.Q	B.C.T.	Countywide	Combined with #10	Mid-term	Mid-term
9. Encourage continuation of house numbering program	High	A.B.C.E.D.Q.W	T	Countywide	In place	Ongoing	Ongoing
10. Communities will acquire and maintain an adequate level of emergency power generators to supply emergency water needs, wastewater processing, emergency communications, emergency health care, and shelters.	Medium	A.B.C.D.Q.S	Q.B.C.T	Countywide	Progress made, City DPW has portable generators	Mid-term	Mid-term
11. Conduct workshops at community gatherings to encourage residents to develop a Family Disaster Plan, which includes the preparation of a Disaster Supplies Kit.	Medium	A.B.C.I.Q.S	B.C.H.T.I.N	Countywide	Presentations made by Fire Dept. and county – materials available	Long-term	On-going
12. Organize outreach program to vulnerable populations during and after hazard events, including wildfires, extreme winter and summer weather events, periods of extreme temperatures, public health emergencies, and other hazards that can impact the community.	Medium	A.B.C.D.E.I.J.N.P	B.C.T.I	Countywide	Commission on Aging & County EMS maintains lists and contacts	Short-term	Short-term
13. Build the capabilities of the county GIS program to function as a tool to address multiple hazards. This effort would require the creation/updating of datasets such as parcels/ownership, location of all structures, driveways with ingress/egress conditions, roads, forest types, ownership types, floodplains, utilities (power lines, gas lines and water lines), wetlands, water features, bridges and culverts, (SARA III sites)	High	A.B.C.D.E.J.P	B.C.Q.T	Countywide	Major progress made, GIS program in place	On-going	On-going
14. Review and improve strategy for providing public with emergency telephone numbers	Medium	A.B.C.D.W	T	Countywide	In place, material and handouts available	Long-term	Long-term
15. Review and improve program to provide regular maintenance and equipment checks of all critical equipment.	Medium	A.B.C.D.E.P	T	Countywide	In place, each department responsible	Ongoing	Ongoing
16. Explore methods to provide NOAA radios at cost or as reward for completing "Family disaster Plan"	Medium	A.B.C.O.Q.S	T	Countywide	In place, provided radios to facilities and individuals	Long-term	Long-term

