Chapter 7 – Risk and Vulnerability Assessment

Hazard Ranking Methodology

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

Evaluation Criteria

Selection of evaluation criteria was accomplished by determining what aspects of the hazards were of most concern to the community. This process was completed by assigning a level of importance ranging from "Always Important" to "Not Worth Considering" to each hazard aspect. **Table 7-1** shows a complete list of all aspects considered and level of importance assigned by the committee.

Each evaluation criteria was then assigned a "weight" to express the level of importance each criteria will have in ranking hazards. The sum of weights of all of evaluation criteria must equal 100%. Each individual criteria was then assigned a percentage value based on the relative importance that specific criteria would have in ranking the various hazards. Point values of 1-10 were assigned using the scoring parameters as outlined in the Evaluation Measure Benchmark Factors shown below. Using a spread sheet, values were input and calculated to provide a hazard ranking as shown in **Table 7-2**.

Table 7-1
Cheboygan County Hazard Evaluation Criteria

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

Hazard Analysis Evaluation Measures

This model uses a common set of 8 evaluation measures to evaluate each hazard facing the community. Those measures are: 1) likelihood of occurrence; 2) potential for damage; 3) potential for casualties; 4) ability to mitigate; 5) public awareness; 6) current response capabilities; 7) inter agency cooperation; and 8) economic impact. Each corresponding benchmark factor has been assigned a specific point value (10, 7, 4 or 1 point), based on each individual factor's relative severity and negative impacts. In recognition of the fact that some factors need to be given more consideration than others, each of the criteria was weighted. A percentage value has been assigned to each measure based on the relative significance of the measure in ranking the hazards. The sum of all measures must equal 100 percent. The following is a synopsis of each hazard evaluation measure, weight and benchmark factor used in this analysis:

Likelihood of Occurrence

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

Size of Affected Area

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

Capacity to Cause Physical Damages

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

Speed of Onset

Speed of onset refers to the amount of time it typically takes for a hazard event to occur. Speed of onset is an important evaluation measure because the faster an event occurs, the less time local governmental agencies typically have to warn the potentially impacted population of appropriate protective actions.

Potential for Causing Casualties

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

Percent of Population Affected

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

Economic Effects

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

Duration

Duration refers to the time period the hazard event is actively present and causing damage (often referred to as the "time on the ground".) Duration is not always indicative of the damaging potential of a hazard event (a tornado is a good example). However, in most cases, the longer an event is "active" and thus causing damage, the greater the total damages will be.

Seasonal Pattern

Seasonal pattern refers to the time of year in which a particular hazard event can reasonably be expected to occur. Some hazard events can occur at any time of the year, while others occur primarily during one particular season (i.e., blizzards in winter). Oftentimes, hazard patterns coincide with peak tourism seasons and other times of temporary population increases, greatly increasing the vulnerability of the population to the negative impacts of certain hazard events.

Predictability

Predictability refers to the ease with which a particular hazard event can be predicted - in terms of time of occurrence, location, and magnitude. Predictability is important because the more predictable a hazard event is, the more likely it is a community will be able to warn the potentially impacted population and take other preventive measures to minimize loss of life and property.

Collateral Damage

Collateral damage refers to the possibility of a particular hazard event causing secondary damage and impacts. For example, blizzards and ice storms can cause power outages, which can cause loss of heat, which can lead to hypothermia and possible death or serious injury. Generally, the more collateral damage a hazard event causes, the more serious a threat the hazard is to a community.

Environmental Impact

Environmental Impact refers to the environmental damage that may be caused by a particular hazard event. The effects of a hazard event must be thought through to identify possible environmental impact. For example, a flood event may overwhelm a sewage treatment plant which then discharges raw sewage thereby contaminating water supplies.

