Chapter 6 - Hazard Identification

Overview

Alcona 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 the 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, the hazard identification and vulnerability assessment becomes a powerful planning tool that enables 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. **Figure 6.3** on page 23 is a hazards map of Alcona County. Upland forest types, wetlands, water features, oil and gas wells, and roads are displayed on the map. The General Hazards Map was created to emphasize areas in the county with highest risks for wildfire, riverine flooding, and shoreline erosion and flooding hazards, see **Figure 6.4.**

Hazard Descriptions

Natural Hazards

Subsidence

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. *There have been no recorded incidents of subsidence in Alcona County.*

Severe Summer Weather Hazards

Data from the National Oceanic and Atmospheric Administration shows that from 1950 through 2002 there were 104 severe weather events recorded in Alcona County. Damages from these events in Alcona County and the surrounding region is estimated at over 11 million dollars.

Hailstorms: 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 areas 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 give 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.

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
- 0.7% are radio, transmitter and antenna-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%)

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

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. Table 6.1 lists lightning related deaths by location. 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 6.1
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 location / unknown	18%
Source: Storm Data, National Climatic Data Center		

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. Windstorms occur in all areas of Michigan, although more often along the lakeshore and in central and southern Lower Michigan.

Severe winds spawned by thunderstorms or other storm events have had devastating effects on Michigan in terms of loss of life, injuries and property damage. According to data compiled by the National Weather Service for the period 1970-August 2000, Michigan experienced 9,215 severe wind events (not including tornadoes) that resulted in 115 deaths and millions of dollars in damage. It is important to note that the high number of severe wind events is due in part to the fact that storm data is compiled by county. Thus, multi-county storms are counted more than once. Severe wind events are characterized by wind velocities of 58 miles per hour or greater, with gusts sometimes exceeding 74 miles per hour (hurricane velocity).

Figures from the National Weather Service indicate that severe winds occur more frequently in the southern-half of the Lower Peninsula than any other area of the state. On average, severe wind events can be expected 2-3 times per year in the Upper Peninsula, 3-4 times per year in the northern Lower Peninsula, and 5-7 times per year in the southern Lower Peninsula. **Table 6.1** is a list of severe storm events in Northern Michigan. It must be emphasized that this refers to winds from thunderstorms and other forms of severe weather, but **not** tornadoes. In terms of response to a severe wind event, providing for the mass care and sheltering of residents left without heat or electricity, and mobilizing sufficient resources to clear and dispose of downed tree limbs and other debris from roadways, are the primary challenges facing Michigan communities. Therefore, every community should adequately plan and prepare for this type of emergency.

Strong winds and thunderstorm winds are a common severe weather that affects Alcona County. Annually, thunderstorms will occur on an average of 24 days per year and on average one or two thunderstorms per year will have severe winds. Since 1962 there have been 37 severe wind events recorded in the County. Strong winds are most likely to be associated with thunderstorms that occur in the summer, but can occur any time of year. 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.

Tornadoes: 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. Tornadoes in Michigan are most frequent in the spring and early summer when warm, moist air from the Gulf of Mexico collides with cold air from the polar regions to generate severe thunderstorms. These thunderstorms often produce the violently rotating columns of wind that are called tornadoes. Michigan lies at the northeastern edge of the nation's primary tornado belt, which extends from Texas and Oklahoma through Missouri, Illinois, Indiana, and Ohio. Michigan averages approximately 16 tornadoes per year, most occurring in the southern Lower Peninsula.

National Weather Service data indicates that Michigan has experienced 893 tornadoes and 239 related deaths during the period from 1950-1999, an average of 18 tornadoes and 5 tornado-related deaths per year. The greatest number of tornadoes per year during that period occurred

in 1974 with 39 tornadoes. The least number occurred in 1959 with only 2 tornadoes. From 1950-1999, Michigan experienced 473 "tornado days" (defined as days in which tornadoes are observed), an average of nearly 9.5 days per year. Approximately 63% of all Michigan tornadoes have been weak tornadoes (F0 or F1 intensity), while 33% have been strong tornadoes (F2 or F3 intensity) and 4% have been classified as violent tornadoes (F4 or F5 intensity). However, those few violent tornadoes have been responsible for 78% of Michigan's tornado-related deaths. Strong tornadoes (F2 or F3 intensity) have accounted for approximately 21% of the deaths, while weak tornadoes (F0 or F1 intensity) have caused only 1% of all tornado-related deaths.

Although relatively rare, tornados have occurred in Alcona County and have caused massive amounts of 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 49 years, 9 tornados touched down in the Alcona County, causing over $3 million in property damage. Tornados are most common in the afternoon and all of the tornados in Alcona County occurred in the afternoon between the hours of 1:00 and 7:00 P.M. In Northern Michigan tornadoes are most likely in the summer months, although have occurred in the spring and fall. In Alcona County, two tornados have been recorded in the month of March. The most destructive tornado to touch down in Alcona County was an F3 tornado that occurred on March 27, 1991 causing $2.5 million in damages. 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 tornado's are described as weak tornado's with wind speeds from 40 to 112 mph, F2 and F3 are strong tornado's with wind speeds from 113-206 mph, F4 and F5 are violent tornado's 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 Alcona County, two were F3, one was an F2, five were an F1 and one was an F0.

Severe Winter Weather Hazards

Winter weather hazards consisting of heavy snow, freezing rain and blizzards are the most prevalent seasonal hazards in Alcona County and can be expected to occur several times every year. In 1993, 24 heavy snowstorms and 3 blizzards were recorded in Alcona County. Over the past 10 years the county averaged 2.7 heavy snowstorms and/or blizzards each year, although the number and intensity of snowstorms can fluctuate dramatically from year to year. In 1993 heavy snowstorms, freezing rain and or blizzards occurred 8 times while in 1995 only one heavy snow storm was recorded.

Ice and Sleet Storms: 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) which bounce when hitting the ground or other objects. Sleet does not stick to trees and wires, but sleet in sufficient depth does cause hazardous driving conditions. Ice storms are the result of cold rain that freezes on contact with the surface, coating the ground, trees, buildings, overhead wires, 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.

Table 6.2 Severe Windstorms in Northern Michigan	
Location	**Summary of Impacts**
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.
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 was 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 15 counties to help rebuild homes and businesses damaged in the storms.
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.

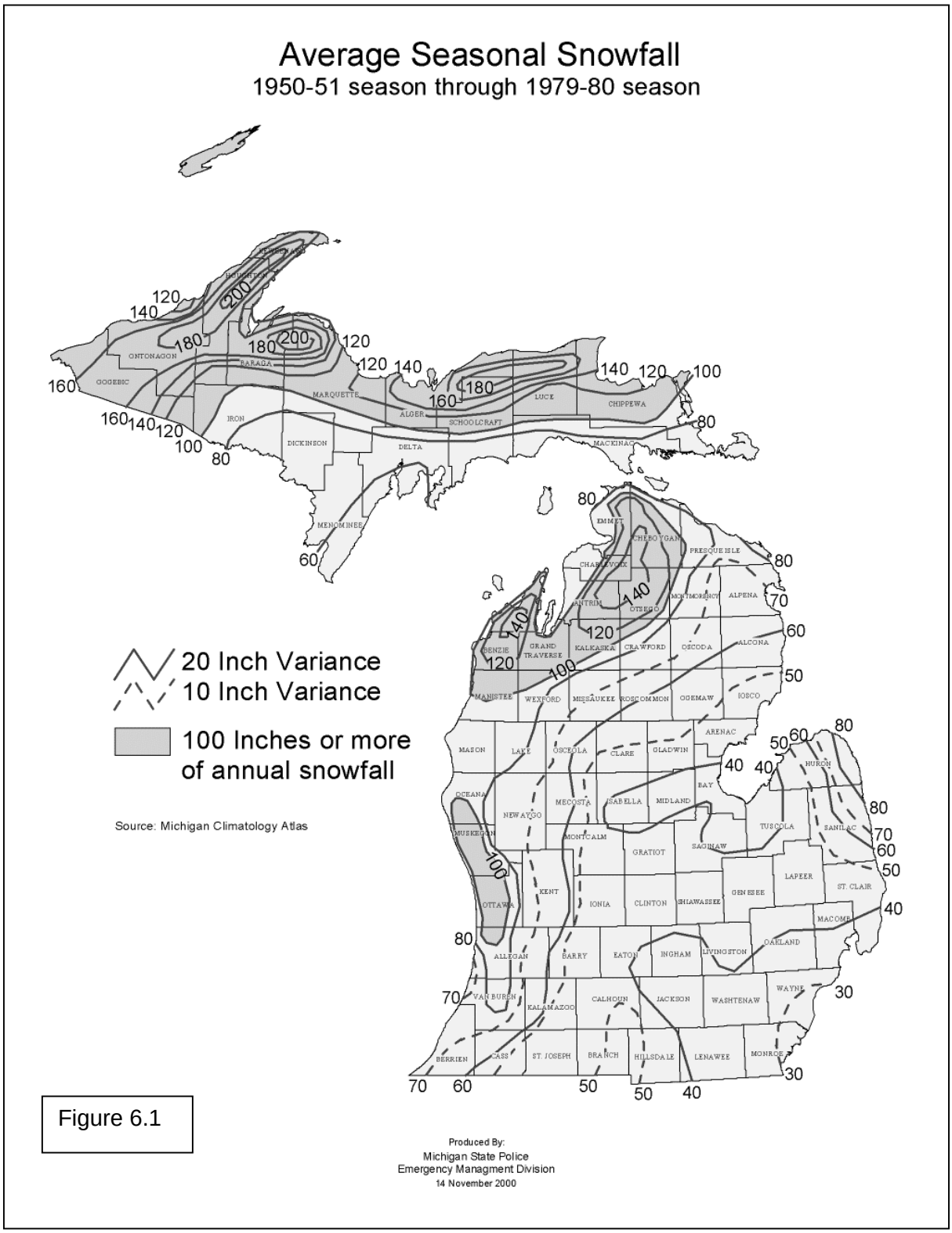
Snowstorms: A period of rapid accumulation of snow often accompanied by high winds, cold temperatures, and low visibility. Blizzards are the most dramatic and perilous of all snowstorms, characterized by low temperatures and strong winds bearing enormous amounts of snow. Most of the snow accompanying 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. 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 accumulations are in the northern and western parts of the Upper Peninsula. In the northern lower peninsula, average snowfall ranges from 140 inches in the Gaylord area to less than 50 inches in the Harrisville area. Over the past 10 years, Alcona County has averaged 3.3 severe winter weather hazards each year. The number and intensity of winter weather hazards can fluctuate dramatically from year to year. In 1993 heavy snowstorms, freezing rain and or blizzards occurred 8 times while in 1995 only one heavy snow storm was recorded.*

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 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. Nationwide, approximately 200 deaths a year are directly attributable to extreme heat. Extreme summer heat is also hazardous to livestock and agricultural crops, and it can cause water shortages, exacerbate fire hazards, and prompt excessive demands for energy. Roads, bridges, railroad tracks and other infrastructure are susceptible to damage from extreme heat. Like heat waves, periods of prolonged, unusually cold weather can result in a significant number of temperature-related deaths. Each year in the United States, approximately 700 people die as a result of severe cold temperature-related causes. The major direct threats of extreme cold are hypothermia (also a major medical emergency) and frostbite. However, a significant number of cold-related deaths are the result of illnesses and diseases that are negatively impacted by severe cold weather, such as stroke, heart disease and pneumonia. *Alcona County is subject to both temperature extremes.*

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.


Average Seasonal Snowfall
1950-51 season through 1979-80 season
20 Inch Variance
10 Inch Variance
100 Inches or more of annual snowfall
Source: Michigan Climatology Atlas
ONTONAGON
GOGEBIC
BARAGA
MARQUETTE
IRON
DICKINSON
MENOMINEE
DELTA
ALGER
SCHOOLCRAFT
LUCE
CHIPPEWA
MACKINAC
EMMET
CHEBOYGAN
PRESQUE ISLE
CHARLEVOIX
ANTRIM
OTSEGO
MONTMORENCY
ALPENA
BENZIE
GRAND TRAVERSE
KALKASKA
CRAWFORD
OSCODA
ALCONA
MANISTEE
WEXFORD
MISSAUKEE
ROSCOMMON
OGEMAW
IOSCO
ARENAC
MASON
LAKE
OSCEOLA
CLARE
GLADWIN
HURON
OCEANA
NEWAYGO
MECOSTA
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OAKLAND
VAN BUREN
KALAMAZOO
CALHOUN
JACKSON
WASHTENAW
WAYNE
BERRIEN
CASS
ST. JOSEPH
BRANCH
HILLSDALE
LENAWEE
MONROE
Produced By:
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Emergency Managment Division
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Figure 6.1

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

The 1976-77 drought in the Great Plains, Upper Midwest, and West also severely impacted Michigan. Extreme drought conditions contributed to wildfire, crop damage and low Great Lakes levels. The 1988 drought / heat wave in the Central and Eastern U.S. (an event that greatly impacted Michigan) caused an estimated $40 billion in damages from agricultural losses, disruption of river transportation, water supply shortages, wildfires, and related economic impacts. 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 Alcona County, impacts from extended drought are increased potential for wildfires, reduction in farm products, and reduction in timber production, and loss of tourism.

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. Most earthquake occurrences result in little or no damage. However, when moderate or severe earthquakes occur, the results can be devastating in terms of loss of life, property and essential services. One of the most dangerous characteristics of earthquakes is their ability to cause severe and sudden loss. Within 1 to 2 minutes, an earthquake can devastate an area through ground shaking, surface fault ruptures, and ground failures. Most deaths and injuries are not directly caused by the earthquake itself, but rather indirectly through the collapse of structures.

Earthquakes are measured by their magnitude and intensity. Magnitude is a measure of the amount of energy released at the epicenter or origin of the event. The Richter Magnitude Scale is commonly used to determine earthquake magnitude. An earthquake of 5.0 is a moderate event, 6.0 characterize a strong event, 7.0 is a major earthquake, and 8.0 is a catastrophic earthquake. Earthquake intensity is the measure of damage done at a given location. In the

U.S., the most commonly used intensity scale is the Modified Mercalli Intensity Scale, which describes 12 increasing levels of intensity ranging from imperceptible to catastrophic.

Michigan is not located in an area subject to major earthquake activity. No severely destructive earthquake has ever been documented in Michigan. However, several mildly damaging earthquakes have been felt since the early 1800s. The exact number is difficult to determine, as scientific opinion on the matter varies. Although there are fault lines in the bedrock of Michigan, they are now considered relatively stable. However, these fault lines are poorly mapped. According to the U.S. Geological Survey, although Michigan is in an area in which there is a low probability of earthquake occurrences, the area may be affected by distant earthquakes that occur in the New Madrid Seismic Zone and upstate New York. The New Madrid Seismic Zone poses the most significant threat. Based on recent scientific studies, portions of southern Michigan could be expected to receive minor damage were such an earthquake to occur (see map below). The greatest impact on the state would probably come from damage to natural gas and petroleum pipelines. If the earthquake occurs in the winter, many areas of the state could be severely impacted by fuel shortages. Damage would probably be negligible in well-designed and constructed buildings. However, poorly designed and constructed buildings could suffer considerable damage under the right circumstances. *There have been no recorded incidences of significant earthquakes in Alcona County.*

Fire Hazards

Wildfires

An uncontrolled fire in grass or 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.

According to the 1978 Michigan Resource Information System Land Cover/use Inventory, over 73 percent of the County is forested. Aspen-birch, red oak-white oak and jack-red-white pine are the most common forest types. Under dry spring conditions forest fires can occur in any forests type. However some forest types have higher risks. Jack and red pine forests have a high risk for wildfires. Oak and white pine forests have a moderate risk for wildfires. According to the MIRIS Land Cover/Use Inventory, jack pine and red pine forest types cover approximately 14 percent of the forestland. Oak and white pine forests account for another 20 percent.

Draughty, low fertility sandy soils, found in outwash plains and channels, supported pre-settlement pine forests that for thousands of years were perpetuated by wildfires. A review of the presettlement vegetation map of Alcona County show extensive areas were covered with pine and oak forests, see **Figure 2.8** in Chapter 2. This clearly shows a long history of wildfires in the area. The map delineates jack pine-red pine forest, white pine-red pine forest, pine barrens and pine/oak barrens, which combined covered 36 percent of the County. Given jack pine is a species that coexists and in fact depends upon wildfires to regenerate new forests, one can only surmise that wildfires were common prior to the 1800's. Today, residential development has occurred within the same wildfire prone areas. There is a concentration of pine forest types Mikado, Curtis and Mitchell Townships. *The Alcona County Hazards Map (**Figure 6.3**) and individual community maps at the end of the chapter show areas of highest wildfire hazards: pine forests are red, oak-pine forest are orange and aspen-birch forests are yellow. Wildfires can occur in all cover types, however, these three forest types have the highest risk. The General Hazards map identifies areas in the county with higher risks of wildfires.*

Although Michigan's landscape has been shaped by wildfire, the nature and scope of the wildfire threat has changed. Michigan's landscape has changed substantially over the last several decades 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 the increase in tourists during the most dry (and therefore most vulnerable) times of the year, greatly increases the risk from wildfires.

Contrary to popular belief, lightning strikes are **not** the primary cause of wildfires in Michigan. Today, only 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.

Information from the Michigan Department of Natural Resources show there were 206 wildfires in Alcona County from 1981 to 1999. Table It should be noted that the figures shown on the maps do not include those wildfires suppressed by local volunteer fire departments or the U.S. Forest Service. If those records were readily available and broken down by county, the statistics would be significantly affected. Between 1970 and 1996, the U.S. Forest Service responded to 2,727 Wild Fires in Huron National Forest. Many of these fires were in Alcona County. As recently as 1999, a wildfire near Barton City destroyed over 200 acres of forest. The low water level of Lake Huron, combined with abnormally dry winters, ensures that Wild Fires will certainly occur in the near future.