Mitigation Actions & Implementation Strategies **A. Multi-Hazard Actions, #2**	Priority	Responsible Agency	Funding Sources	Application	Progress	Original Status	New Status
17. Compile a listing of homes and facilities with vulnerable residents such as elderly, infirmed and disabled individuals; and establish outreach procedures for assisting residents after severe winter storm events	High	A.B.C.H.I.N.T	C.H.T	Countywide	In place, Commission on Aging and County EMS maintain and update lists	Short-term	Ongoing
18. Produce and distribute family emergency preparedness information relating to all natural hazards affecting the County.	High	A.B.C.D.J.O.Q	A.C.D.R	Countywide	Materials available and distributed	Short-term	Short-term
19. To address multiple hazards in the county improve tree trimming and maintenance efforts to prevent limb breakage and safeguard nearby utility lines. The end goal is to create and maintain a disaster-resistant landscape in public rights-of-way.	Low	A.B.C.E.P	P	Countywide	Consumer's Power has program	Long-term	Long-term
20. Where feasible and cost effective (more densely populated areas) bury and protect power and utility lines.	Low	A.B.C.P.U	P	Countywide	Limited costs prohibitive	Long-term	Long-term
21. Increase usage of NOAA Weather Radio by subsidizing purchase and distribution of radios to county residents, organizations and businesses. Use NOAA radios as a community emergency alert system to inform on hazard events.	Low	A.B.C.D.K.O.R.U	Q.T	Countywide	In place	Mid-term	Mid-term
22. Enforce a balanced system of ordinances that protect the community as-a-whole while respecting the rights of individuals.	Low	B.C.Q.W	C	Countywide	Progress made, communities active	Long-term	Long-term
23. Identify optimal staffing levels for County and community needs – seek funding to meet optimal levels	Low	A.B.C.E	B.C	Countywide	Ongoing funding limiting	Long-term	Long-term
24. Acquire portable/changeable message signs to direct crowds and provide information.	Low	A.B.C.D.E.W	B.Q	Countywide	Minor activity	Mid-term	Mid-term
25. Individual communities should prepare future land use plans and capital improvement programs to plan for their future hazard mitigation needs.	High	A.B.C.D.F	C	Countywide	Progress made & Ongoing	Short-Term	Short-Term
26. Communities will work with the Federal Emergency Management Agency (FEMA) to refine flood plains mapping.	Medium	A.B.C.Q.S	T	Countywide	Refining maps	Mid-term	Mid-term
27. Encourage key gasoline stations to have the capacity to pump gasoline during power outages.	Low	A.M.W	M	Countywide	Identified, table top exercise, sent letters to all service stations	Long-term	Long-term
28. Pre-planning for debris management staging and storage areas	Low	A.B.C.D.E.Q	A.B.C	Countywide	Identified sites	Mid-term	Mid-term
29. Expand community awareness of evacuation plans.	Low	A.B.C	A.B.C	Countywide	Progress made	Long-term	Long-term
30. Promote and implement solutions for keeping roads and driveways accessible to vehicles and fire equipment.	High	A.B.C.D.E.F.J.U	A.B.C.D	Countywide	Progress made through Firewise program	On-going	On-going
31. Identify escape routes and emergency snow routes.	Low	A.B.C.E.Q	A.B.C.E	Countywide	No activity	Mid-term	Mid-term
32. Explore and implement plan for distribution of NOAA radios throughout community	Low	A.B.C.O	A.B.C	Countywide	Combined with 21	Long-term	Long-term
33. Encourage residents to develop a Family Disaster Plan that includes the preparation of a Disaster Supplies Kit.	Low	A.B.C.D.I	A.B.C	Countywide	Combined with 11	Ongoing	Ongoing

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Mitigation Actions & Implementation Strategies **B. Wildfire**	Priority	Responsible Agency	Funding Sources	Application	Progress	Original Status	New Status
1. Provide strict enforcement of open burning regulations	High	A.B.C.D.J.W	D. Q. T	Countywide	In place, fire departments issue tickets	Short-term	Short-term
2. Promote and implement fuel management by thinning of flammable vegetation, creation of fuel breaks, use of fire-retardant materials/vegetation and selective thinning	High	A.D.J.Q	B.Q.T	Countywide	In progress – USFS and MDNR	New	Short-term
3. Implement the Crawford County Community Wildfire Protection Plan by pursuing grants.	High	A.D.J.Q.U	Q.T	Countywide	In progress plan completed in 2013	New	Short-term
4. Implement a countywide Firewise program as outlined in the Community Wildfire Protection Plan, through a cooperative effort of local fire departments, and state and federal agencies.	High	A.D.J.Q.U	B.C.D.J.Q.T	Countywide	In progress	New	Short-term
5. Develop a wildfire evacuation plan for residential areas and high use recreational areas such as the AuSable River Corridor, ORV trails and campgrounds	High	A.D.J.Q	B.C.D.J.Q.T	Countywide	Progress made	Short-term	Short-term
6. Continue to build partnerships with local fire departments, MDNR, USFS and National Guard to address wildfire mitigation and suppression.	High	A.B.C.D.J.X	B.C.D.J.Q.T	Countywide	In place	New	Short-term
7. Develop a program to utilize National Guard Helicopters for supplying water for fire suppression	Medium	D.J.X	J.Q.T	Countywide	In place	New	Mid-term
9. Implement Reverse 911 System to selectively notify homeowners in areas threatened by a wildfire.	High	B	B	Countywide	Purchased and implementing	New	Short-term
10. Establish procedures for notifying campground and canoe liveries	High	A. B. D. J	B,C,D,J	Countywide	Reverse 911 and send out emergency units	New	Short-term
11. Implement Firewise development strategies in local master plans and zoning ordinance.	High	B. C	B.C	Countywide	IN progress – South Branch Twp taking lead	New	Short-term
12. Promote media broadcasts of fire weather and fire warnings	Medium	A.B.C.D.J	B.C.J.T	Countywide	In place, USFS & MDNR, EMS Facebook	Mid-term	Mid-term
13. Promote proper disposal of woody debris at designated sites in the county to reduce burning of brush piles.	Medium	A.B.C.D.U.	B,C,D	Countywide	Co-Gen plant atkes materials	New	Long-term
14. Work with insurance companies to provide wildfire safety information to area residents.	Medium	A.B.C.D.K.L.Q.U	Q.T	Countywide	In progress	Mid-term	Mid-term
15. Develop program to inspect campsites in public forest areas to insure safe open fires, where allowed.	Medium	A.B.C.D.J.W	J	Countywide	In place – MDNR and USFS	Mid-term	Mid-term
16. Review and develop a regional base for air-firefighting wildfire support at Camp Grayling Airport.	Medium	A.D.J.Q	J.Q.T	Countywide	Some progress made	Long-term	Long-term
17. Study and develop GIS layers to include water supply location, Tier II sites, gas and oil wells, etc.	Medium	A.B.C.D.J.Q	B.C.J.Q.T	Countywide	In place and ongoing	Mid-term	Mid-term