Availability of Warnings

Availability of warnings indicates the ease with which the public can be warned of a hazard. This measure does not address the availability of warning systems in a community, per se. Rather, it looks at the overall availability of warning in general for a particular hazard event. For example, a community might receive warning that a flood will occur within 24 hours, but receive no warning when a large structural fire occurs. Generally, hazards that have little or no availability of warning tend to be more problematic for a community from a population protection and response standpoint.

Mitigative Potential

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

Public Awareness

The amount of public awareness indicates the ease with which the public can be informed about particular hazards. This measure does not address the current level of public awareness that exists in the community. Rather, it looks at the overall value of public awareness in general for a particular hazard event.

Hazard Analysis Evaluation Benchmark Factors

<u>Likelihood of Occurrence</u>

Excessive Occurrence	**10 pts**
High Occurrence	**7 pts**
Medium Occurrence	**4 pts**
Low Occurrence	**1 pt**

<u>Speed of Onset</u>

Minimal/No Warning	**10 pts**
Less than 12 Hours	**7 pts**
12-24 Hours	**4 pts**
Greater than 24 Hours	**1 pt**

<u>Economic Effects</u>

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

<u>Seasonal Pattern</u>

Year-round Occurrences	**10 pts**
Three Season Occurrences	**7 pts**
Two Season Occurrences	**4 pts**
One Season Occurrence	**1 pt**

<u>Collateral Damage</u>

High Possibility	**10 pts**
Good Possibility	**7 pts**
Some Possibility	**4 pts**
No Possibility	**1 pt**

<u>Mitigative Potential</u>

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

<u>Environmental Damage</u>

High Possibility	**10 pts**
Good Possibility	**7 pts**
Some Possibility	**4 pts**
No Possibility	**1 pt**

<u>Public Awareness</u>

Significant Value	**10 pts**
Some Value	**7 pts**
Limited Value	**4 pts**
No Value	**1 pts**

<u>Affected Area</u>

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

<u>Population Impact</u>

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

<u>Duration</u>

Long Duration	**10 pts**
Medium Duration	**7 pts**
Short Duration	**4 pts**
Minimal Duration	**1 pt**

<u>Predictability</u>

Unpredictable	**10 pts**
Somewhat Predictable	**7 pts**
Predictable	**4 pts**
Highly Predictable	**1 pt**

<u>Availability of Warnings</u>

Warnings Unavailable	**10 pts**
Generally Not Avail.	**7 pts**
Sometimes Available	**4 pts**
Warnings Available	**1 pt**

<u>Percent of Population Affected</u>

60% to 100%	**10 pts**
30% to 60%	**7 pts**
15% to 30%	**4 pts**
15% or less	**1 pts**

<u>Damage Capacity</u>

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

Table 7-2
Cheboygan County Hazard Rating

Criteria	Likelihood to Occur	Size of Area Affected	Warning system available	% Pop. Affected	Ability to Mitigate	Collateral Damage	Total Weight Must = 100%	
WEIGHT =========>	30%	20%	5%	15%	25%	5%	100%	
Hazards								
Winter Weather Hazard	10	10	1	10	5	7	8.15	1
Fixed Site Hazmat	7	7	4	4	7	7	6.40	2
Transportation Hazmat	10	4	10	4	4	7	6.25	3
Extreme Temperature	3	10	3	10	5	2	5.90	4
Transportation Accident	10	2	10	4	4	7	5.85	5
Public Health	4	7	6	7	7	2	5.80	6
Infrastructure Failure	4	5	7	5	7	4	5.25	7
Structural Fire	10	3	7	1	4	2	5.20	8
Terrorism/Sabotage/WMD	4	5	10	5	4	5	4.70	9
Dam Failure	4	4	4	1	7	7	4.45	10
Civil Disturbance	4	5	4	4	5	3	4.40	11
Wildfire	7	3	6	1	4	4	4.35	12
Shoreline Flooding	5	5	1	4	4	4	4.35	12
Severe Winds	4	4	3	4	5	7	4.35	14
Lightning	10	2	5	1	1	3	4.20	15
Nuclear Attack	1	10	2	7	1	7	4.05	16
Pipeline Accident	5	2	10	1	5	4	4.00	17
Earthquake	1	10	7	5	1	4	3.85	18
Hail	4	4	5	3	2	3	3.35	19
Tornados	4	1	5	5	2	7	3.25	20
Scrap Tire Fire	1	1	7	1	8	4	3.20	21
Riverine Flooding	1	3	5	4	4	7	3.10	22
Drought	1	4	2	5	2	7	2.80	23
Oil/Gas Well Incident	1	1	10	1	4	2	2.25	24
Subsidence	1	1	10	1	1	2	1.50	25