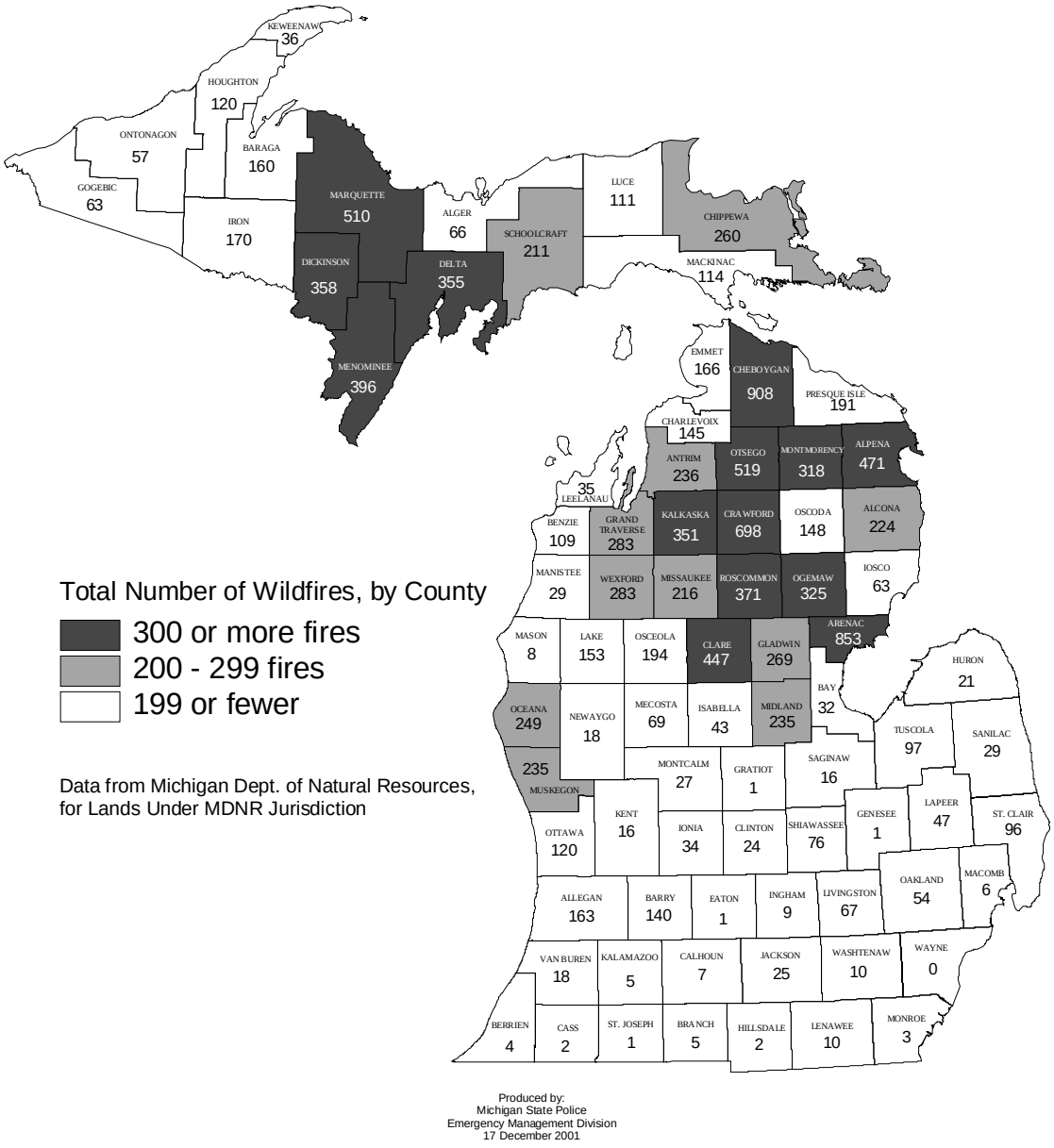
Table 6.3
Number of Wildfires, by County: 1981-1999
(MDNR jurisdiction only)

County	**Number of Wildfires (200+)**	**Number of Wildfires/Year*** (over 19 year period)
Cheboygan	874	46
Crawford	677	36
Otsego	493	26
Alpena	465	24
Montmorency	300	16
Alcona	**206**	**11**
Presque Isle	169	9
Oscoda	144	8

Source: Michigan Department of Natural Resources, Forest Management Division
(*rounded to nearest whole number)

Number of Wildfires, by County
1981-2000

Figure 6.2



Total Number of Wildfires, by County

- 300 or more fires
- 200 - 299 fires
- 199 or fewer

Data from Michigan Dept. of Natural Resources, for Lands Under MDNR Jurisdiction

Produced by:
Michigan State Police
Emergency Management Division
17 December 2001

Table 6.4 Major Wildfires in Oscoda and Crawford County: 1980 - 2000	
Date of Fire	**Summary of Impacts**
May 1980	In May 1980, a wildfire in Oscoda County (known as the Mack Lake fire) destroyed 44 homes and buildings, forced the evacuation of 1,500 people, and killed one firefighter. A total of 24,000 acres were burned, resulting in a total property and timber loss of $2 million.
May 1990	In May 1990, a wildfire near Grayling in Crawford County (known as the Stephan Bridge Road fire) burned 76 homes and 125 other structures, 37 vehicles and boats, and over 5,900 acres of forestland, resulting in property losses of $5.5 million. The timber losses totaled another $700,000. The fire originated from a controlled burning of a pile of brush and timber accumulated from recently cleared land. The burning was initiated while snow covered the ground, and it was presumed the fire was completely extinguished. However, the pile rekindled approximately 7 weeks later, and on May 8, ignited the Stephan Bridge Road fire. Strong winds and dry conditions helped spread the fire at a rate beyond that which could be controlled by human intervention. At one point in the fire, the rate of spread was an astonishing 277 feet per minute. Fortunately, the combination of human fire suppression and a passing weather front that produced rainfall finally contained the fire before it could do any additional damage. There were no fatalities as a result of this fire, and only one firefighter was injured from smoke inhalation. However, the property losses were significant.
May 1999	In early May 1999, a wildfire near the village of Champion in Marquette County (known as the Tower Lake fire) burned a total of 5,625 acres of forestland, destroyed at least 8 structures, and forced the evacuation of over 400 At the request of the Governor, the Federal/State Forest Fire Suppression Agreement was activated by the Federal Emergency Management Agency (FEMA) to provide financial assistance to the State and eligible local agencies to cover some of the firefighting costs incurred. At about the same time as the Tower Lake fire, major wildfires were also being fought in several other locations across Northern Michigan. An 850-acre fire burned in the **Huron-Manistee National Forest in Oscoda County**. In the Northern Lower Peninsula alone during that first week of May, MDNR forces fought nearly 40 wildfires. All of the wildfires were fueled by the same dry conditions that set the stage for the Tower Lake fire.
May-June 2000	A wildfire that began on April 30 near Mio and was fed by extremely dry conditions consumed nearly 5,200 acres in the Huron-Manistee National Forest before being contained a week later. Nearly 300 firefighters and two aerial water tankers were deployed to suppress the fire. The fire prompted the evacuation for a short time of approximately 30 persons. Fortunately, the fire did not cause any injuries or structural damage.

Scrap Tire Fires

Any instance of uncontrolled burning a 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 fire fighting 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 which 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.

Although the estimated 2,500 scrap tires in Alcona County cannot be ignored as a threat, it is doubtful a scrap tire fire in itself could cause a severe emergency or disaster. In Alcona County, scrap tires are more likely to add problems to an already existing fire. In the past, all scrap tire fires in Alcona County have been managed by local fire fighters. *There are no known major tire storage sites in Alcona County.*

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. According to statistics compiled by the Fire Marshal Division, Michigan Department of State Police for 1998 (the last year for which statewide statistics are available), nearly 22,000 structural fires occurred in Michigan, resulting in 213 deaths and 669 injuries. Dollar losses for structural fires were estimated at nearly $400 million. The Fire Marshal Division estimated that a structural fire occurred in Michigan every 27 minutes, 37 seconds in 1998. Nationally, Michigan’s fire death rate in 1996 of 21.1 persons per million population puts it in the upper third of all states in the nation.

Alcona County, like all other rural areas of Michigan, relies on a network of township volunteer fire departments. The fire departments provide excellent fire fighting services in their respective communities, and are often an element of community pride. However, the lack of full-time professional fire fighters means less time is available to conduct fire inspections and take other preventive measures necessary to lessen the structural fire threat. Out of necessity, efforts in these communities are directed at fire suppression. This typical scenario in rural areas of the state poses great challenges for maintaining a sustainable fire prevention and inspection program.

The other 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.

According to the Michigan Department of State Police, Fire Marshal Division in 1998, there were 6.58 structural fires and other types of fires per 1000 persons in Alcona. The number is above average for counties in the state with a couple of figures likely contributing to this figure. First of all, the per 1000 population in this statistic is based on the U.S. Census year round population not the seasonal population. Given the high number of seasonal housing units (48 percent or 4,174 housing units) if the seasonal population were used the number of fires per 1000 population would be much lower. Also, given that other fires are included, the higher incidence of wildfires would inflate figures. This is not to diminish the importance of programs to reduce the number of fires and continued support of fire suppression activities.

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 mis-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.

Part 315, Dam Safety, of the Natural Resources and Environmental Protection Act (451 P.A. 1994), as amended, provides for the inspection of dams. This statute requires the MDEQ to rate each dam as either "high", "significant", or "low" hazard potential, according to the potential downstream impact if the dam were to fail (not according to the physical condition of the dam). The MDEQ has identified and rated over 2,400 dams. Dams over 6 feet in height that create an impoundment with a surface area of more than 5 acres are regulated by this statute. Dam owners are required to maintain an EAP for "high" and "significant" hazard potential dams. Owners are also required to coordinate with local emergency management officials to assure consistency with local emergency operations plans. Dams regulated by FERC, such as hydro electric power dams, are generally exempt from this statute. The FERC licenses water power projects (including dams) that are developed by non-federal entities, including individuals, private firms, states and municipalities. Under provisions of the Federal Power Act and federal regulations, the licensee of the project must prepare an EAP. This plan must include a description of actions to be taken by the licensee in case of an emergency. Inundation maps showing approximate expected inundation areas must also be prepared. Licensees must conduct a functional exercise at certain projects, in cooperation with local emergency management officials.

Alcona Dam is a FERC license hydro dams and is classified as high hazard by the Department of Environmental Quality, Land and Water Management Division. Consumers Energy has compiled inundation maps for the AuSable River below Mio and Alcona Dams. Maps show failure of the Mio Dam upstream, would flood campgrounds on Alcona Pond. A review of inundation areas on topographic maps below Alcona Pond Dam, indicates no impacts on homes in Alcona County if that dam failed. Several bridges may be impacted in all dams failed. The company conducts functional exercises according to the Federal Power Act. There are seven other dams in the county. All are considered low hazard by the DEQ.

B. Riverine and Urban Flooding: Riverine flooding is defined as the periodic occurrence of over bank 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.

From 1975-1998, Michigan experienced seven flood disasters that resulted in both a Presidential Major Disaster Declaration and a Governor's Disaster Declaration, and seven that resulted only in a Governor's Disaster Declaration. Combined, these flood disasters have caused hundreds of millions of dollars in damage to homes, businesses, personal property, and agriculture. High risk communities for riverine flooding are Alcona, Greenbush, Gustin, Harrisville, Haynes, and Mikado. ***Figure 6.2****, General Hazards Map shows areas of the county with higher risks of riverine flooding.*

Riverine flooding, though not a common occurrence in Alcona County, has caused damage to bridges and roadways. These events occurred in when spring snowmelt coincided with heavy prolonged rains. Riverine Flooding is very likely to occur in Alcona County when Lake Huron is at or near its record level. The levels of the Great Lakes are cyclic, but impossible to predict at this point. The last high water level in 1998 washed out several roads and conduits. Alcona County was granted a Presidential Declaration of Disaster in 1985 for flood related events.

C. Shoreline Flooding/Erosion: Flooding and erosion along Michigan's 3,200 mile long Great Lakes shoreline is typically caused by high Great Lakes water levels, storm surges, or high winds. Shoreline flooding and erosion are natural processes that occur at normal and even low Great Lakes water levels. During periods of high water, however, flooding and erosion are more frequent and serious, causing damage to homes, businesses, roads, water distribution and wastewater treatment facilities, and other structures in coastal communities. Windstorms and differences in barometric pressure can temporarily tilt the surface of a lake up at one end as much as 8 feet.

In nearly every decade, high water levels on the Great Lakes have caused significant damage and impact to Michigan coastal communities. The most recent high water period began in 1997 and resulted in the Great Lakes being at or near record levels set in the mid-1980s'. In response to the threat of severe shoreline flooding and erosion, the U.S. Army Corps of Engineers (USACE), at the request of the Governor, implemented its Advance Measures Program to assist Michigan shoreline communities in their flood and erosion mitigation efforts. To date, over 20 Michigan jurisdictions have taken advantage of this program.

Prior to that, the record-high lake levels in 1985-86 culminated in a Governor's disaster declaration for 17 shoreline counties. The USACE implemented its Advance Measures

Program, and the State of Michigan implemented three shoreline flooding and erosion mitigation programs aimed at reducing future flood impacts on shoreline communities and homeowners. During 1972-73, high water levels caused flooding in over 30 counties, resulting in an excess of $50 million in public and private damage. Thousands of people were forced to evacuate their homes. Similar high water level flooding occurred in the early 1950s and late 1960s, also resulting in millions of dollars worth of damage to shoreline communities.

Many of the same events that influence riverine flooding occur simultaneously as shoreline flooding. Alcona County was granted Presidential Declaration of Disaster in 1985 for riverine and shoreline flooding. Although the Great Lakes are currently in a low cycle, the probability they will rise again is a certainty. The coastal areas of Alcona, Haynes, Harrisville and Greenbush Townships are high risk zones for shoreline flooding and erosion. The Michigan Department of Environmental Quality identify Alcona, Harrisville and Greenbush Townships as having high risk erosion areas along the Lake Huron Shoreline. ***Figure 6.2****, General Hazards Map shows areas of the county with higher risks of shoreline erosion and flooding.*

Technological Hazards

Hazardous Material Incident - Fixed Site

An 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. There is currently one site in Alcona County designated SARA Title III, Section “302 Site”. This site is required to have an emergency plan on file with the Local Emergency Planning Commission, Fire Department, and at their facility. All “302” Sites in Alcona County have an emergency plan on file with the Local Emergency Planning Committee and their individual Fire Departments. These emergency plans are reviewed and updated annually.

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.

Hazardous Material Incident – Transportation

An uncontrolled release of hazardous materials during transport is 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. *Three highways, M-72, M-65 and US-23, traverse Alcona County. Hazardous materials are shipped through the county making communities like Harrisville vulnerable to hazardous materials incidents.*

Oil and Gas Pipeline Accidents

An uncontrolled release of oil or gas, or the poisonous by-product hydrogen sulfide, from a pipeline is capable of posing a risk to health, safety, property or the environment. 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.

One major high pressure gas line runs through Alcona County. Smaller lines form a delivery network that supplies natural gas to homes and businesses. Another network of extractive lines are associated with the 278 producing oil and gas wells in the county. Lines connect each well to a small processing/compressor facility. Brine and moisture is removed from the natural gas, 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 397 oil and gas wells in Alcona. In addition, there are small gas processing facilities for separating natural gas and brine in the well fields. Numerous small, low pressure gas lines connect wells to the small processing facilities*.

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). 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.

According to information supplied by the Department of Environmental Quality there are 397 oil and gas wells, with 278 still active and producing, see **Figure 6.3** and individual community hazard maps. This is a relatively small quantity when compared to the State leader, Otsego County, with over 5,700 wells. Of almost as great a concern is the fact that a combination of 32 organizations and individuals own the wells. As a general rule, most gas companies prefer to respond to incidents involving their wells themselves and in the vast majority of cases that is what happens. Because gas companies often have controlled burns, and deal with wells on a daily basis, it is impossible to ascertain how many incidents have actually occurred in Alcona County. However, there is still the possibility that an emergency response agency could find themselves in the situation of responding the an incident at a gas well. Responders must understand the dangers associated with H2S and must have a working knowledge of these wells that are in their areas of responsibility.

Infrastructure Failures

A failure of critical public or private utility infrastructure result in a temporary loss of essential functions and/or services can have a server impact on the community. 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.*

Air, Land and Water Transportation Accidents

A crash or accident involving an air, land or water-based commercial passenger carrier could result 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. Alcona County does not have a commercial airport, passenger rail service, commercial marine passenger service or intercity bus service. School bus transportation and specialized public transit service does exist in the county. Accidents on either system could result in injuries and loss of life.

Societal Hazards

Public Health Emergencies

Public health emergencies include 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 from 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. District Health Department 2 is developing an emergency response plan. The plan contains strategies to address public health emergencies.

Civil Disturbances

Civil disturbances include 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 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 exist in the world a large number of nuclear weapons capable of destroying multiple locations simultaneously. In addition, controls on nuclear weapons and weapon 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 has identified 25 potential target areas in Michigan, and 4 in Ohio and Indiana that would impact Michigan communities, classified as follows: 1) commercial power plants; 2) chemical facilities; 3) counterforce military installations; 4) other military bases; 5) military support industries; 6) refineries; and 7) political targets. For each of these target areas, detailed plans have been developed for evacuating and sheltering the impacted population, protecting critical resources, and resuming vital governmental functions in the post-attack environment.

Nuclear Power Plant Accidents

Accidents include 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. Alcona County does not have a Nuclear power plant.

Sabotage/Terrorism

Sabotage and terrorism involve 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/or 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 to 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.