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Mitigation Actions & Implementation Strategies **C. Fixed Site Hazmat**	Priority	Responsible Agency	Funding Sources	Application	Progress	Original Status	New Status
1. Review and/or implement strategy to train, equip, and prepare site and local hazardous material emergency response teams.	High	A.C.D.M.Q	T	Countywide	Ongoing and yearly review, Beaver Creek Twp has HAZMAT Team	Mid-term	Mid-term
2. Educate public and implement steps to encourage "shelter in place" response to Hazmat incidents.	High	A.B.C.D.U	T	Countywide	Minor progress	Short-term	Short-term
3. Continue Brownfield cleanup activities.	High	B.C	Q.T	Countywide	In place some progress made	Ongoing	Ongoing
4. Develop and/or improve public warning systems and networks for hazardous material releases.	Medium	A.B.C.D.Q.S	T	Countywide	Reverse 911	Mid-term	Mid-term
5. Maintain site emergency plans and community response plans as required under SARA Title III.	Medium	A.B.C.D.M	T	Countywide	In place	New	Ongoing
6. Inform public and support pollution control, enforcement and cleanup; proper disposal of chemicals and scrap materials.	Medium	A.B.C.D	H.T	Countywide	In place, household hazardous waste collection program	Mid-term	Mid-term
7. Training in and compliance with all safety procedures and systems related to the manufacture, storage, transport, use, and disposal of hazardous materials.	Medium	A.D.M.Q.U	Q.T	Countywide	In place, 302 sites	Mid-term	Mid-term
8. Reinforce planning emphasis on proper separation and buffering between industrial areas and other land uses.	Medium	B.C.L.M.N.R.T.U	B.C	Countywide	In place through zoning	Mid-term	Mid-term
9. Emphasize locating industrial areas away from schools, nursing homes, and hospitals, in future planning.	Medium	B.C.L.M.N.R.T.U	B.C	Countywide	In place under zoning	Long-term	Long-term
10. Provide inventory and secure debris, yard items or stored objects (including oil, gasoline and propane tanks, and paint and chemical barrels) in flood plain that might pose hazard.	Medium	A.B.C.D.M.U	C	Countywide	Minor activity	Mid-term	Mid-term
11. Continue emphasis on policies and training stressing importance of safety above other considerations.	Medium	A.D.H.Q.T.U	A.B.C	Countywide	In place & ongoing	Ongoing, short-term	Ongoing, short-term