Composite Hazard Rankings

High to Moderate County Significance

Winter Weather Hazards – 8.15
Fixed Site Hazmat – 6.40
Transportation Hazmat – 6.25
Riverine/urban Flooding – 5.95
Extreme Temperatures – 5.9
Transportation Accidents –5.85
Public Health – 5.8

Moderate to Low County Significance

Infrastructure Failure – 5.25
Terrorism/Sabotage/WMD – 4.7
Dam Failure – 4.45
Civil Disturbance – 4.4

Low County Significance

Shoreline Flooding – 4.35
Wildfire – 4.35
Severe Winds – 4.35
Lightning – 4.2
Nuclear Attack – 4.05
Pipeline Accident – 4.0

Risk Assessment and Vulnerability Assessment Summary

Risk Assessment

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

- **High Risk:** -- very likely to occur during hazard mitigation planning horizon of 20 years, and/or affect all or most of the county.
- **Medium Risk:** -- somewhat likely to occur during hazard mitigation planning horizon of 20 years, and/or affect a significant area of the County.
- **Low Risk:** -- means it is not likely to occur, or cover only a limited area within county.

Vulnerability Assessment

This step looks at such points as population concentrations, age-specific populations, development pressures, types of housing (older homes, mobile homes), presence of agriculture, sprawl (spreading resources too thin), and other issues that may make Cheboygan County more vulnerable to specific hazards. Basic criteria are listed below.

- **High Vulnerability: --** If an event occurred it would have severe impacts over large geographic areas or more densely populated areas and have a serious financial impact on County residents and businesses.
- **Medium Vulnerability: --** If an event occurred it would have confined impacts on the safety of residents but would have a financial impact on County residents and businesses.
- **Low Vulnerability: --** If an event occurred it would have very minimal impact on the safety of County residents and minimal financial impact on County residents and businesses.

Table 7-3,
Cheboygan County -- Risk and Vulnerability Assessment Summary

Ranked Hazards in Cheboygan County	Risk Assessment	Vulnerability Assessment
Winter Weather Hazards	**High**	**High**
Fixed Site Hazmat	**High**	**Medium**
Transportation Hazmat	**High**	**Medium**
Riverine Flooding	**High**	**Low**
Extreme Temperatures	**High**	**High**
Transportation Accidents	**High**	**Medium**
Public Health	**Medium**	**Medium**
Infrastructure Failure	**Medium**	**High**
Terrorism/Sabotage/WMD	**Medium**	**Low**
Dam Failure	**Medium**	**Low**
Civil Disturbance	**Medium**	**Low**
Shoreline Flooding	**Medium**	**Low**
Wildfire	**Medium**	**Low**
Severe Winds	**High**	**Medium**
Nuclear Attack	**Low**	**Medium**
Oil/Gas Pipeline Accident	**Low**	**Medium**
Shoreline Erosion	**Low**	**Low**
Oil/Gas Well Incident	**Low**	**Low**
Drought	**Low**	**Medium**
Lightning	**Low**	**Low**
Hail	Low	Low
Scrap Tire Fire	Low	Low
Subsidence	Low	Low
Earthquake	Low	Low

Specific Vulnerabilities in Cheboygan County

Winter Weather Hazards.