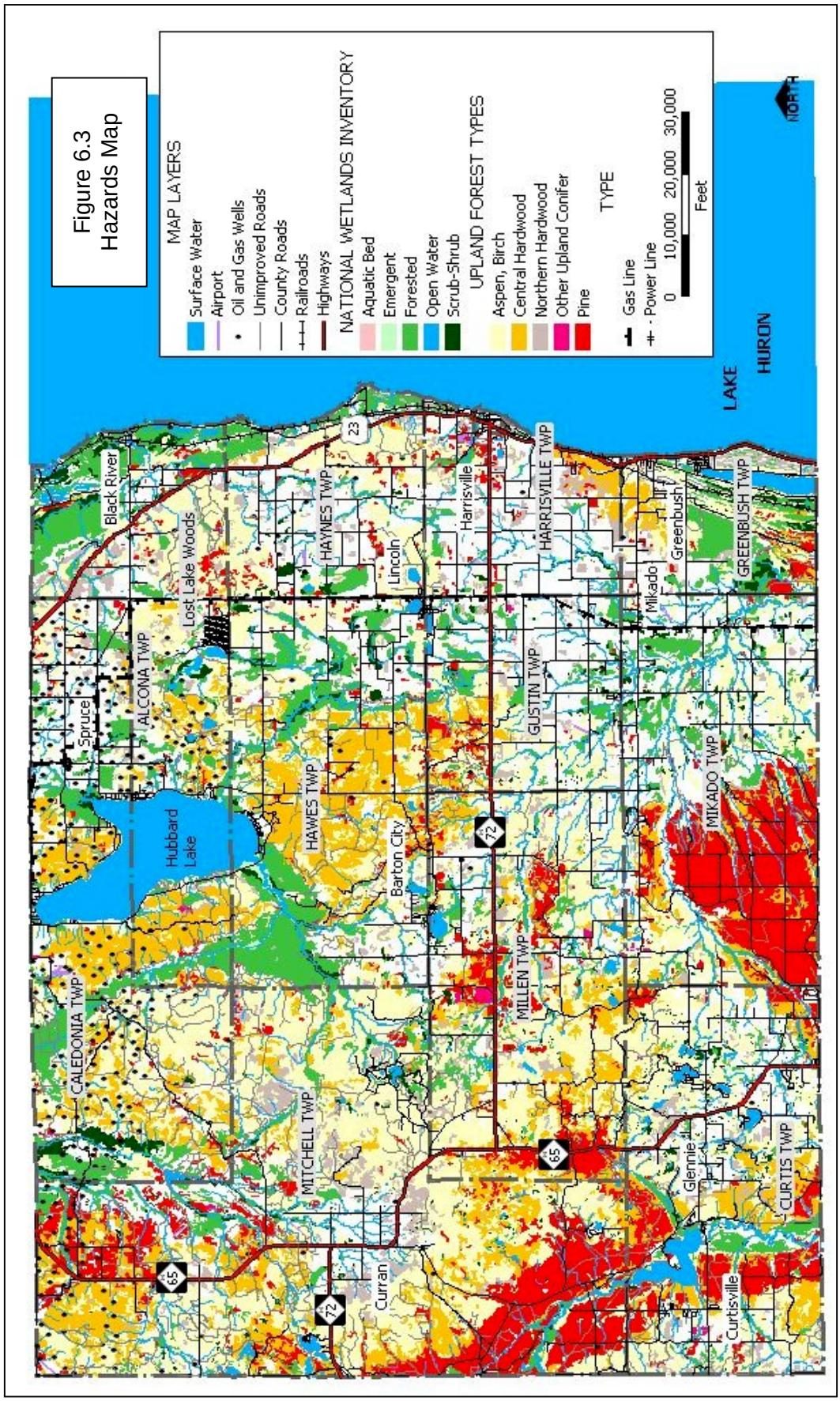


Figure 6.3
Hazards Map
MAP LAYERS
Surface Water
Airport
Oil and Gas Wells
Unimproved Roads
County Roads
Railroads
Highways
NATIONAL WETLANDS INVENTORY
Aquatic Bed
Emergent
Forested
Open Water
Scrub-Shrub
UPLAND FOREST TYPES
Aspen, Birch
Central Hardwood
Northern Hardwood
Other Upland Conifer
Pine
TYPE
Gas Line
Power Line
0 10,000 20,000 30,000
Feet
NORTH
LAKE HURON
Black River
Lost Lake Woods
Spruce
ALCONA TWP
HAYNES TWP
Lincoln
Harrisville
HARRISVILLE TWP
Greenbush
GREENBUSH TWP
Mikado
GUSTIN TWP
Hubbard Lake
HAWES TWP
Barton City
MIKADO TWP
MILLEN TWP
CALEDONIA TWP
MITCHELL TWP
Glennie
CURTIS TWP
Curran
Curtisville
23
72
65

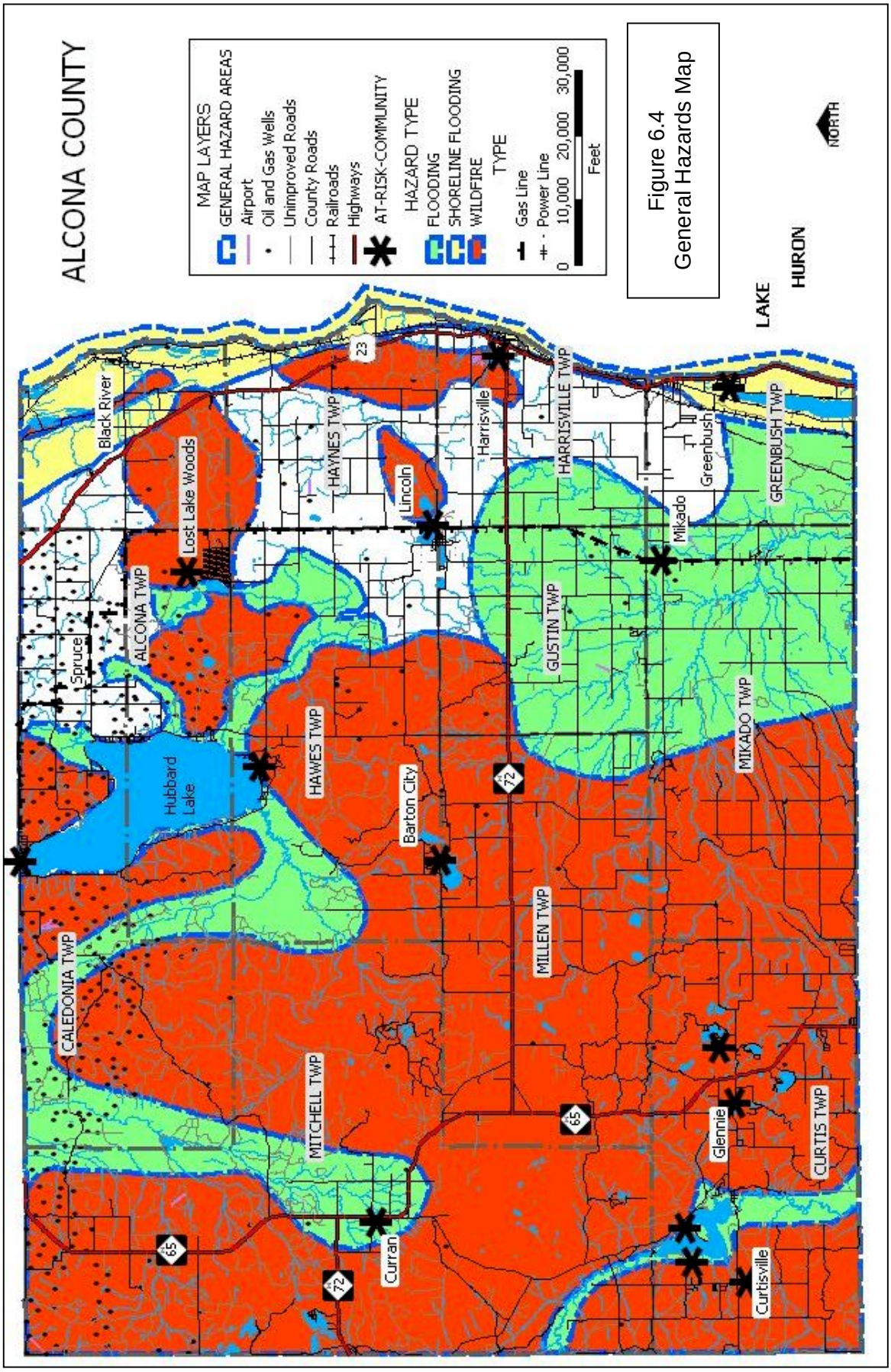


Figure 6.4
General Hazards Map

Local Jurisdictions

Overview

Alcona County is located in the northeastern part of the lower peninsula of Michigan on the western shore of Lake Huron. The County measures twenty-four miles north to south and thirty miles east to west and encompasses approximately 679 square miles or approximately 434,560 acres. Its eastern border is defined by Lake Huron, which offers some 27 miles of unspoiled beaches. The county is composed of 11 townships Alcona, Caledonia, Curtis, Greenbush, Gustin, Harrisville, Hawes, Haynes, Mikado, Millen and Mitchell. There are two incorporated places in the county: the City of Harrisville located in Harrisville Township and the Village of Lincoln in Gustin and Hawes Townships. The City of Harrisville is the county seat and is located on the coast of Lake Huron at the intersection of M-72 and US-23. There are several unincorporated places within county, they include Curran in Mitchell Township, Glennie and Curtisville in Curtis Township, Greenbush in Greenbush Township, Hubbard Lake and Spruce in Caledonia Township, Mikado in Mikado Township, Black River in Alcona Township, and Barton City in Millen Township.

Communities

The **City of Harrisville**, located at the junction of M-72 and US-23, is the Alcona County seat. Harrisville is the only incorporated city in the county. Tourism is the main business in Harrisville, with several motels and bed & breakfast establishments situated near and along the Lake Huron coastline. The Harrisville State Park is located just south of town, and offers camping and swimming on Lake Huron. Harbor Park is a day use picnic area located in town, just to the north of Main Street. This is a favorite place to view the marina, or listen to the rapids at the mouth of Mill Creek as it flows into the harbor.

According to the U.S. Bureau of the Census, the Year 2000 population for the City of Harrisville was 514, a 9.4% increase from 1990. Of the total 327 housing units, 239 units are occupied, 88 are vacant, with 66 are for seasonal, recreational, or occasional use. Some 61.7 % of the total housing units are 40+ years old, and 4.2 % of the occupied housing units are mobile homes.

Highway M-72 turns into Main Street at the City boundary, and intersects State Street (US-23) in town. The 2002 Annual Average Daily Traffic (AADT) volume on this segment of M-72 was 1,800 vehicles per day. The AADT on US-23 north of the M-72 intersection was 3,000 vehicles per day. South of the intersection, the AADT on US-23 was 3,100 vehicles per day.

The predominant land use is residential, commercial, and institutional. Commercial uses are mostly found along Main Street and the US-23 highway. Residential development is found along the Lake Huron coast and on either side of the commercial areas. Patches of coniferous and deciduous forest are located on either side of Mill Creek in the northern third of the City, and surrounding small wetland areas in the southern third of the City. Extractive industrial areas are located just outside of the City, to the west.

<u>Potential Hazards</u>
Natural: Riverine flooding, shoreline flooding, erosion, wildfire, wind, thunder storms and tornadoes, and winter storms.
Technological: Transportation accident (air, land, rail, water), hazardous material spill, structural fire, and industrial accident.
Societal: Bovine TB

The **Village of Lincoln** is located approximately 8 miles west of Harrisville just north of M-72 . It incorporated as a village in 1907. Lincoln today is still related to the lumber industry, with a wood-burning generator helping to supply power to the area. With many lakes within and nearby, as well as vast areas of forestlands, the community also benefits from tourism.

According to the U.S. Bureau of the Census, the Year 2000 population for the Village of Lincoln was 364, an 8.0% increase from 1990. Of the total 246 housing units, 179 units are occupied, 67 are vacant, with 40 are for seasonal, recreational, or occasional use.

Highway F-41 turns into Grand Traverse Road at the southwestern Village boundary, and travels eastward to Barlow Road, where F-41 then continues to the north. The 2002 Annual Average Daily Traffic (AADT) volume on the intersecting M-72 to the south, was 1,400 vehicles per day.

The predominant land use is residential, commercial, and institutional. Commercial uses are primarily found along Lake Street, north of Grand Traverse Road (F-41). Residential development is found surrounding Brownlee Lake and Twin Lake, as well as on either side of the commercial areas. An area of agricultural use is observed in the northwest corner of the Village, just north of the County Road Commission's center of operations. A small industrial area is located just outside of the Village, to the south.

Potential Hazards
Natural: Lakeshore flooding, erosion, wildfire, damaging wind, thunder storms and tornadoes, and winter storms.
Technological: Transportation accident, hazardous material spill, structural fire, and industrial accident.
Societal: Bovine TB

The **Township of Alcona** is located in the northeast quadrant of Alcona County. It extends from the shore of Lake Huron to the west approximately 18 miles. The Township encompasses approximately 58 square miles of land and 9 square miles of Hubbard Lake.

According to the U.S. Bureau of the Census, the Year 2000 population for the Township of Alcona was 1,089, a 20.2% increase from 1990. Of the total 1,313 housing units, 524 units are occupied, 789 are vacant, with 748 are for seasonal, recreational, or occasional use. Some 49.0 % of the total housing units are 40+ years old, and 2.9 % of the occupied housing units are mobile homes.

Highway US-23 runs north and south through the east side of Alcona Township. The 2002 Annual Average Daily Traffic (AADT) volume on this segment of US-23 was 4,100 vehicles per day.

The predominant land cover is deciduous forest distributed evenly throughout areas of the Township, except for the north and easternmost 1/6 of the Township that contains approximately 50% coniferous forest. Residential and commercial uses are primarily found near the coastal community of Black River, along the east and west shoreline of Hubbard Lake, and a large residential development on the east side of Badger Lake called Lost Lake Woods. Agricultural areas are chiefly north and south of Black River Road in the eastern 1/3 of the Township. A small industrial (extractive) area is located just to the northeast of Sand Hill Road and Black River Road.

Potential Hazards
Natural: Lakeshore flooding and erosion, riverine flooding, wildfire, damaging wind, thunder storms and tornadoes, and winter storms.
Technological: Transportation accident, hazardous material spill, structural fire, and industrial accident.
Societal: Bovine TB

The **Township of Caledonia** is located to the north and west of Alcona Township. The Township encompasses approximately 68 square miles of land and 4.5 square miles of Hubbard Lake. The western 36 square miles of the Township have very few access roads, with Hubbard Lake Trail cutting that area diagonally southwest to northeast. Spruce Road runs through the community of Spruce on the east side of the Township, then turns north at Hubbard Lake into Alpena County.

According to the U.S. Bureau of the Census, the Year 2000 population for the Township was 1,203, a 21.9% increase from 1990. Of the total 1,074 housing units, 535 units are occupied, 539 are vacant, with 513 are for seasonal, recreational, or occasional use. Some 51.1 % of the total housing units are 40+ years old, and 9.4 % of the occupied housing units are mobile homes.

Highway US-23 just intersects the northeast corner of the Township. The 2002 Annual Average Daily Traffic (AADT) volume on this segment of US-23 was 6,500 vehicles per day.

The predominant land cover is deciduous forest distributed mainly west of Hubbard Lake. Agriculture takes up approximately 50% of the land use east of Hubbard Lake. Agricultural areas are chiefly found between the east-west Spruce Road and Swede Road. Commercial uses can be found in the Community of Spruce, at the intersection of Gillard Road and Spruce Road. Residential development is concentrated along the east and west shores of Hubbard Lake, and along Spruce Road and US-23 near that intersection.

Potential Hazards
Natural: Lakeshore flooding and erosion, riverine flooding, wildfire, damaging wind, thunder storms and tornadoes, and winter storms.
Technological: Transportation accident, hazardous material spill, structural fire, and industrial accident.
Societal: Bovine TB

Curtis Township is located in the southwest quadrant of Alcona County. It is comprised of township-ranges T25N R5E and T25N R6E. The Township encompasses approximately 70 square miles which includes the Alcona Dam Pond.

According to the U.S. Bureau of the Census, the Year 2000 population for Curtis Township was 1,378, a 22.2% increase from 1990. Of the total 1,605 housing units, 608 units are occupied, 997 are vacant, with 924 are for seasonal, recreational, or occasional use. Some 42.9 % of the total housing units are 40+ years old, and 14.5 % of the occupied housing units are mobile homes.

Highway M-65 runs north and south through the east side of Curtis Township. The 2002 Annual Average Daily Traffic (AADT) volume on this segment of M-65 was 2,500 vehicles per day.

The predominant land cover is deciduous forest distributed evenly throughout areas of the Township. A large swath of coniferous forest follows the Au Sable River system on the west half of the Township. Residential and commercial uses are primarily found near the communities of Curtisville and Glennie, and along the shorelines of a series of lakes in the east side of the Township. Agricultural areas are chiefly located in the southeast part of the Township. Several small industrial (extractive) areas are located just to the northeast of Curtisville.

The communities of Curtisville and Glennie are located in Alcona County's southwest corner, in Curtis Township. Neither of these communities are incorporated and therefore, fall under the jurisdiction of Curtis Township. The township hall and post office are located in Glennie. Both communities remain small rural towns, but the area is starting to undergo change as real estate development increases. The community's close proximity to the scenic Au Sable River Valley, as well as the abundance of public lands, open space, and small lakes draw people to his area to recreate and settle down.

Potential Hazards
Natural: Lakeshore flooding and erosion, riverine flooding, wildfire, damaging wind, thunder storms and tornadoes, and winter storms.
Technological: Transportation accident, hazardous material spill, structural fire, and industrial accident.
Societal: Bovine TB

The community of Greenbush is located in **Greenbush Township**, the southeastern corner of Alcona County. Today, the Greenbush area remains a prime tourist attraction, with its miles of Lake Huron shoreline, Cedar Lake, golfing, and many outdoor recreational opportunities. The community has retained much of its historical character by carefully preserving the township hall and an old one-room school house. The Township encompasses approximately 24 square miles, which includes the northern portion of Cedar Lake.

According to the U.S. Bureau of the Census, the Year 2000 population for the Township was 1,499, a 9.2% increase from 1990. Of the total 1,453 housing units, 685 units are occupied, 768 are vacant, with 733 are for seasonal, recreational, or occasional use. Some 56.8 % of the total housing units are 40+ years old, and 7.1 % of the occupied housing units are mobile homes.