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Mitigation Actions & Implementation Strategies **D. Structural Fire**	Priority	Responsible Agency	Funding Sources	Application	Progress	Original Status	New Status
1. Review and develop programs to raise community awareness on proper installation and maintenance of heating systems.	High	A.C.D	D.T	Countywide	In place, fire dept and EMS awareness programs	Ongoing,	Ongoing,
2. Promote homeowner pre-emergency plan such as evacuation route and congregation spot.	High	A.B.C.D	A.B.C.D	Countywide	In place, fire dept and EMS awareness programs	Short-term	Short-term
3. Develop information and programs about safe and responsible use of electric and "space" heaters.	High	A.D.K	D.T	Countywide	In place, fire dept and EMS awareness programs	Ongoing, Short-term	Ongoing, Short-term
4. Develop public education and school programs related to the use of stoves, heaters, fireworks, matches/lighters, etc.	Medium	A.D	D.T	Countywide	In place, fire dept and EMS awareness programs	Mid-term	Mid-term
5. Communicate to residents information related to handy household items that can be used as fire tools.	Medium	A.D.K	D	Countywide	In place, fire dept and EMS awareness programs	Mid-term	Mid-term
6. Increase volunteer recruitment, and study offering paid training.	Medium	A.B.C.D	D	Countywide	Ongoing	Long-term	Long-term

Mitigation Actions & Implementation Strategies **E. Transportation & Transportation of HAZMAT**	Priority	Responsible Agency	Funding Sources	Application	Progress	Original Status	New Status
1. Provide more training for fireman, police and first responders to school bus and commercial bus accidents.	High	A.B.D.E.R.W	T	Countywide	Ongoing	Mid-term	Mid-term
2. Encourage and enforce use of designated truck routes, and strict enforcement of weight and travel restrictions for truck traffic.	High	A.B.C.E.Q	T	Countywide	Some progress made towards identifying routes	Short-term	Short-term
3. Study and support pre-arranged shelters for stranded motorists/travelers, and others.	High	A.I.N.R	B.C.H.T	Countywide	In place Red Cross responsible	Mid-term	Mid-term
4. Provide more training for airfield emergencies involving all county fire departments.	Medium	A.B.C.D.W	T	Countywide	Developing partnership with Grayling and National Guard, includes equipment and staffing	Mid-term	Mid-term
5. Develop and implement improved design, routing, and traffic control at problem roadway areas.	Medium	A.B.C.W	T	Countywide	Some progress	Long-term	Long-term
6. Review and enhance airport maintenance, security, and safety programs.	Medium	A.B.C	Q.T	Countywide	In place, military provides at airbase	Long-term	Long-term
7. Acquire portable signs to inform motorists of high wind area, potential whiteout road hazards and road glazing areas on major highways.	Medium	A.B.C.E.O.Q. S.W	Q	Countywide	Minor activity	Mid-term	Mid-term

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E. County Road Commission	**K.** Insurance Companies	**Q.** State	**W.** Police
F. NEMCOG	**L.** Real Estate Co.	**R.** Schools	

Mitigation Actions & Implementation Strategies **F. Severe Winds**	Priority	Responsible Agency	Funding Sources	Application	Progress	Original Status	New Status
1. Review current and proposed improvements to wind engineering measures and construction techniques to strengthen public and private structures against severe wind damage	High	A.B.C	T	Countywide	Minor progress	Short-term	Short-term
2. Encourage securing loose materials, yard and patio items indoors or where winds cannot blow them about.	High	A.B.C	T	Countywide	Minor progress	Mid-term	Mid-term
3. Review regulations and implement necessary changes to insure proper anchoring of manufactured homes and exterior structures…	Medium	A.B.C	B.Q.T	Countywide	In place	Mid-term	Mid-term

Mitigation Actions & Implementation Strategies **G. Infrastructure Failure**	Priority	Responsible Agency	Funding Sources	Application	Progress	Original Status	New Status
1. Review and develop strategies to insure redundancies in utility and communications systems, especially “lifeline” systems.	High	A.B.C.D.H.N.O.W	P	Countywide	Ongoing and progress made		Mid-term
2. Review and develop strategies to identify and employ generators for backup power at critical facilities.	High	A.B.C.M.P.R.T	A.B.C	Countywide	Progress made		Mid-term
3. Identify sites and obtain support to improve critical road/stream crossings.	Medium	A.B.C.E.J	Q.T	Countywide	In place, as funding allows		Mid-term