Located at the northern tip of Michigan's Lower Peninsula with an extensive shoreline along Lake Huron Cheboygan County is very susceptible to all forms of severe winter weather. The description and extent of these weather conditions are defined in Chapter 6. Although local residents are generally prepared to cope with these conditions, and State and local highway and police agencies are equipped to provide adequate response to these often extreme conditions the immediate and rapid onset of these conditions, especially to travelers, can often be extremely hazardous. I-75 and the Mackinaw Bridge to the Upper Peninsula serve as the principal land-transport north-south artery in the state, and carry significant traffic all times of the year. The following paragraphs from the Traverse City Record Eagle of March 11, 2002 reflect the effect winter conditions have on travel and the local infrastructure.

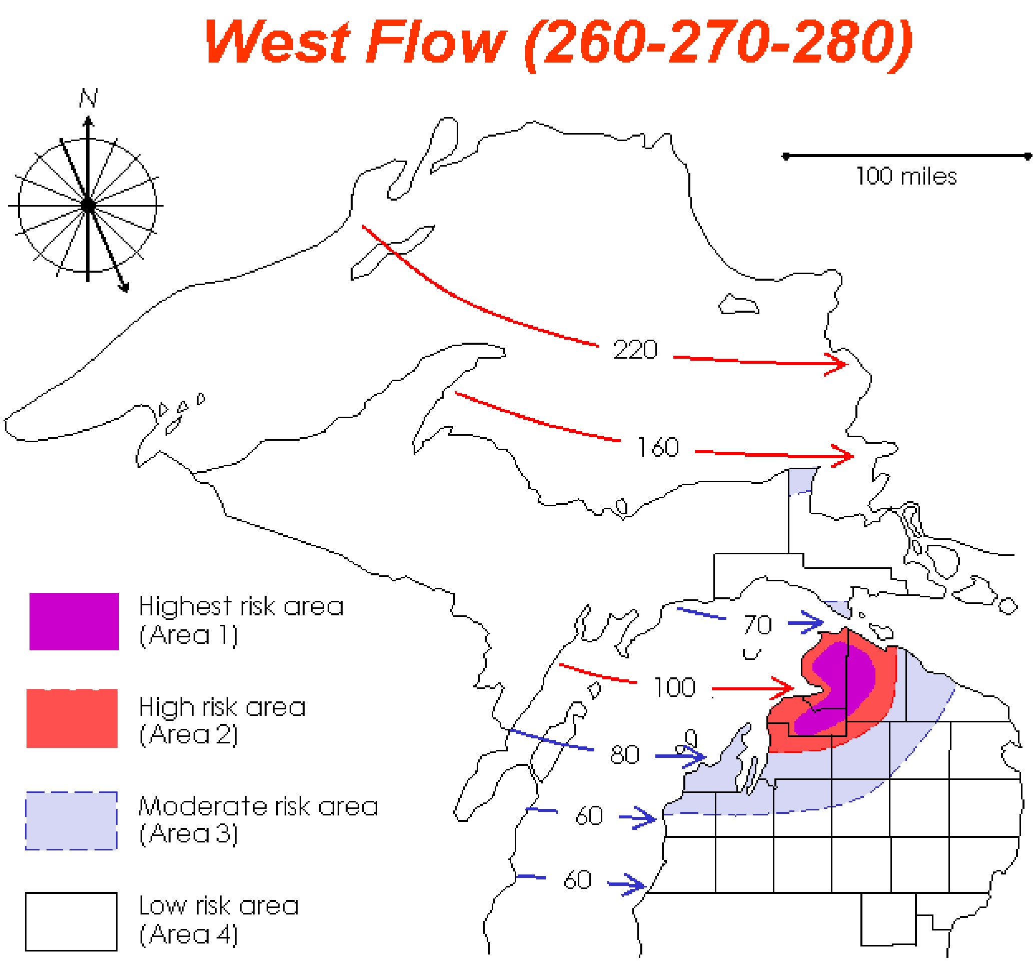
> The winds and snow were blamed for a still uncounted number of traffic accidents around the area, but in some cases motorists added to the problem by driving too fast for conditions. By 8 p.m. Saturday, the Michigan State Police regional dispatch center in Gaylord had declared the situation "extremely dangerous" and ordered drivers to leave the roadways and take refuge - but not everyone got the message. And the accidents continued on Sunday. In Cheboygan County, two minor crashes took place within a few minutes of each other along the same stretch of northbound I-75 just after 8 a.m.
>
> Although the situation Sunday evening was better than it had been on Saturday, accidents continued to take place up and down the northern Lower Peninsula, particularly toward the center of the state. "There's still a whole bunch of people going in the ditch," said Michigan State Police dispatcher…in Gaylord.
>
> Utility crews worked through the weekend to restore power to tens of thousands of customers left in the dark after high winds and winter weather tore through Michigan. About 110,000 Edison customers were without power Sunday afternoon at least 150,000 of the utility's customers had lost power since early Saturday.