Highway US-23 runs north-south through the eastern edge of the Township. The 2002 Annual Average Daily Traffic (AADT) volume along this segment of US-23 was 3,100 vehicles per day.

The predominant land cover is forest, with approximately 50% coniferous forest and 50% deciduous forest. Residential uses are primarily concentrated near the coastal community of Greenbush, along the coast of Lake Huron, along the east and west shoreline of Cedar Lake, and along Mikado Road towards the community of Mikado (just outside of the Township's northwest border. Commercial uses are mainly along US-23, near the Lake Huron coastline. There is a large Industrial extraction area just west of the community of Greenbush. Agricultural areas are chiefly found in the northwest quadrant of the township.

Potential Hazards
Natural: Lakeshore flooding and erosion, riverine flooding, wildfire, damaging wind, thunder storms and tornadoes, and winter storms.
Technological: Transportation accident, hazardous material spill, structural fire, and industrial accident.
Societal: Bovine TB

Gustin Township is located in the southeast quadrant of Alcona County. It extends from the western boundary of Harrisville Township to 6 miles inland. The Township encompasses approximately 36 square miles.

According to the U.S. Bureau of the Census, the Year 2000 population for the Township was 832, a 01.1% increase from 1990. Of the total 483 housing units, 358 units are occupied, 125 are vacant, with 87 are for seasonal, recreational, or occasional use. Some 46.6 % of the total housing units are 40+ years old, and 23.5 % of the occupied housing units are mobile homes.

Highway M-72 traverses east and west through the northern half of the Township. The 2002 Annual Average Daily Traffic (AADT) volume on this segment of M-72 was 1,400 vehicles per day.

The predominant land cover in the west side of the Township is deciduous forest, with coniferous forest following the network of rivers. The east portion of the Township is largely agricultural and open pasture. Residential and commercial areas are concentrated in the Village of Lincoln at the northeast tip of the Township, and in small clusters along the east segment of M-72 which traverses the Township and continues eastward to Harrisville. There are very small industrial (extractive) areas located just to the east of the north and east Township boundary.

Potential Hazards
Natural: Riverine flooding, wildfire, damaging wind, thunder storms and tornadoes, and winter storms.
Technological: Transportation accident, hazardous material spill, structural fire, and industrial accident.
Societal: Bovine TB

Harrisville Township is a coastal township located in the southeast quadrant of Alcona County. It extends from the eastern boundary of Gustin Township to the Lake Huron coastline. The Township encompasses approximately 31 square miles.

According to the U.S. Bureau of the Census, the Year 2000 population for the Township was 1,411, a 7.3% increase from 1990. Of the total 790 housing units, 555 units are occupied, 235 are vacant, with 205 are for seasonal, recreational, or occasional use. Some 45.6 % of the total housing units are 40+ years old, and 13.1 % of the occupied housing units are mobile homes.

Highway M-72 runs east and west through the northern half of the Township to the City of Harrisville on the coast. The 2002 Annual Average Daily Traffic (AADT) volume on this segment of M-72 was 1,800 vehicles per day.

The predominant land use in the western ¾ of the Township is agriculture, while large areas of the eastern ¼ of the Township are covered by deciduous forest. Residential areas are concentrated in the City of Harrisville, along the Lake Huron coastline, and in clusters along M-72. Commercial development is concentrated in or near the City of Harrisville. There are industrial (mostly extractive) areas located just to the west and north of the City.

Potential Hazards
Natural: Lakeshore flooding, riverine flooding, wildfire, damaging wind, thunder storms and tornadoes, and winter storms.

Technological: Transportation accident, hazardous material spill, structural fire, and industrial accident.
Societal: Bovine TB

Hawes Township is located directly west of the coastal township, Haynes. It extends 12 miles inland from the western boundary of Haynes Township, and encompasses approximately 70 square miles. The southern tip of Hubbard Lake reaches into the west half of this Township.

According to the U.S. Bureau of the Census, the Year 2000 population for the Township was 1,167, a 12.8% increase from 1990. Of the total 1,003 housing units, 528 units are occupied, 475 are vacant, with 433 are for seasonal, recreational, or occasional use. Some 51.3 % of the total housing units are 40+ years old, and 7.1 % of the occupied housing units are mobile homes.

Highway M-72 runs east and west just south of this Township. The 2002 Annual Average Daily Traffic (AADT) volume on this segment of M-72 was 1,400 vehicles per day.

The predominant land cover in the central 50% of the Township is deciduous forest, while large areas of the northwestern 1/6 of the Township are covered by coniferous forest. Residential areas and commercial development are concentrated near the community of Barton City on the southwest border, near the Village of Lincoln on the southeast border, and along the southern shoreline of Hubbard Lake. Industrial uses are generally limited to small shops in those same areas, and to an extractive area near the Village of Lincoln. Agriculture is found concentrated in the southeast 1/8 of the Township.

Potential Hazards
Natural: Lakeshore flooding, riverine flooding, wildfire, damaging wind, thunder storms and tornadoes, and winter storms.
Technological: Transportation accident, hazardous material spill, structural fire, and industrial accident.
Societal: Bovine TB

Haynes Township is located directly to the east of Hawes Township, and extends 5 to 7 miles to the coast of Lake Huron. The Township encompasses approximately 34 square miles.

According to the U.S. Bureau of the Census, the Year 2000 population for the Township was 724, a 31.9% increase from 1990. Of the total 598 housing units, 308 units are occupied, 290 are vacant, with 276 are for seasonal, recreational, or occasional use. Some 44.6 % of the total housing units are 40+ years old, and 6.3 % of the occupied housing units are mobile homes.

Highway US-23 runs north and south through the eastern 1/3 of this Township. The 2002 Annual Average Daily Traffic (AADT) volume on this segment of US-23 was 4,100 vehicles per day.

The predominant land cover in the west-central 1/3 of the Township is agriculture and rangeland, while the remaining area of the Township is covered by deciduous forest. Residential areas and commercial development are concentrated near the Village of Lincoln just outside the southwest border, along the Lake Huron shoreline, and at intervals along US-23. Industrial uses are generally limited to small shops and an extractive area near the Village of Lincoln.

Potential Hazards
Natural: Lakeshore flooding, riverine flooding, wildfire, damaging wind, thunder storms and tornadoes, and winter storms.
Technological: Transportation accident, hazardous material spill, structural fire, and industrial accident.
Societal: Bovine TB

Mikado Township is located directly west of coastal Greenbush Township, and extends 12 miles inland from its western boundary. Mikado Township encompasses approximately 72 square miles.

According to the U.S. Bureau of the Census, the Year 2000 population for the Township was 1,043, a 22.4% increase from 1990. Of the total 666 housing units, 397 units are occupied, 269 are vacant, with 229 are for seasonal, recreational, or occasional use. Some 55.9 % of the total housing units are 40+ years old, and 20.2 % of the occupied housing units are mobile homes.

Highway US-23 runs north and south through the adjacent Greenbush Township. The 2002 Annual Average Daily Traffic (AADT) volume on that segment of US-23 was 3,100 vehicles per day.

The western half of the Township's land cover is approximately 2/3 coniferous forest and 1/3 deciduous forest. The predominant land cover in the eastern half of the Township is 2/3 deciduous forest and 1/3 agriculture, pasture, and rangeland. Residential and commercial development areas are found in concentrated intervals along Mikado-Glennie Road in the northernmost part of the Township, and along the north-south road, F-41. Industrial uses are limited to a few small extraction locations.

The Town of Mikado is located at the intersection of Mikado-Glennie Road and F-41 within Mikado Township in southeastern Alcona County. Van Etten Creek flows through the eastern part of the town. Unlike many other towns in the area that disappeared after the lumbering was over, Mikado has survived. While smaller then its "golden years," a handful of businesses still remain. The Mikado Civic Center was built by donations and hard work of local residents. The Pine River, Huron National Forest, Kirtland's Warbler nesting area and Lake Huron, are all nearby.

Potential Hazards
Natural: Riverine flooding, wildfire, damaging wind, thunder storms and tornadoes, and winter storms.
Technological: Transportation accident, hazardous material spill, structural fire, and industrial accident.
Societal: Bovine TB

Millen Township is located directly west of Gustin Township, and extends another 12 miles inland. The Township encompasses approximately 72 square miles.

According to the U.S. Bureau of the Census, the Year 2000 population for the Township was 463, an 11.0% increase from 1990. Of the total 541 housing units, 202 units are occupied, 339 are vacant, with 327 are for seasonal, recreational, or occasional use. Some 55.2 % of the total housing units are 40+ years old, and 12.0 % of the occupied housing units are mobile homes.

Highway M-72 intersects highway M-65 in this Township. The 2002 Annual Average Daily Traffic (AADT) volume on the segment of M-72 was 1,200 vehicles per day, and on the segment of M-65 was 1,300 vehicles per day.

The predominant land cover is deciduous forest, evenly distributed throughout the Township. Significant coniferous forest areas are in the central 1/8th, and in the southwest corner of the Township. Residential areas and commercial development are concentrated near Barton City to the north, and near a development on north-south M-65. Industrial uses are generally limited to small extractive areas.

Barton City is an unincorporated community located in Millen Township in central Alcona County. It is located on Jewell Lake, and easily accessed off of M-72 on Stout Road. This is a small resort town surrounded by woods and a few farms. Most of the township falls within the Huron National Forest boundary.

Potential Hazards
Natural: Lakeshore flooding, riverine flooding, wildfire, damaging wind, thunder storms and tornadoes, and winter storms.
Technological: Transportation accident, hazardous material spill, structural fire, and industrial accident.
Societal: Bovine TB

Mitchell Township extends along three-fourths of Alcona County's western border. The Township encompasses four township-ranges for an approximate total area of 144 square miles. Over a quarter of the township is within the boundaries of the Huron National Forest.

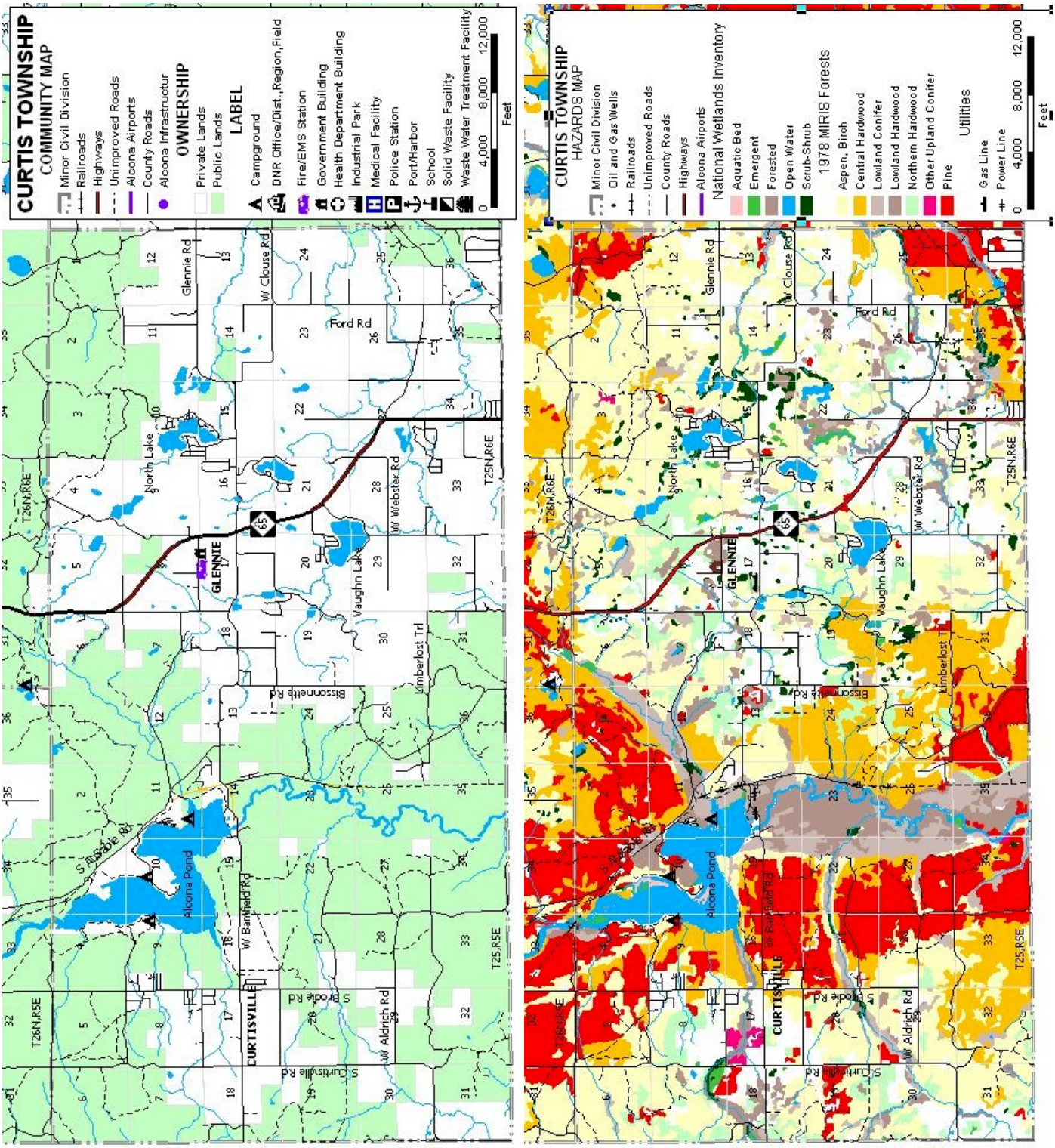
According to the U.S. Bureau of the Census, the Year 2000 population for the Township was 396, a 36.6% increase from 1990. Of the total 731 housing units, 193 units are occupied, 538 are vacant, with 526 are for seasonal, recreational, or occasional use. Some 43.4 % of the total housing units are 40+ years old, and 6.7 % of the occupied housing units are mobile homes.

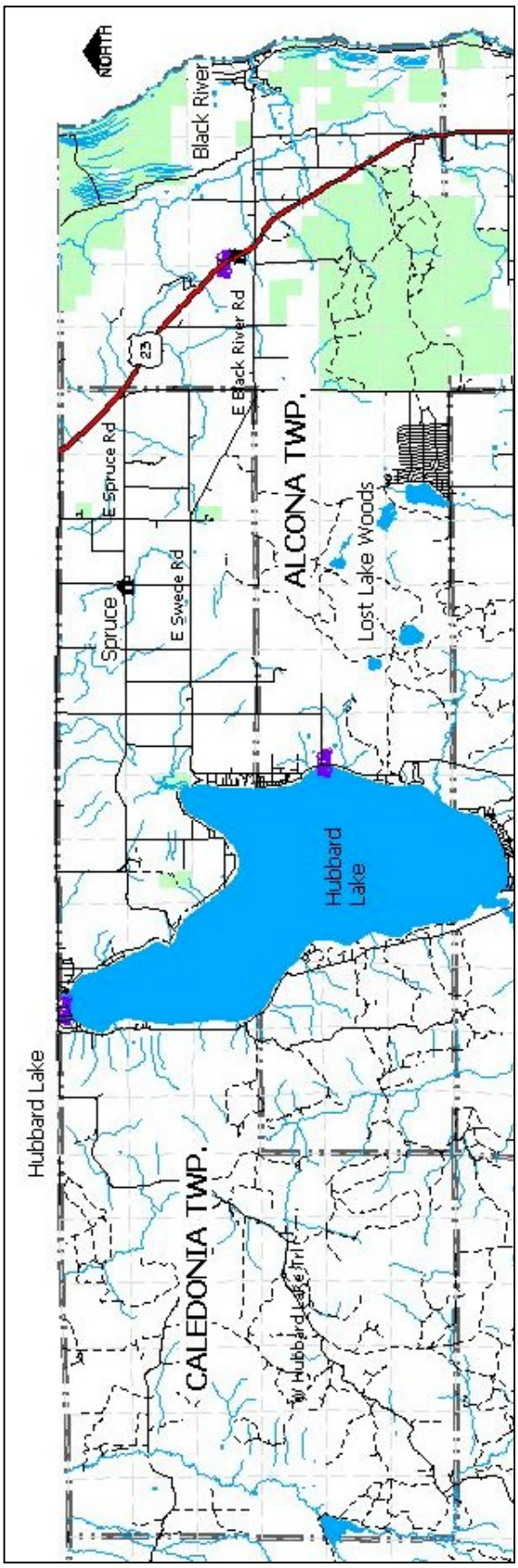
Highway M-65 runs north-south, and intersects with east-west M-72 in the Township. The 2002 Annual Average Daily Traffic (AADT) volume on the M-65 segment was 1,300 vehicles per day and 1,400 vehicles per day on the M-72 segment.