Mitigation Actions & Implementation Strategies **H. Summer Weather Hazards Actions**	Priority	Responsible Agency	Funding Sources	Application	Progress	Original Status	New Status
1. Develop or update emergency response plans for schools, campgrounds, fairgrounds, parks, community events etc.	High	A.B.C.R	C. T	Countywide	Major progress, schools, factories & hospital	Mid-term	Mid-term
2. Require new mobile home parks to have tornado/wind shelters	High	A.B.C.O	T	Countywide	No activity	Mid-term	Mid-term
3. Continue training and increased use of weather spotters.	Medium	A.O	O	Countywide	US Weather Service summer and winter weather spotters training	Mid-term	Mid-term
4. Continue pre-planning efforts for debris management staging and storage areas	Medium	A.B.C.E	A.B.C.E	Countywide	Identified sites	Mid-term	Mid-term

A. County Emergency Management Office	**G.** MSU Extension	**M.** Local Businesses	**S.** Medical
B. County	**H.** District Health Dept.	**N.** Civic Gr.& Churches	**T.** Federal Government
C. Local Units of Gov.	**I.** American Red Cross	**O.** National Weather Service	**U.** landowners
D. Local Fire Dept.	**J.** USFS & MDNR	**P.** Utility Company	**V.** Salvation Army
E. County Road Commission	**K.** Insurance Companies	**Q.** State	**W.** Police
F. NEMCOG	**L.** Real Estate Co.	**R.** Schools	

Mitigation Actions & Implementation Strategies **I. Winter Weather Hazards**	Priority	Responsible Agency	Funding Sources	Application	Progress	Original Status	New Status
1. Study and improve location and design and maintenance of water and sewer systems (to include insulation of critical components to prevent damage from ground freeze)	High	C.P	Q. T	Countywide	Identified and ongoing	Long-term	Long-term
2. Establish pre-arranged shelters for stranded motorists/travelers, and others.	High	A.B.C.I.N.R	B.C.H. T	Countywide	In place and ongoing	Mid-term	Mid-term
3. Continue to support use of emergency shelters	High	A.B.C.I.D	B.C.H. T	Countywide	In place and ongoing	Short-term	Short-term
4. Inventory problem sections of roads. Place snow fences or "living snow fences" (rows of trees or vegetation) to limit blowing and drifting of snow over critical roadway segments	Medium	A.B.C.E.O	E. Q. T	Countywide	Ongoing	Mid-term	Mid-term
5. Acquire portable signs to inform motorists of high wind area, potential whiteout road hazards and road glazing areas on major highways.	Low	A.B.C.E.O.Q. S.W	Q	Countywide	Minor activity	Short-term	Short-term
6. Produce and distribute family emergency preparedness information relating to severe winter weather hazards	Low	A.I.N	A.Q	Countywide	Ongoing materials available	Mid-term	Mid-term

Mitigation Actions & Implementation Strategies **J. Extreme Temperatures**	Priority	Responsible Agency	Funding Sources	Application	Progress	Original Status	New Status
1. Identify location and organize outreach to vulnerable populations during periods of extreme temperatures…	High	A,B,C,I,N,	T	Countywide	In place, County EMS and Commission on Aging	Short-term	Short-term
2. Improve and/or enact landlord/tenant ordinances.	Medium	B,C	Q, T	Countywide	Minor progress	Mid-term	Mid-term
3. Develop housing/landlord codes for heating requirements.	Medium	B,C	Q, T	Countywide	Minor progress	Mid-term	Mid-term