In many cases it is not the extent or overall amount of snowfall, but the rapid change in encountered conditions. With the right combination of wind-speed and direction, white-out conditions can occur in otherwise clear conditions. Knowledge of these conditions through signs posted at critical positions along I-75 and other vulnerable state highways could provide warning of rapid deterioration of driving conditions to unsuspecting drivers.

The National Oceanic and Atmospheric Administration (NOAA) office in Gaylord, Michigan has prepared a series of maps relating wind direction and the risk and distribution of Lake-Effect snow across the Northern Lower and Eastern Upper Peninsulas of Michigan. From this series of maps it becomes apparent that when winds are from the West **(Figure 7-1)** and West-Southwest **(Figure 7-2)** Cheboygan County, especially along the I-75 corridor and Straits area are vulnerable to significant Lake-Effect snow, and often accompanying white-out conditions.

Actions involving public education and communication are important approaches toward mitigating this winter hazard. A program to distribute situational information to drivers at the Mackinaw Bridge and northbound rest areas would be beneficial. NOAA is also urging road-signs, both portable and fixed to provide travelers with direct and immediate warnings of changing road conditions.

Figure 7-1, Lake Effect Snow Vulnerability, from West Flow
Source: NOAA, Gaylord, MI

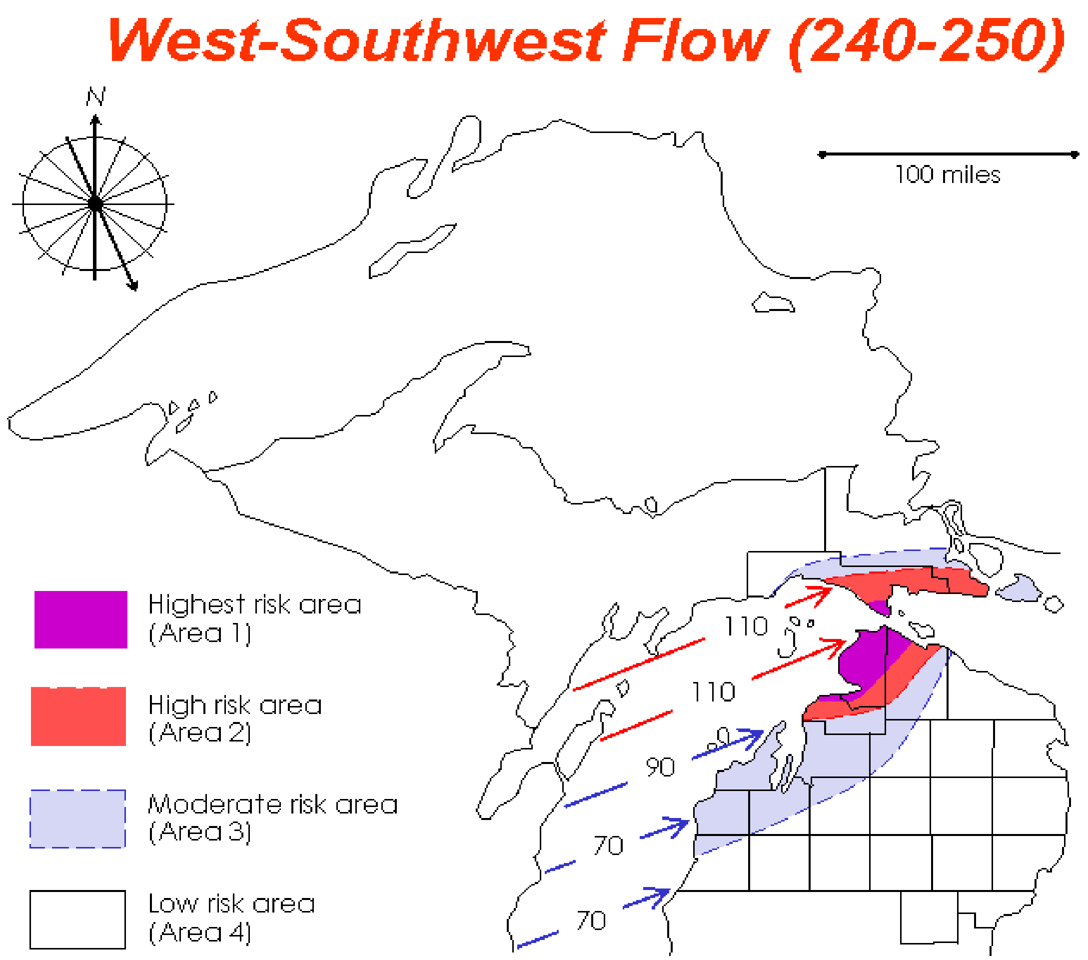


Synoptic Pattern: W Flow regimes can produce heavy snow. The heaviest snowfall off of Lake Superior generally remains north of Chippewa county. Though low level trajectories do not cross Lake Superior, heavy snowfall can still occur across parts of northwest Lower, especially while Green Bay is unfrozen.