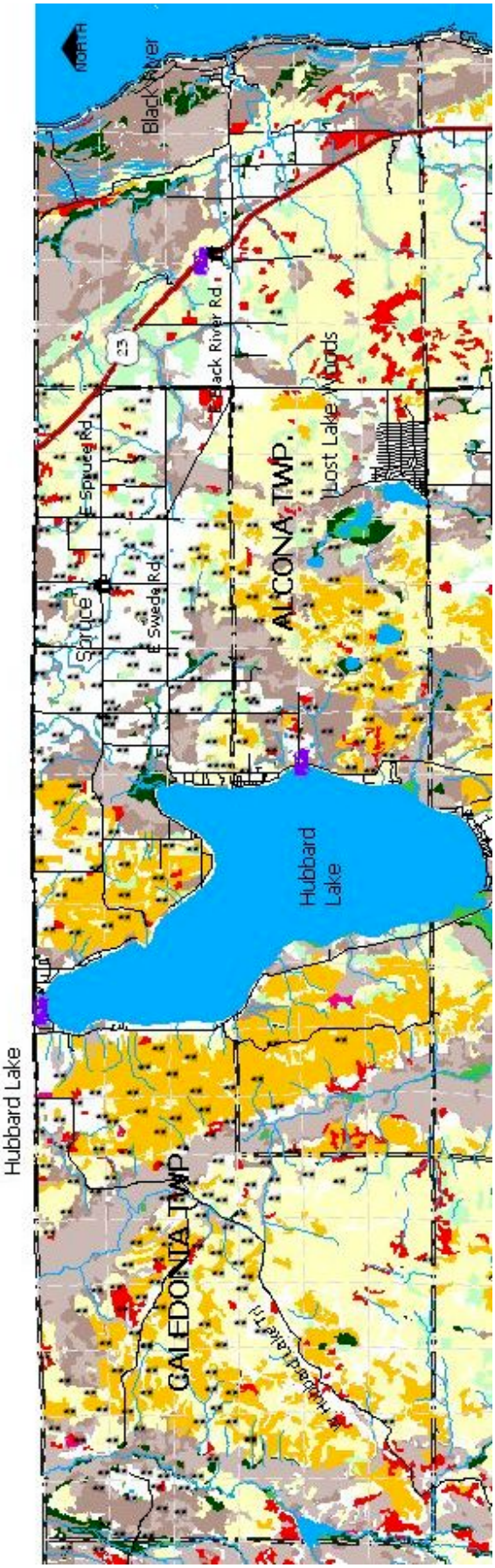
The land cover on each of the southernmost and northernmost township-ranges are approximately 50% deciduous forest and 50% coniferous forest. And, except for the middle 1/3 of T27N-R5E, the predominant land cover is evenly distributed deciduous forest land. The middle 1/3 of T27N-R5E is comprised of agriculture, pasture, and rangeland. Residential and commercial development areas are found at intervals along M-65 in the westernmost part of the Township. Residential development is also found along the shorelines of lakes in the northwest part of the Township. Industrial uses are limited to small extraction locations.

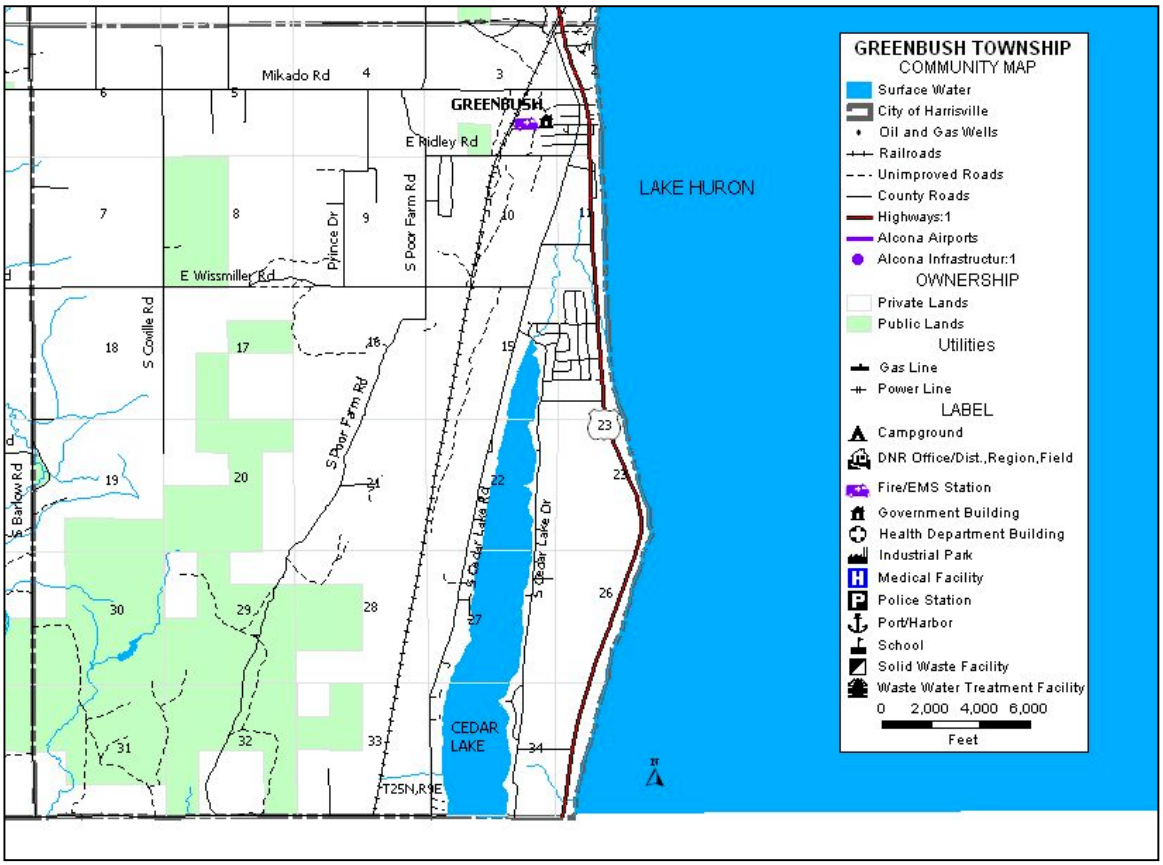
The community of Curran is located at the junction of M-65 and M-72 in Mitchell Township.

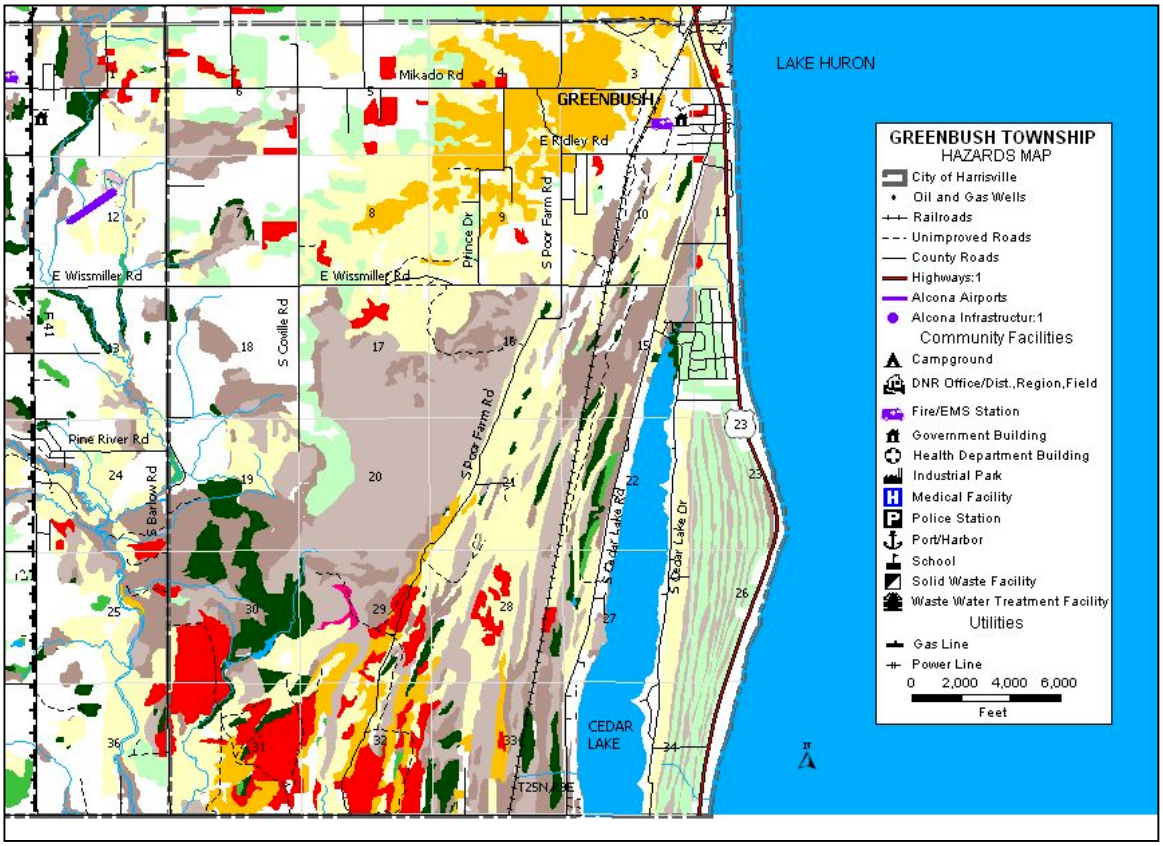
Potential Hazards
Natural: Lakeshore flooding, riverine flooding, wildfire, damaging wind, thunder storms and tornadoes, and winter storms.
Technological: Transportation accident, hazardous material spill, structural fire, and industrial accident.
Societal: Bovine TB

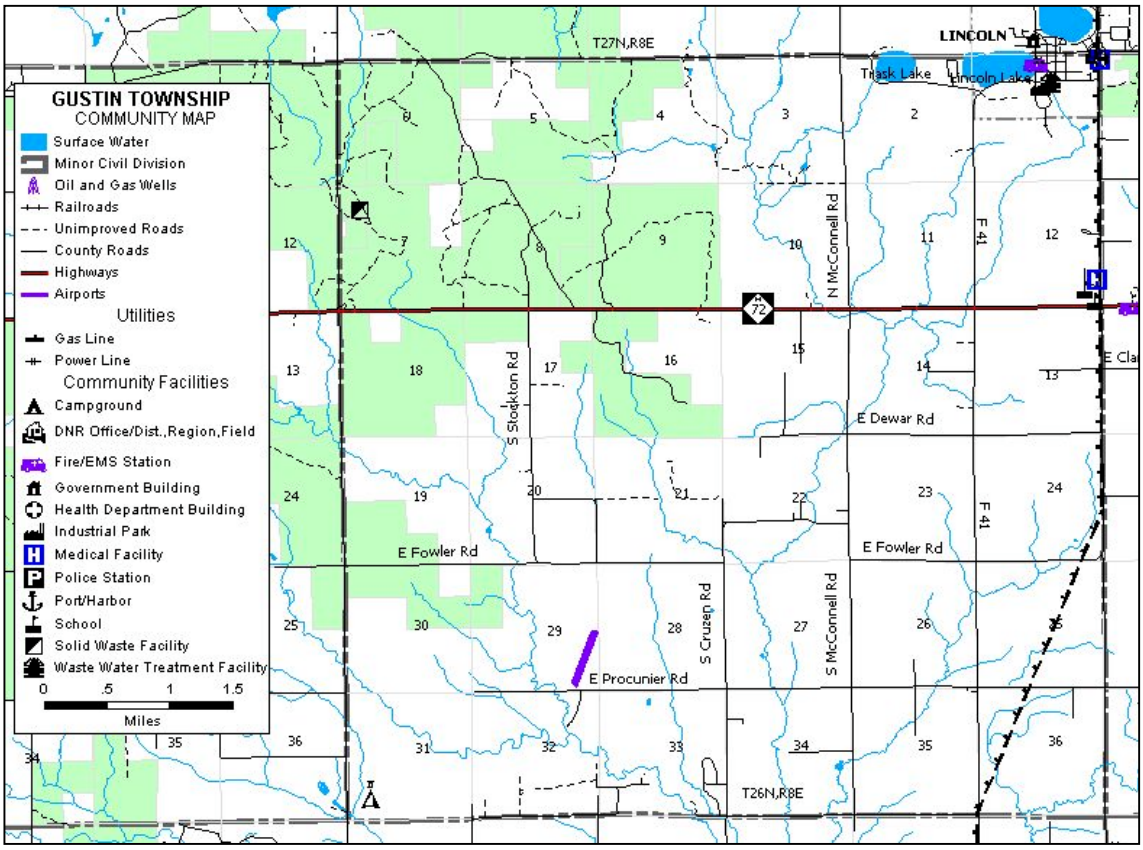

CURTIS TOWNSHIP
COMMUNITY MAP
Minor Civil Division
Railroads
Highways
Unimproved Roads
Alcona Airports
County Roads
Alcona Infrastructur
OWNERSHIP
Private Lands
Public Lands
LABEL
Campground
DNR Office/Dist.,Region,Field
Fire/EMS Station
Government Building
Health Department Building
Industrial Park
Medical Facility
Police Station
Port/Harbor
School
Solid Waste Facility
Waste Water Treatment Facility
0 4,000 8,000 12,000
Feet
CURTIS TOWNSHIP
HAZARDS MAP
Minor Civil Division
Oil and Gas Wells
Railroads
Unimproved Roads
County Roads
Highways
Alcona Airports
National Wetlands Inventory
Aquatic Bed
Emergent
Forested
Open Water
Scrub-Shrub
1978 MIRIS Forests
Aspen, Birch
Central Hardwood
Lowland Conifer
Lowland Hardwood
Northern Hardwood
Other Upland Conifer
Pine
Utilities
Gas Line
Power Line
0 4,000 8,000 12,000
Feet
Glennie Rd
W Clouse Rd
Ford Rd
North Lake
T26N,R6E
GLENNIE
65
W Webster Rd
Vaughn Lake
T25N,R6E
Bissonnette Rd
Timberlost Trl
S Eustace Rd
Alcona Pond
W Barnfield Rd
CURTISVILLE
S Brodie Rd
W Aldrich Rd
S Curtisville Rd
T26N,R5E
T25,R5E

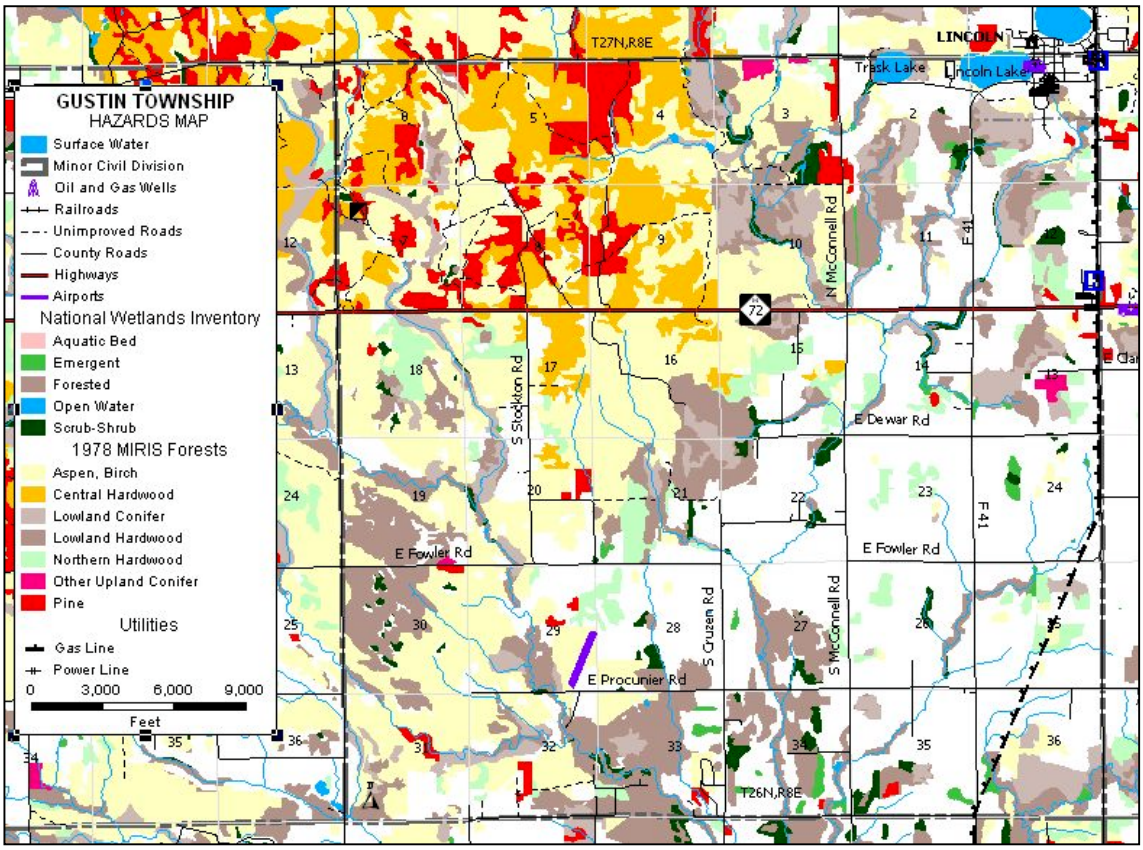

NORTH
Black River
E Black River Rd
23
E Spruce Rd
Spruce
E Swede Rd
ALCONA TWP.
Lost Lake Woods
Hubbard Lake
CALEDONIA TWP.
Hubbard Lake Trl

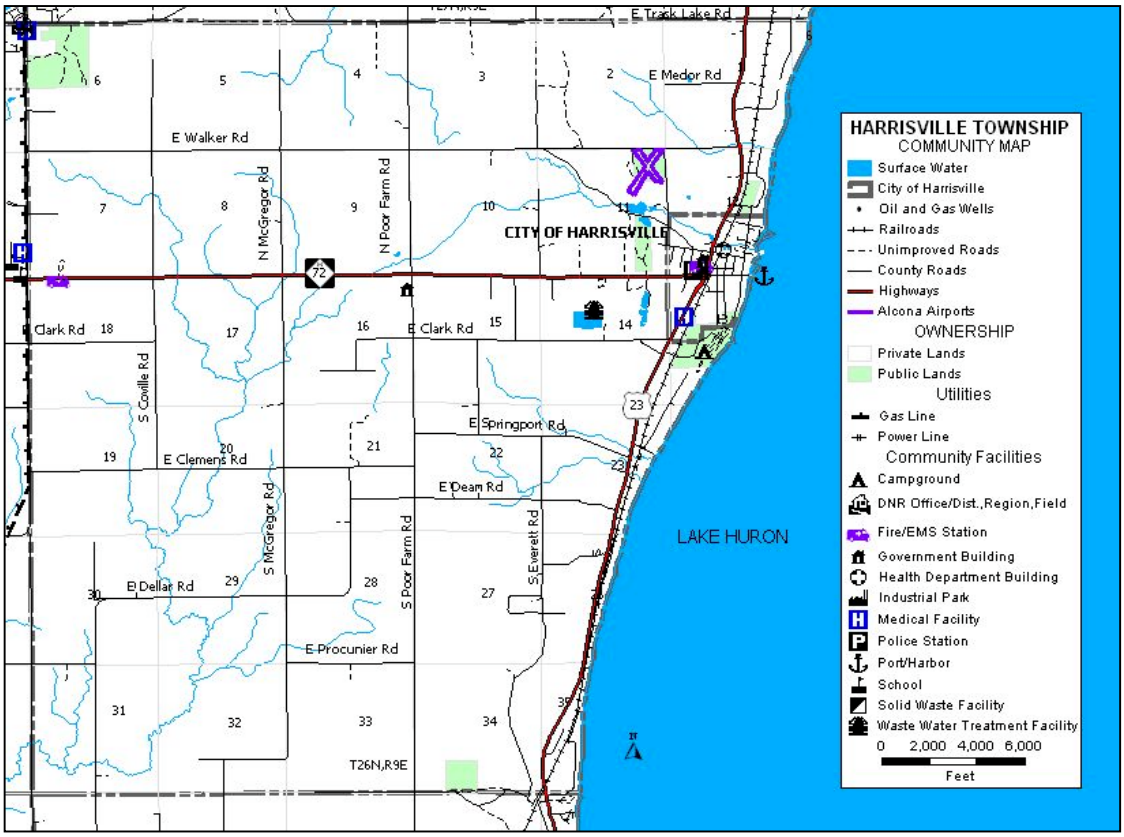

NORTH
Black River
E Black River Rd
23
E Spruce Rd
Spruce
E Swede Rd
ALCONA TWP.
Lost Lake Woods
Hubbard Lake
CALEDONIA TWP.
Hubbard Lake Trl