A. County Emergency Management Office	**G.** MSU Extension	**M.** Local Businesses	**S.** Medical
B. County	**H.** District Health Dept.	**N.** Civic Gr.& Churches	**T.** Federal Government
C. Local Units of Gov.	**I.** American Red Cross	**O.** National Weather Service	**U.** landowners
D. Local Fire Dept.	**J.** USFS & MDNR	**P.** Utility Company	**V.** Salvation Army
E. County Road Commission	**K.** Insurance Companies	**Q.** State	**W.** Police
F. NEMCOG	**L.** Real Estate Co.	**R.** Schools	

Mitigation Actions & Implementation Strategies **K. Public Health Emergencies**	Priority	Responsible Agency	Funding Sources	Application	Progress	Original Status	New Status
1. Encourage residents to receive immunizations against communicable diseases	High	H. I. N. Q. S.	H.T	Countywide	In place	Ongoing	Ongoing
2. Maintain a community public health system with sufficient disease monitoring and surveillance capabilities to adequately protect the population from large-scale outbreaks	High	H. Q. S. T.	H. T	Countywide	In place	New	Mid-term
3. Increase public awareness of the causes, symptoms, and protective actions for disease outbreaks and other potential public health emergencies	High	H. N. R. S.	H. T	Countywide	In place	Ongoing	Ongoing
4. Inform public and support pollution control, enforcement and cleanup; proper disposal of chemicals and scrap materials	Med	A. B. H. M. Q. R. T.	H. T	Countywide	In place	New	Ongoing
5. Expand community support of free or reduced-expense clinics and school health services	Med	B. C. H. N. Q. S.	H	Countywide	In place	New	Ongoing
6. Increase public awareness of radon dangers and the prevention efforts that can be taken to reduce concentrations of radon in homes and buildings	Low	H. Q.	H	Countywide	In place	Ongoing	Ongoing
7. Demolish and clear vacant condemned structures in populated areas to prevent rodent infestations	Low	C. B. H.	B.C	Countywide	In place	Ongoing	Ongoing
8. Coordinate with health department and local communities to assure proper location, installation, cleaning, monitoring, and maintenance of septic tanks	Low	C. H.	H	Countywide	In place	Ongoing	Ongoing
9. Seek support and funding to clean up sites of environmental contamination	Low	B. M. Q. T.	Q.T	Countywide	In place	New	Ongoing
Review and insure community water and sewer infrastructure is maintained at acceptable operating standards.				County wide	Removed	Ongoing	Removed
Continue to provide free Radon kits to public.				County wide	Removed	Ongoing	Removed
Protect public contact with contaminated sites or waters (including flood waters)				County wide	In place	Ongoing	Removed

A. County Emergency Management Office	**G.** MSU Extension	**M.** Local Businesses	**S.** Medical
B. County	**H.** District Health Dept.	**N.** Civic Gr.& Churches	**T.** Federal Government
C. Local Units of Gov.	**I.** American Red Cross	**O.** National Weather Service	**U.** landowners
D. Local Fire Dept.	**J.** USFS & MDNR	**P.** Utility Company	**V.** Salvation Army
E. County Road Commission	**K.** Insurance Companies	**Q.** State	**W.** Police
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Chapter 10 -- Adoption and Implementation

Adoption Process

Public Review and Comment

Several avenues have been used to disseminate the draft plan for public review and comment. All meetings of the LEPC were open to the public. A presentation was made to the Crawford County Chapter of the Michigan Township Association. Officials from communities were present at the meeting. The purpose of this presentation was to review the hazard mitigation planning process and proposed mitigation strategies. The draft plan was transmitted to the Michigan State Police and FEMA for review and comment. In addition, the draft plan was posted on Crawford County's and NEMCOG's web sites. A newspaper article informed county residents of the draft plan, where it can be reviewed and when the County Board of Commissioners would be considering approval.

Adoption

County Board of Commissioners
Townships
Cities and Villages

After completion of the review process, the Crawford County LEPC recommended the plan be adopted by the Crawford County Board of Commissioners and all local municipalities in Crawford County. The hazard mitigation plan was presented to the Crawford County Board of Commissioners, requesting approval. Finally the plan was transmitted to the Grayling City Council and to the Boards of Trustees for each Township. Copies of these resolutions will be included at the end of this chapter.

Plan Implementation

Roles and Responsibilities

The primary entities responsible for implementing the Hazard Mitigation Plan are the Crawford County Board of Commissioners and the Crawford County Emergency Management Office. A Hazard Mitigation Committee (HMC), was formed from members of the County LEPC, and will be the local group responsible for overseeing implementation of this plan. The Local Emergency Management Committee (LEPC) is organized under Michigan SARA Title III Program and meets on a regular basis to carry out its duties. Roles related to a HMC may need to be defined by the committee and could include establishing an annual work plan, supporting grant writing to seek funding to complete specific projects, monitoring mitigations activities, evaluating the need for new projects, amending the plan to add new projects and functioning as a clearing house for mitigation grant applications.

It is understood that current resources, both staff and financial, may not accommodate the expanded role of the Crawford LEPC and Crawford Emergency Management Office. The County Board of Commissioners may need to evaluate funding and staffing required to implement the Crawford Hazard Mitigation Plan.

Working partnerships with the following agencies and organizations will strengthen the County's hazard mitigation program.

- County Emergency Management Coordinator
- Crawford County Departments
- Townships in Crawford County
- City of Grayling
- Township, and City Fire Departments
- Crawford County Conservation District
- Crawford County Road Commission
- Crawford County Sheriff Department
- Northeast Michigan Council of Governments
- Michigan Department of Natural Resources
- Michigan Department of Environmental Quality
- U.S. Forest Service
- Michigan State University Cooperative Extension Service
- Michigan Department of Agricultural
- Natural Resource Conservation Service
- Huron Pines RC&D
- Federal Emergency Management Administration
- Northeast Michigan Council of Governments
- Michigan State Police
- District Health Department
- American Red Cross
- Insurance Companies
- Real Estate Companies
- Local Businesses
- Civic Groups and Churches

Capability Assessment

Presently, staff and financial resources are limited in the communities. For example, none of the communities have planners, foresters, floodplain managers, public works engineers, transportation engineers, and civil engineers on staff. All communities provide fire and rescue services either on their own or under a cooperative arrangement. Crawford County has no zoning enforced at the county level. All townships and the City of Grayling have their own zoning ordinances. These entities have planning commissions, but do not have planners on staff. Communities have a zoning administrator, planning commission and zoning board of appeals that administer their zoning. The planning commissions are responsible for overseeing the master plan, recreation plan and zoning ordinance.

The Township Boards, City Council and County Board are the governing bodies responsible for managing finances and making policy decisions. The City of Grayling has a manager and staff to support day to day operations. Other than fire and rescue activities, townships have limited or no staff.

The County has an active and strong Emergency Management Office. The County operates a countywide 911 system. The Crawford County Sheriff Department operates under the county board of commissioners. Crawford County has an appointed drain commissioner who works

with communities and landowners on drainage and flooding issues. The County Road Commission manages the local road network in conjunction with townships. The Michigan Department of Transportation is responsible for State and Federal highways.

U.S. Forest Service and the Michigan Department of Natural Resources have foresters on staff to conduct forest and fuels management on public lands. Forest management assistance on private land is limited to forestry consultants and the county conservation district. Agencies and local units of government have fire suppression crews. All entities provide some level of prevention and education activities. However, additional staff and financial resources would be needed to implement this comprehensive hazard mitigation plan.

The communities have limited capability of implementing action items in the plan and will use a combination of staff, elected officials, appointed officials (planning commissions) and contractual services. Given current budget constraints it is not likely communities will be “staffing up” in the near future. Instead they will use contractual and temporary if necessary to complete hazard mitigation strategies.

Process for Monitoring, Evaluating and Updating

Monitor

The Crawford County Hazard Mitigation Committee and the Crawford County Emergency Management Office will monitor implementation of the Mitigation Plan. This may include reviewing reports from agencies involved in implementing projects or activities; having a staff person, who is responsible for overseeing the plan, conduct site visits and meetings concerning mitigation project activities; preparing an annual mitigation activity report for the County Board of Commissioners. This will be done during the five-year update or more often if deemed necessary.