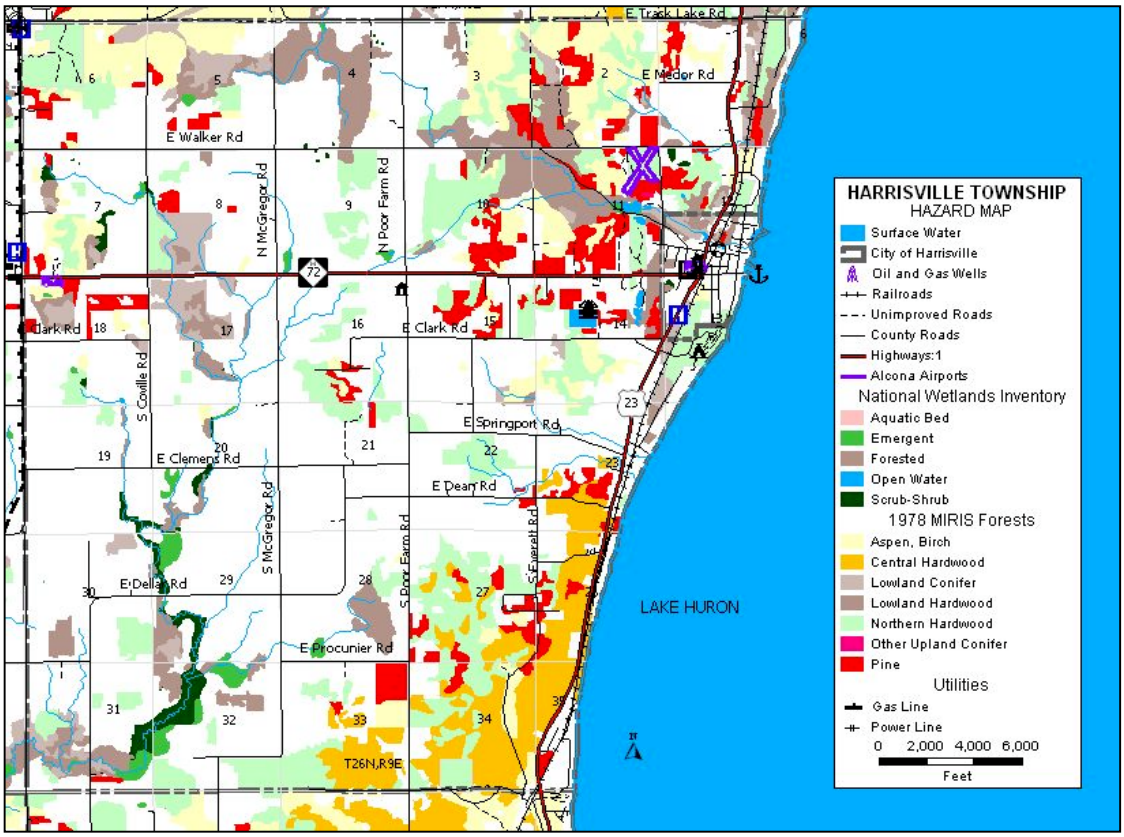

GREENBUSH TOWNSHIP
COMMUNITY MAP
Surface Water
City of Harrisville
Oil and Gas Wells
Railroads
Unimproved Roads
County Roads
Highways:1
Alcona Airports
Alcona Infrastructur:1
OWNERSHIP
Private Lands
Public Lands
Utilities
Gas Line
Power Line
LABEL
Campground
DNR Office/Dist.,Region,Field
Fire/EMS Station
Government Building
Health Department Building
Industrial Park
Medical Facility
Police Station
Port/Harbor
School
Solid Waste Facility
Waste Water Treatment Facility
0 2,000 4,000 6,000
Feet
LAKE HURON
GREENBUSH
CEDAR LAKE
Mikado Rd
E Ridley Rd
E Wissmiller Rd
Prince Dr
S Poor Farm Rd
S Coville Rd
S Barlow Rd
S Cedar Lake Rd
S Cedar Lake Dr
T25N,R3E

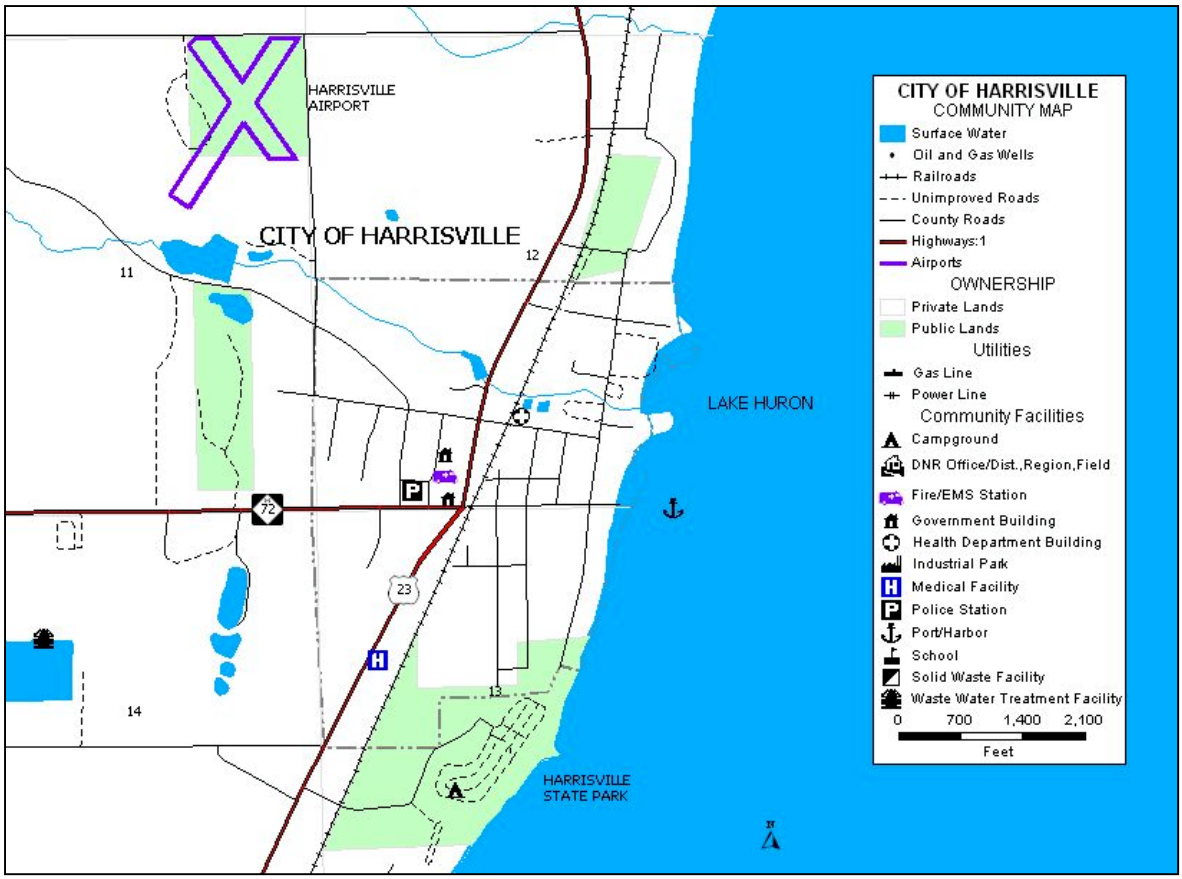

GREENBUSH TOWNSHIP
HAZARDS MAP
City of Harrisville
Oil and Gas Wells
Railroads
Unimproved Roads
County Roads
Highways:1
Alcona Airports
Alcona Infrastructur:1
Community Facilities
Campground
DNR Office/Dist.,Region,Field
Fire/EMS Station
Government Building
Health Department Building
Industrial Park
Medical Facility
Police Station
Port/Harbor
School
Solid Waste Facility
Waste Water Treatment Facility
Utilities
Gas Line
Power Line
0 2,000 4,000 6,000
Feet
LAKE HURON
GREENBUSH
CEDAR LAKE
Mikado Rd
E Ridley Rd
E Wissmiller Rd
Pine River Rd
Prince Dr
S Poor Farm Rd
S Coville Rd
S Barlow Rd
S Cedar Lake Rd
S Cedar Lake Dr
T25N,R3E

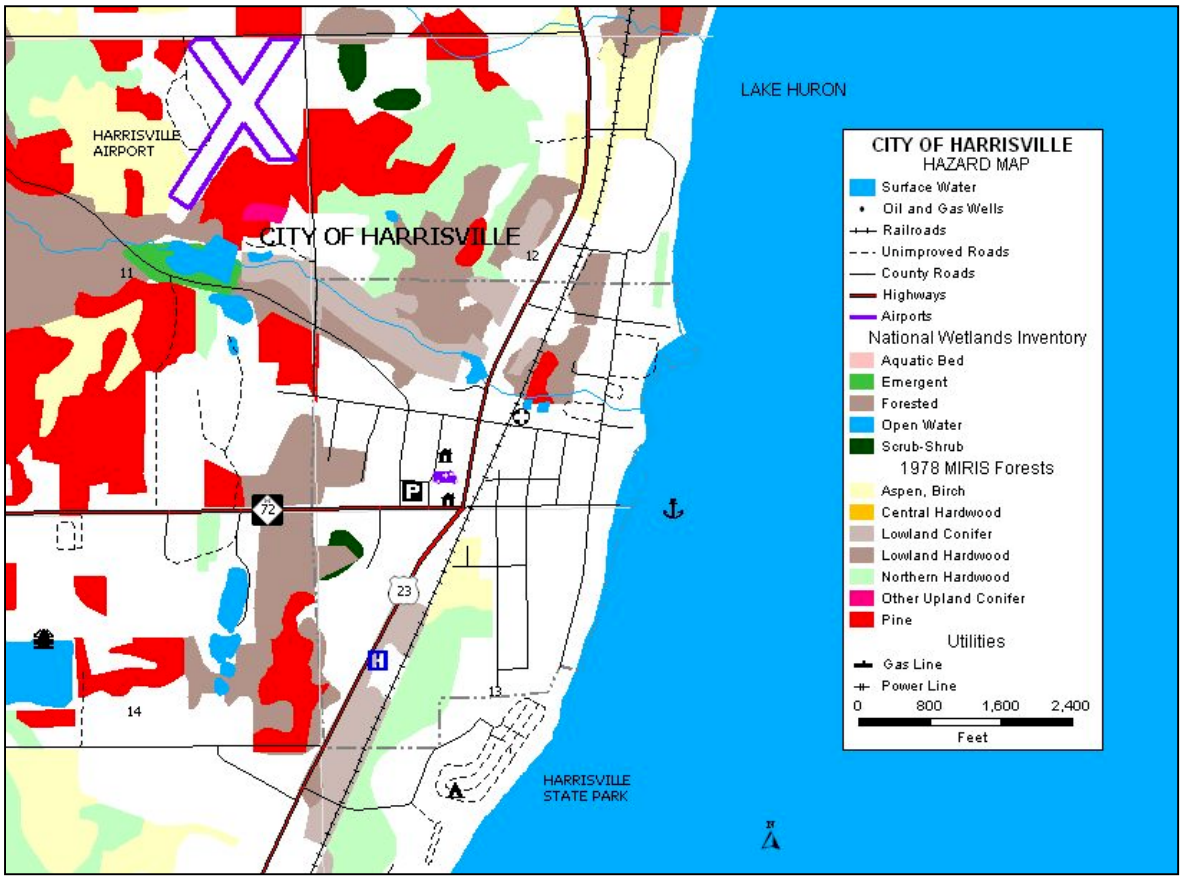

GUSTIN TOWNSHIP
COMMUNITY MAP
Surface Water
Minor Civil Division
Oil and Gas Wells
Railroads
Unimproved Roads
County Roads
Highways
Airports
Utilities
Gas Line
Power Line
Community Facilities
Campground
DNR Office/Dist.,Region,Field
Fire/EMS Station
Government Building
Health Department Building
Industrial Park
Medical Facility
Police Station
Port/Harbor
School
Solid Waste Facility
Waste Water Treatment Facility
0 .5 1 1.5
Miles
T27N,R8E
T26N,R8E
LINCOLN
Trask Lake
Lincoln Lake
N McConnell Rd
S Stockton Rd
S Cruzen Rd
S McConnell Rd
F 41
E Dewar Rd
E Fowler Rd
E Procunier Rd
72


GUSTIN TOWNSHIP
HAZARDS MAP
Surface Water
Minor Civil Division
Oil and Gas Wells
Railroads
Unimproved Roads
County Roads
Highways
Airports
National Wetlands Inventory
Aquatic Bed
Emergent
Forested
Open Water
Scrub-Shrub
1978 MIRIS Forests
Aspen, Birch
Central Hardwood
Lowland Conifer
Lowland Hardwood
Northern Hardwood
Other Upland Conifer
Pine
Utilities
Gas Line
Power Line
0 3,000 6,000 9,000
Feet
T27N,R8E
T26N,R8E
LINCOLN
Trask Lake
Lincoln Lake
N McConnell Rd
S Stockton Rd
S Cruzen Rd
S McConnell Rd
F 41
E Dewar Rd
E Fowler Rd
E Procunier Rd
72


HARRISVILLE TOWNSHIP
COMMUNITY MAP
Surface Water
City of Harrisville
Oil and Gas Wells
Railroads
Unimproved Roads
County Roads
Highways
Alcona Airports
OWNERSHIP
Private Lands
Public Lands
Utilities
Gas Line
Power Line
Community Facilities
Campground
DNR Office/Dist.,Region,Field
Fire/EMS Station
Government Building
Health Department Building
Industrial Park
Medical Facility
Police Station
Port/Harbor
School
Solid Waste Facility
Waste Water Treatment Facility
0 2,000 4,000 6,000
Feet
CITY OF HARRISVILLE
LAKE HURON
E Walker Rd
E Medor Rd
E Track Lake Rd
N McGregor Rd
N Poor Farm Rd
E Clark Rd
S Coville Rd
E Springport Rd
E Clemens Rd
E Dean Rd
S McGregor Rd
S Poor Farm Rd
S Everett Rd
E Dellar Rd
E Procunier Rd
T26N,R9E


HARRISVILLE TOWNSHIP
HAZARD MAP
Surface Water
City of Harrisville
Oil and Gas Wells
Railroads
Unimproved Roads
County Roads
Highways:1
Alcona Airports
National Wetlands Inventory
Aquatic Bed
Emergent
Forested
Open Water
Scrub-Shrub
1978 MIRIS Forests
Aspen, Birch
Central Hardwood
Lowland Conifer
Lowland Hardwood
Northern Hardwood
Other Upland Conifer
Pine
Utilities
Gas Line
Power Line
0 2,000 4,000 6,000
Feet
LAKE HURON
E Walker Rd
E Medor Rd
E Track Lake Rd
N McGregor Rd
N Poor Farm Rd
E Clark Rd
S Coville Rd
E Springport Rd
E Clemens Rd
E Dean Rd
S McGregor Rd
S Poor Farm Rd
S Everett Rd
E Dellar Rd
E Procunier Rd
T26N,R9E


HARRISVILLE AIRPORT
CITY OF HARRISVILLE
LAKE HURON
HARRISVILLE STATE PARK
11
12
13
14
72
23
CITY OF HARRISVILLE
COMMUNITY MAP
Surface Water
Oil and Gas Wells
Railroads
Unimproved Roads
County Roads
Highways:1
Airports
OWNERSHIP
Private Lands
Public Lands
Utilities
Gas Line
Power Line
Community Facilities
Campground
DNR Office/Dist.,Region,Field
Fire/EMS Station
Government Building
Health Department Building
Industrial Park
Medical Facility
Police Station
Port/Harbor
School
Solid Waste Facility
Waste Water Treatment Facility
0 700 1,400 2,100
Feet