Evaluation

The Crawford County Hazard Mitigation Committee and the Crawford County Emergency Management Office will be responsible for evaluating the effectiveness of the plan. This will be done during the five year update or more often if deemed necessary.

The evaluation should assess whether:

- The goals and objectives address current and expected conditions;
- The nature, magnitude and/or type of risks have changed.
- The current resources are appropriate for implementing the plan.
- There are any problems with implementation.
- There have been favorable outcomes
- Agencies and other partners participated as originally expected.

Update

The Disaster Mitigation Act (DMA) of 2000 requires the Crawford County Hazard Mitigation Plan be updated every five years. This may include updating community profiles, examining goals, redoing the hazard analysis and revisiting the project list. *In order to properly update the plan, Crawford County will need to seek funding from appropriate state and federal agencies.* It may be necessary to examine the project each year and as projects are completed and new mitigation projects are identified, the list would be updated. Any update would require public

comment, county approval, local jurisdictional approval if projects are located or proposed in a particular township, and approval by the State of Michigan and FEMA.

Process to Incorporate into Local Planning Activities

Crawford County, City of Grayling, townships, and local and state agencies Oscoda County, townships, and local and state agencies will consider integrating information from the Hazard Mitigation as their perspective comprehensive and operations plans. When updating master plans and zoning ordinances, communities will consider incorporating appropriate hazard mitigation information into the master plan. As a part of the education and outreach aspect of the hazard mitigation effort, communities will be encouraged to adopt zoning regulations that will minimize effects of hazards.

Ongoing Public Participation

Crawford County is committed to involving the public in the implementing and updating of the Hazard Mitigation Plan. Copies of the plan will be available at county libraries, county clerk's office and all township offices. The plan contains the address and phone number of the Emergency Management Office, which will be responsible for keeping a record of public comments on the plan.

Copies of the plan will be posted on a community web site or regional planning agency web site. The web page will contain a mailing address, phone number and email address of the appropriate contact person.

During the update process of the Hazard Mitigation Plan, the committee will advertise and facilitate a public meeting to obtain input and guidance from the general public, businesses, townships and agencies. A notice will be posted to advertise any meeting of the Hazard Mitigation Committee where the committee is reviewing and/or updating the mitigation plan.

Crawford County 2014 Hazard Mitigation Plan Adoption

WHEREAS, Crawford County, Michigan has experienced risks that may damage commercial, residential and public properties, displace citizens and businesses, close streets and impair infrastructure, and present general public health and safety concerns; and

WHEREAS, Crawford County has updated its *Hazard Mitigation Plan* that outlines the County's options to reduce overall damage and impact from natural hazards; and

WHEREAS, the *Hazard Mitigation Plan* has been reviewed by County residents, business owners, and federal state, and local agencies, and has been revised to reflect their concerns;

WHEREAS, The County Local Emergency Planning Committee (LEPC) functions as the Hazard Mitigation Committee. The Committee's duties are designated in the *Hazard Mitigation Plan*.

WHEREAS, The Emergency Manager and Hazard Mitigation Committee is charged with supervising the implementation of the Plan's recommendations within the funding limitations as provided by the Crawford County Board of Commissioners or other sources. The Committee shall monitor implementation of the plan and shall provide a progress report to the County Board of Commissioners.

NOW THEREFORE BE IT RESOLVED THAT,

The *Hazard Mitigation Plan* is hereby adopted as an official plan of Crawford County. The content of this document, together with all maps attached to and contained herein are hereby adopted by the Crawford County Board of Commissioners as the Crawford _County Hazard Mitigation Plan on this _____ day of _____, 2014.

Motion:_____ Second:_____'

Ayes:

Nays:

Absent:

_____ _____

_____, Chair _____, Clerk

Crawford County Board of Commissioners Crawford County Board of Commissioners