HARRISVILLE AIRPORT
CITY OF HARRISVILLE
LAKE HURON
HARRISVILLE STATE PARK
11
12
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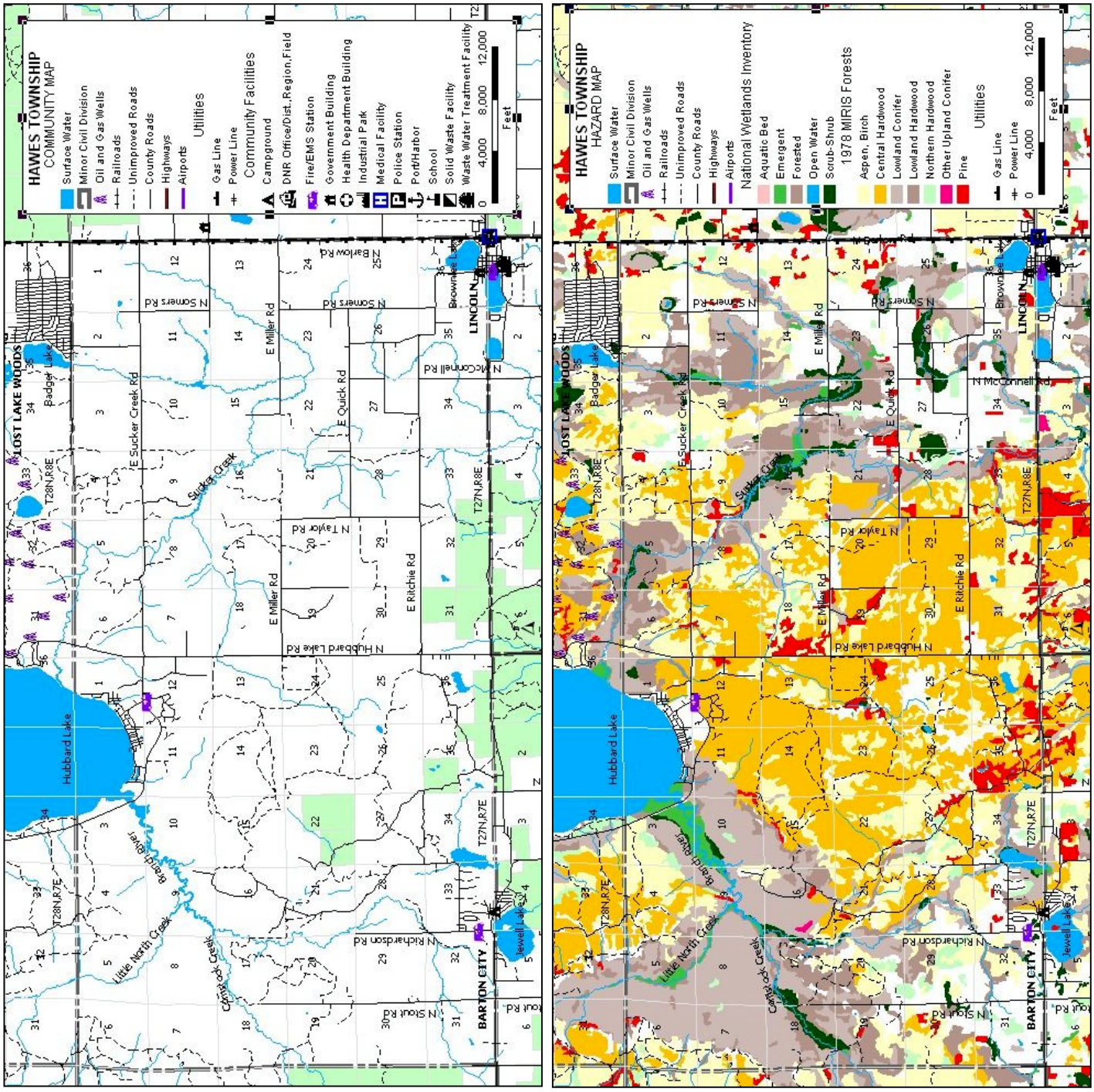
14
72
23
CITY OF HARRISVILLE
HAZARD MAP
Surface Water
Oil and Gas Wells
Railroads
Unimproved Roads
County Roads
Highways
Airports
National Wetlands Inventory
Aquatic Bed
Emergent
Forested
Open Water
Scrub-Shrub
1978 MIRIS Forests
Aspen, Birch
Central Hardwood
Lowland Conifer
Lowland Hardwood
Northern Hardwood
Other Upland Conifer
Pine
Utilities
Gas Line
Power Line
0 800 1,600 2,400
Feet


HAWES TOWNSHIP
COMMUNITY MAP
Surface Water
Minor Civil Division
Oil and Gas Wells
Railroads
Unimproved Roads
County Roads
Highways
Airports
Utilities
Gas Line
Power Line
Community Facilities
Campground
DNR Office/Dist.Region.Field
Fire/EMS Station
Government Building
Health Department Building
Industrial Park
Medical Facility
Police Station
Port/Harbor
School
Solid Waste Facility
Waste Water Treatment Facility
0 4,000 8,000 12,000
Feet
HAWES TOWNSHIP
HAZARD MAP
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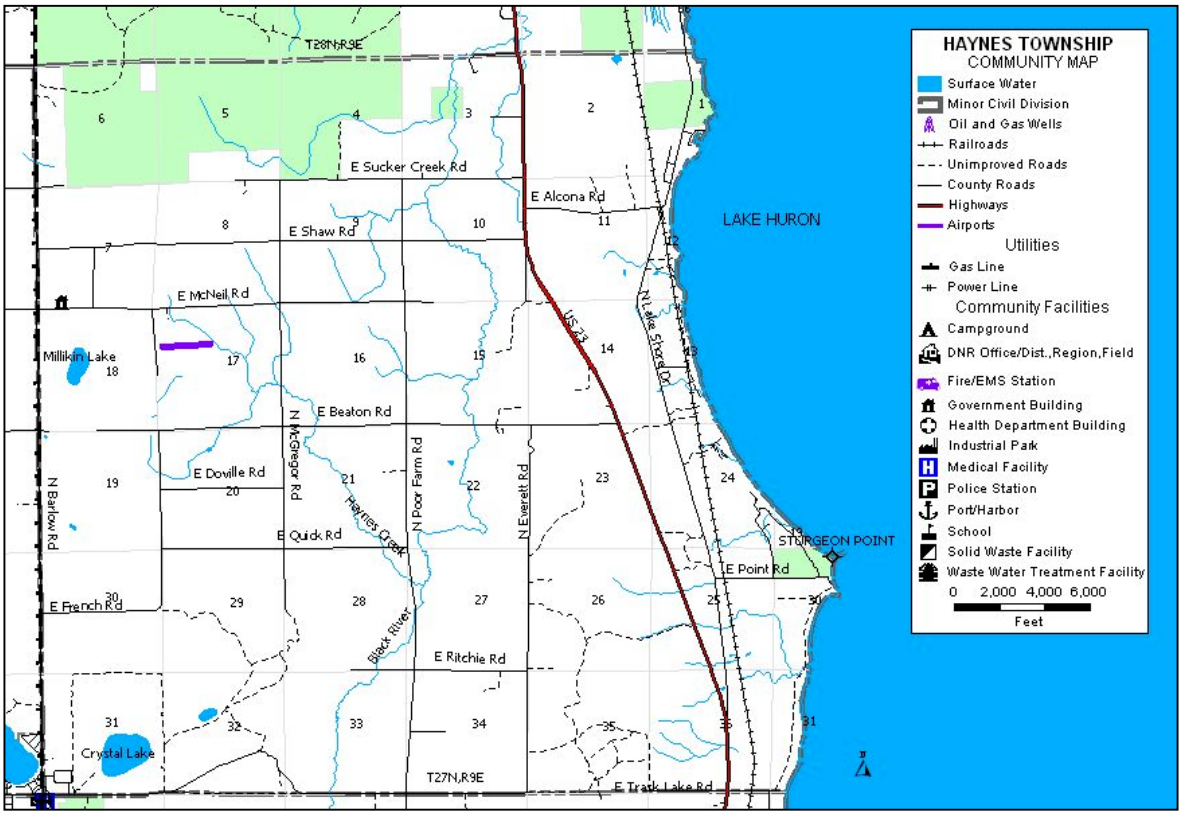
Aquatic Bed
Emergent
Forested
Open Water
Scrub-Shrub
1978 MIRIS Forests
Aspen, Birch
Central Hardwood
Lowland Conifer
Lowland Hardwood
Northern Hardwood
Other Upland Conifer
Pine
LOST LAKE WOODS
LINCOLN
BARTON CITY
Hubbard Lake
Badger Lake
Brownies Lake
Jewell Lake
Sucker Creek
Little North Creek
Camp Cook Creek
Bartlett River
E Sucker Creek Rd
N Somers Rd
E Miller Rd
E Quick Rd
N Taylor Rd
E Ritchie Rd
N Hubbard Lake Rd
N Richardson Rd
N Stout Rd
N McConnell Rd
Barlow Rd
T28N,R8E
T27N,R8E
T28N,R7E
T27N,R7E


HAYNES TOWNSHIP
COMMUNITY MAP
Surface Water
Minor Civil Division
Oil and Gas Wells
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Unimproved Roads
County Roads
Highways
Airports
Utilities
Gas Line
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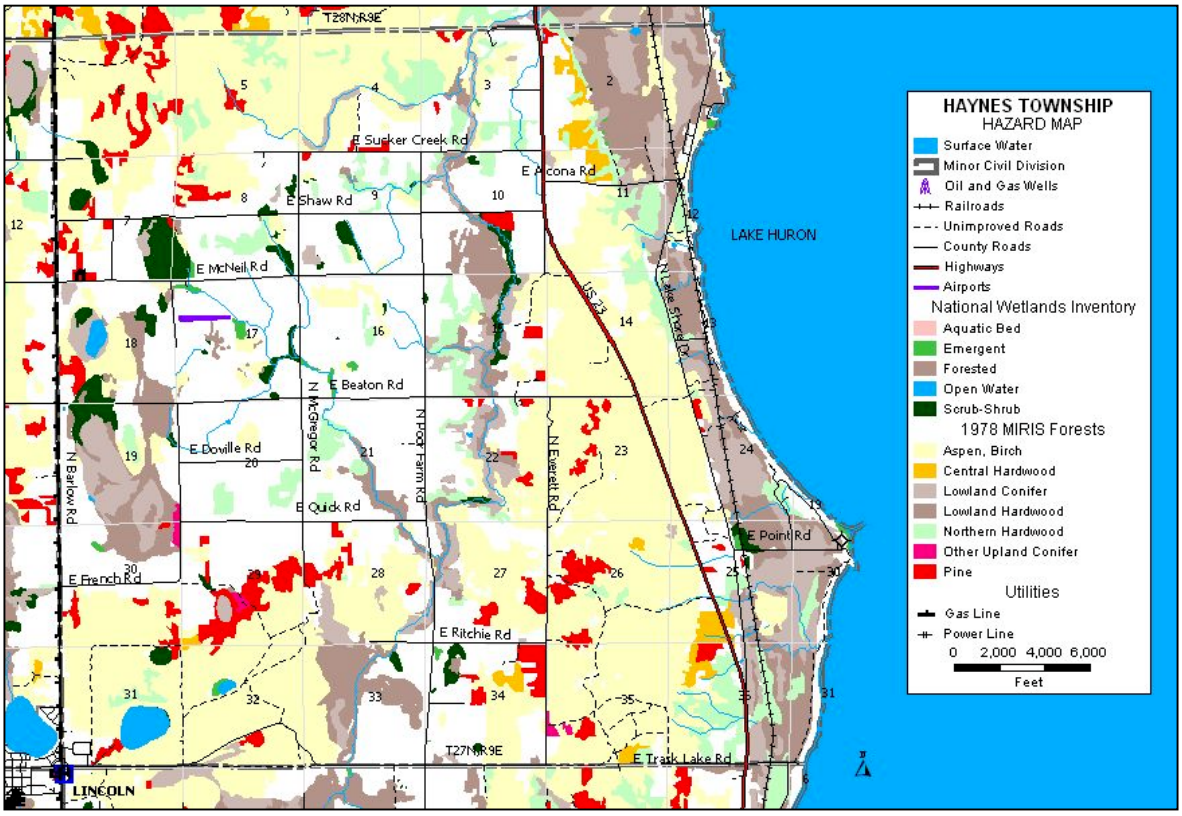
Fire/EMS Station
Government Building
Health Department Building
Industrial Park
Medical Facility
Police Station
Port/Harbor
School
Solid Waste Facility
Waste Water Treatment Facility
0 2,000 4,000 6,000
Feet
LAKE HURON
STURGEON POINT
T28N,R3E
T27N,R9E
E Sucker Creek Rd
E Alcona Rd
E Shaw Rd
E McNeil Rd
E Beaton Rd
E Doville Rd
E Quick Rd
E French Rd
E Ritchie Rd
E Point Rd
E Trask Lake Rd
N Barlow Rd
N Poor Farm Rd
N Everett Rd
N Lake Shore Dr
US-23
Millikin Lake
Crystal Lake
Harrisville Creek
Black River


HAYNES TOWNSHIP
HAZARD MAP
Surface Water
Minor Civil Division
Oil and Gas Wells
Railroads
Unimproved Roads
County Roads
Highways
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National Wetlands Inventory
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1978 MIRIS Forests
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Lowland Hardwood
Northern Hardwood
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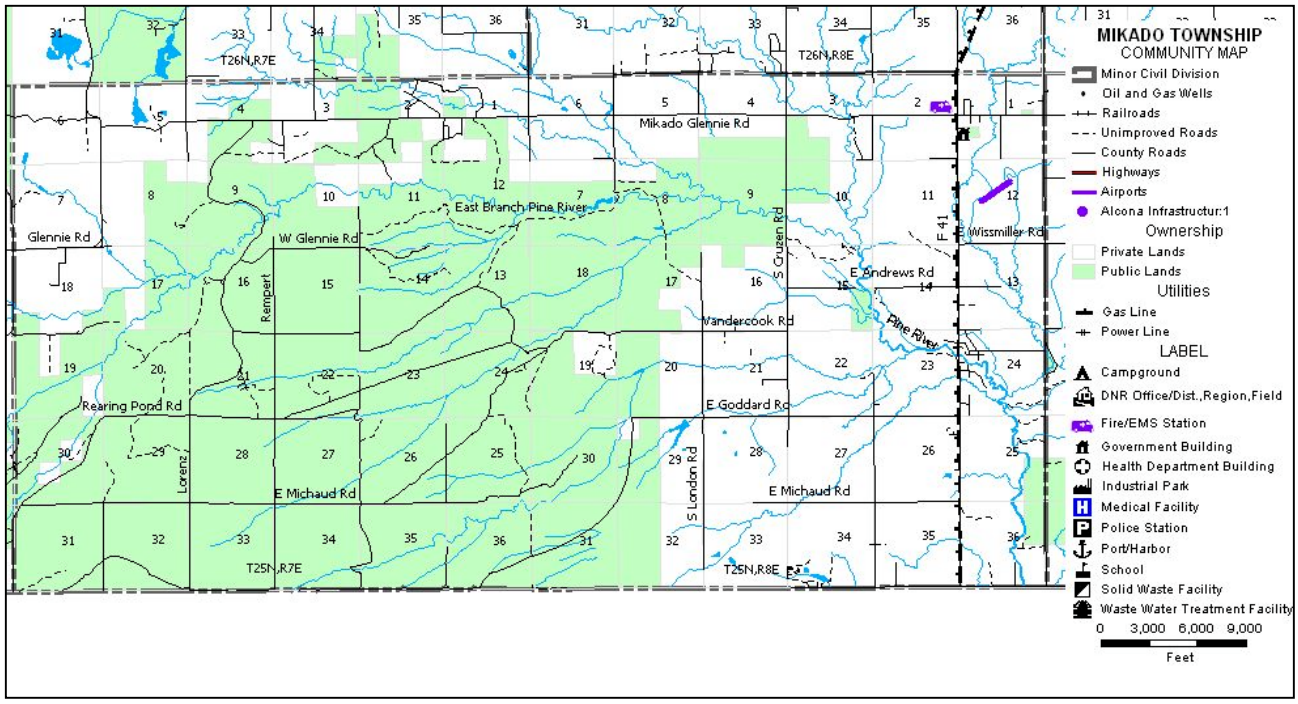
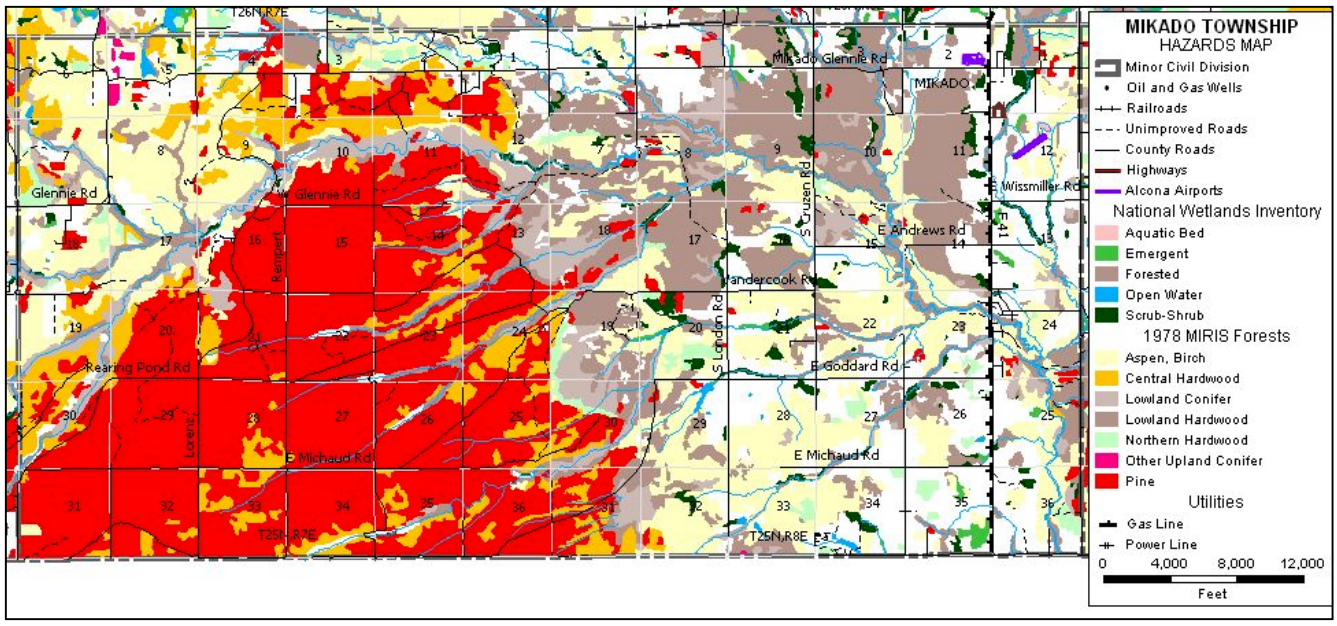
Pine
Utilities
Gas Line
Power Line
0 2,000 4,000 6,000
Feet
LAKE HURON
T28N,R3E
T27N,R9E
E Sucker Creek Rd
E Alcona Rd
E Shaw Rd
E McNeil Rd
E Beaton Rd
E Doville Rd
E Quick Rd
E French Rd
E Ritchie Rd
E Point Rd
E Trask Lake Rd
N Barlow Rd
N Poor Farm Rd
N Everett Rd
N Lake Shore Dr
US-23
LINCOLN


MIKADO TOWNSHIP
COMMUNITY MAP
Minor Civil Division
Oil and Gas Wells
Railroads
Unimproved Roads
County Roads
Highways
Airports
Alcona Infrastructur:1
Ownership
Private Lands
Public Lands
Utilities
Gas Line
Power Line
LABEL
Campground
DNR Office/Dist.,Region,Field
Fire/EMS Station
Government Building
Health Department Building
Industrial Park
Medical Facility
Police Station
Port/Harbor
School
Solid Waste Facility
Waste Water Treatment Facility
0 3,000 6,000 9,000
Feet
T26N,R7E
T26N,R8E
T25N,R7E
T25N,R8E
Mikado Glennie Rd
East Branch Pine River
Glennie Rd
W Glennie Rd
Rempert
S Cruzen Rd
E Wissmiller Rd
F 41
E Andrews Rd
Vandercook Rd
Pine River
Rearing Pond Rd
E Goddard Rd
Lorenz
E Michaud Rd
S London Rd


MIKADO TOWNSHIP
HAZARDS MAP
Minor Civil Division
Oil and Gas Wells
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County Roads
Highways
Alcona Airports
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Scrub-Shrub
1978 MIRIS Forests
Aspen, Birch
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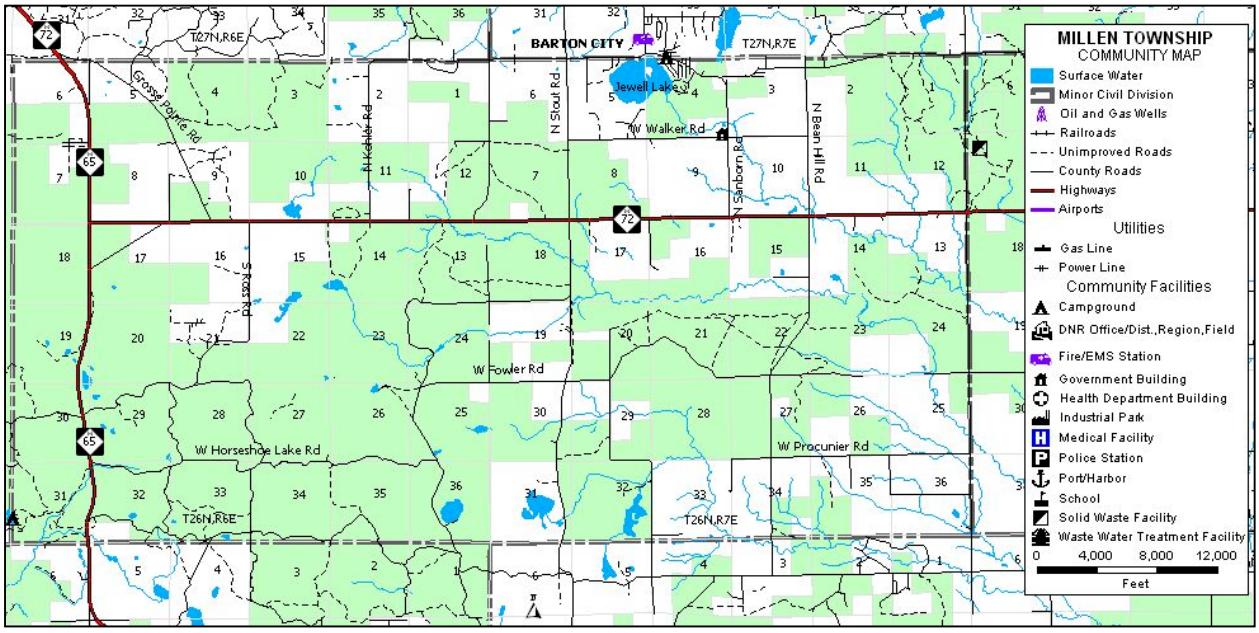
Lowland Conifer
Lowland Hardwood
Northern Hardwood
Other Upland Conifer
Pine
Utilities
Gas Line
Power Line
0 4,000 8,000 12,000
Feet
T26N,R7E
T26N,R8E
T25N,R7E
T25N,R8E
Mikado Glennie Rd
MIKADO
Glennie Rd
W Glennie Rd
Rempert
S Cruzen Rd
E Wissmiller Rd
F 41
E Andrews Rd
Vandercook Rd
Rearing Pond Rd
E Goddard Rd
Lorenz
E Michaud Rd
S London Rd


MILLEN TOWNSHIP
COMMUNITY MAP
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County Roads
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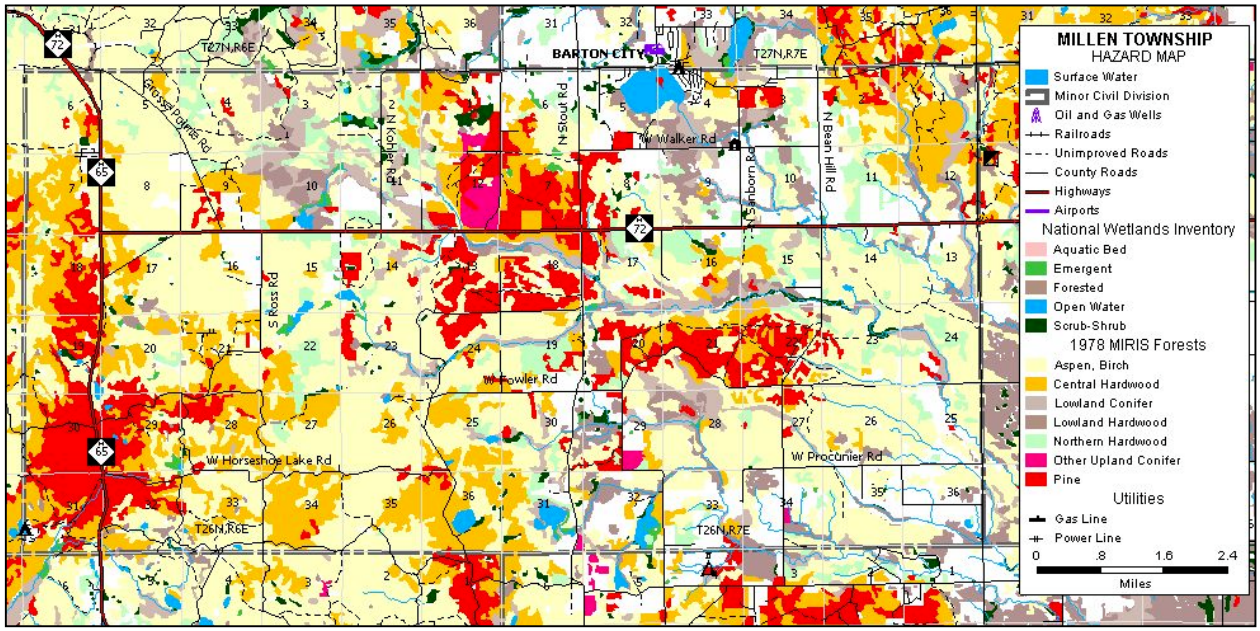
Government Building
Health Department Building
Industrial Park
Medical Facility
Police Station
Port/Harbor
School
Solid Waste Facility
Waste Water Treatment Facility
0 4,000 8,000 12,000
Feet
BARTON CITY
Jewell Lake
W Walker Rd
W Fowler Rd
W Horseshoe Lake Rd
W Procunier Rd
N Stout Rd
N Bean Hill Rd
N Sanborn Rd
S Ross Rd
T27N,R6E
T27N,R7E
T26N,R6E
T26N,R7E


MILLEN TOWNSHIP
HAZARD MAP
Surface Water
Minor Civil Division
Oil and Gas Wells
Railroads
Unimproved Roads
County Roads
Highways
Airports
National Wetlands Inventory
Aquatic Bed
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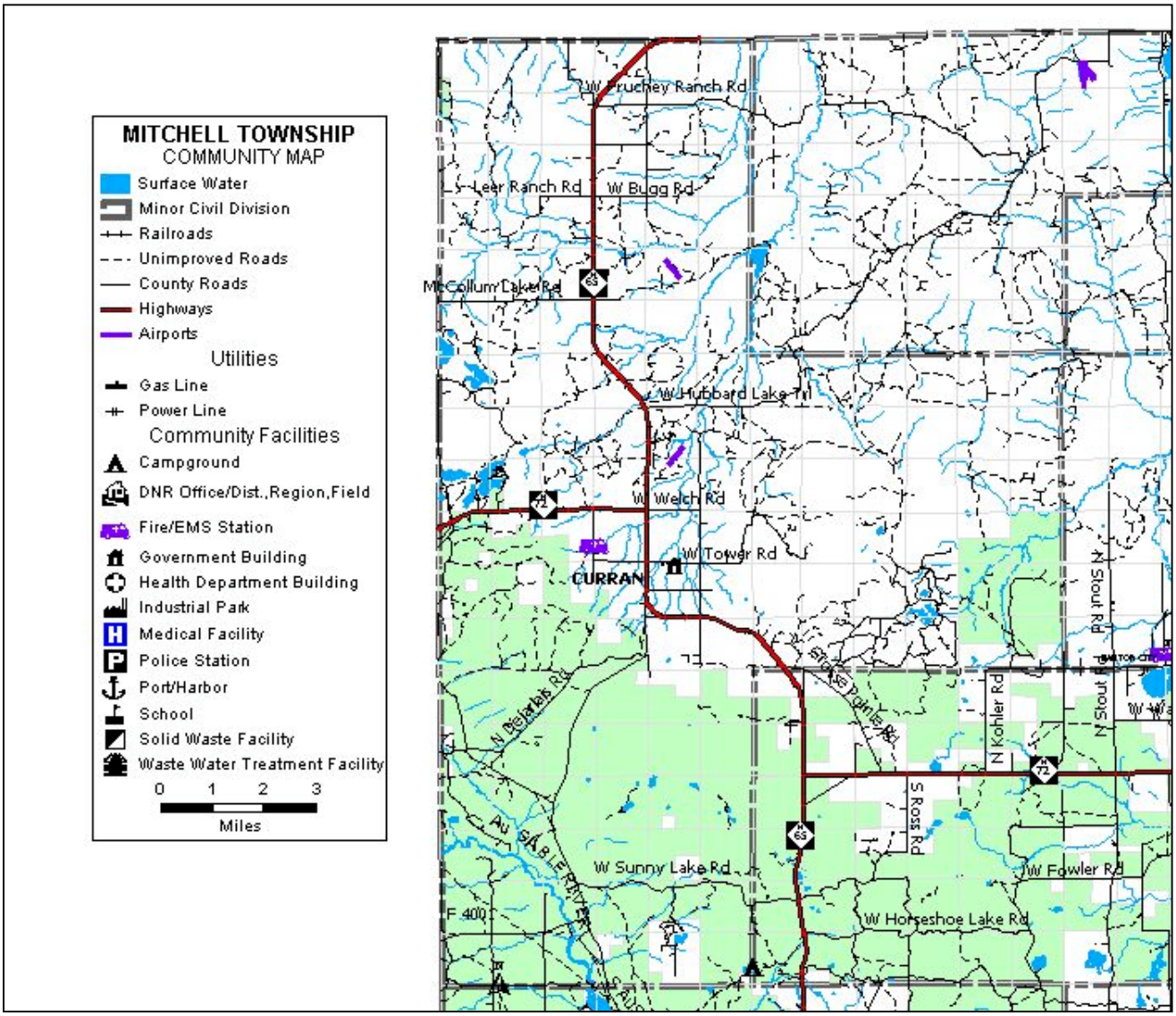
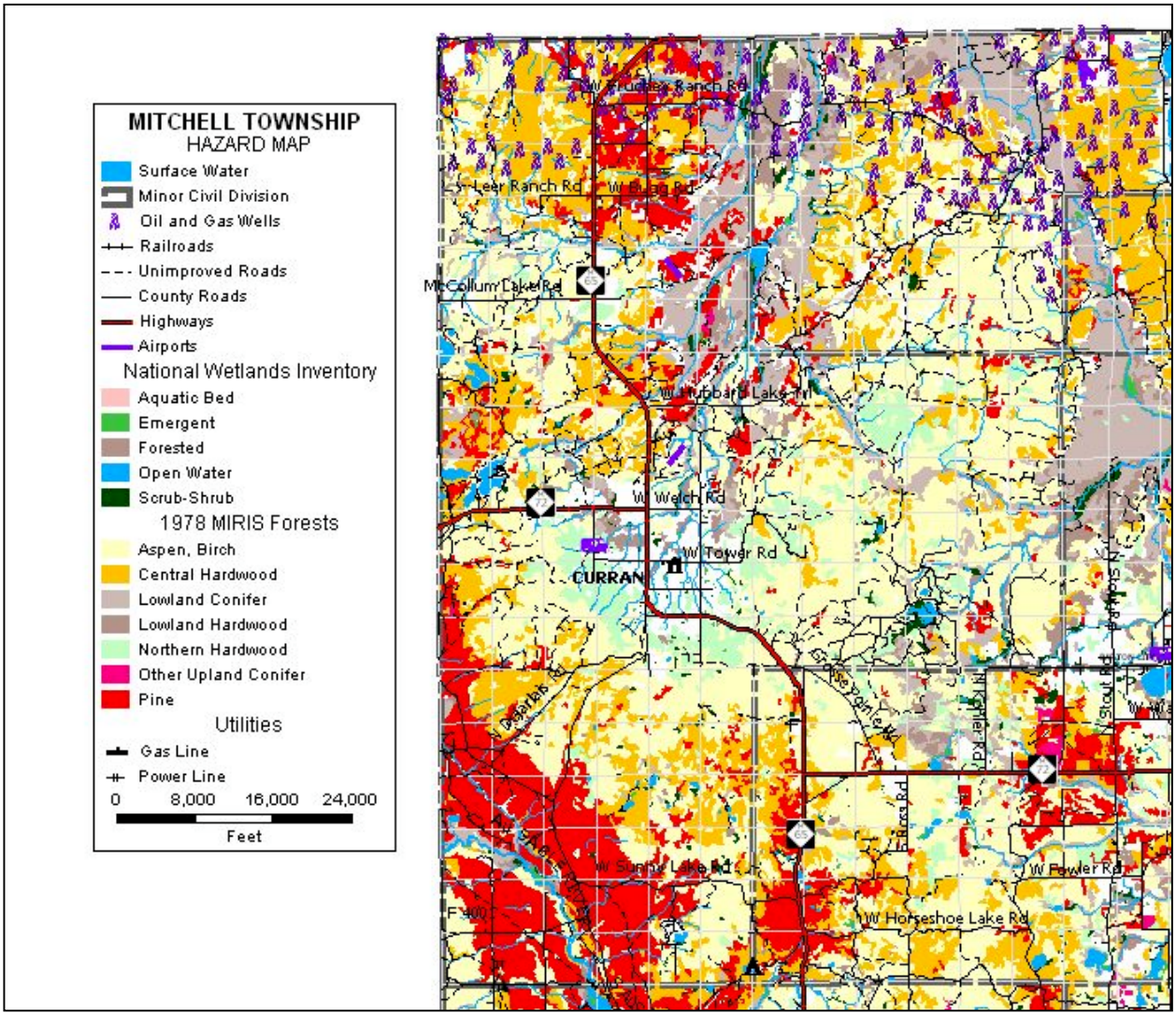
1978 MIRIS Forests
Aspen, Birch
Central Hardwood
Lowland Conifer
Lowland Hardwood
Northern Hardwood
Other Upland Conifer
Pine
Utilities
Gas Line
Power Line
0 .8 1.6 2.4
Miles
BARTON CITY
W Walker Rd
W Fowler Rd
W Horseshoe Lake Rd
W Procunier Rd
N Stout Rd
N Bean Hill Rd
N Sanborn Rd
S Ross Rd
T27N,R6E
T27N,R7E
T26N,R6E
T26N,R7E


MITCHELL TOWNSHIP
COMMUNITY MAP
Surface Water
Minor Civil Division
Railroads
Unimproved Roads
County Roads
Highways
Airports
Utilities
Gas Line
Power Line
Community Facilities
Campground
DNR Office/Dist.,Region,Field
Fire/EMS Station
Government Building
Health Department Building
Industrial Park
Medical Facility
Police Station
Port/Harbor
School
Solid Waste Facility
Waste Water Treatment Facility
0 1 2 3
Miles
W Prucney Ranch Rd
Leer Ranch Rd
W Bugg Rd
McCollum Lake Rd
W Hubbard Lake Trl
W Welch Rd
W Tower Rd
CURRAN
N Stout Rd
N Kohler Rd
S Ross Rd
W Sunny Lake Rd
W Fowler Rd
W Horseshoe Lake Rd
F 400


MITCHELL TOWNSHIP
HAZARD MAP
Surface Water
Minor Civil Division
Oil and Gas Wells
Railroads
Unimproved Roads
County Roads
Highways
Airports
National Wetlands Inventory
Aquatic Bed
Emergent
Forested
Open Water
Scrub-Shrub
1978 MIRIS Forests
Aspen, Birch
Central Hardwood
Lowland Conifer
Lowland Hardwood
Northern Hardwood
Other Upland Conifer
Pine
Utilities
Gas Line
Power Line
0 8,000 16,000 24,000
Feet
W Hubbard Lake Trl
W Welch Rd
W Tower Rd
CURRAN
W Sunrise Lake Rd
W Horseshoe Lake Rd
W Fowler Rd
Stout Rd