Eastern Upper: Far northern Chippewa county near Whitefish Point is most susceptible. In most cases, a land breeze off of Alger and Luce counties will push the most intense bands north of Whitefish Point. Watch for snow bands to clip extreme southern Mackinac county near St. Ignace. In most cases, a land breeze will push these snow bands just south of the Mackinac Bridge.

Northern Lower: Areas around Petoskey, Charlevoix, Ellsworth, Vanderbilt, and Indian River are most susceptible. West winds over Lake Michigan (including Green Bay) are just able to attain a 100 mile fetch into Charlevoix and Emmet counties. The resulting snow bands can push as far east at Presque Isle and Montmorency counties if the winds are strong. A very short Lake Michigan fetch greatly reduces snowfall in the Manistee and Cadillac areas.

Figure 7-2, Lake Effect Snow Vulnerability, from West-Southwest Flow
Source: NOAA, Gaylord, MI



Synoptic Pattern: The WSW flow associated with this regime is often the result of backing winds ahead of a surface trough. Such a trough can help to increase the low-level convergence over Lake Michigan and ultimately lead to snow intensification, especially if mid clouds are present (lake-enhanced snowfall).

Eastern Upper: Mackinac county is most susceptible. Fetches are very long across northern Lake Michigan. Furthermore, the shoreline orientation of the Straits area favors additional land breeze convergence and snow intensification.

Northern Lower: Areas around Charlevoix, Harbor Springs, Pellston, and Cheboygan are most susceptible. WSW winds over northern Lake Michigan result in fetches of greater than 100 miles. Watch for a land breeze to develop off of northwest Lower. This can lead to a dominant band which nearly parallels the shoreline. In these instances, the heaviest snow often falls in Emmet and far northern Cheboygan counties. The shorter fetch over central Lake Michigan greatly reduces the prospects for heavy snowfall south of Traverse City (unless significant enhancement is occurring).

N
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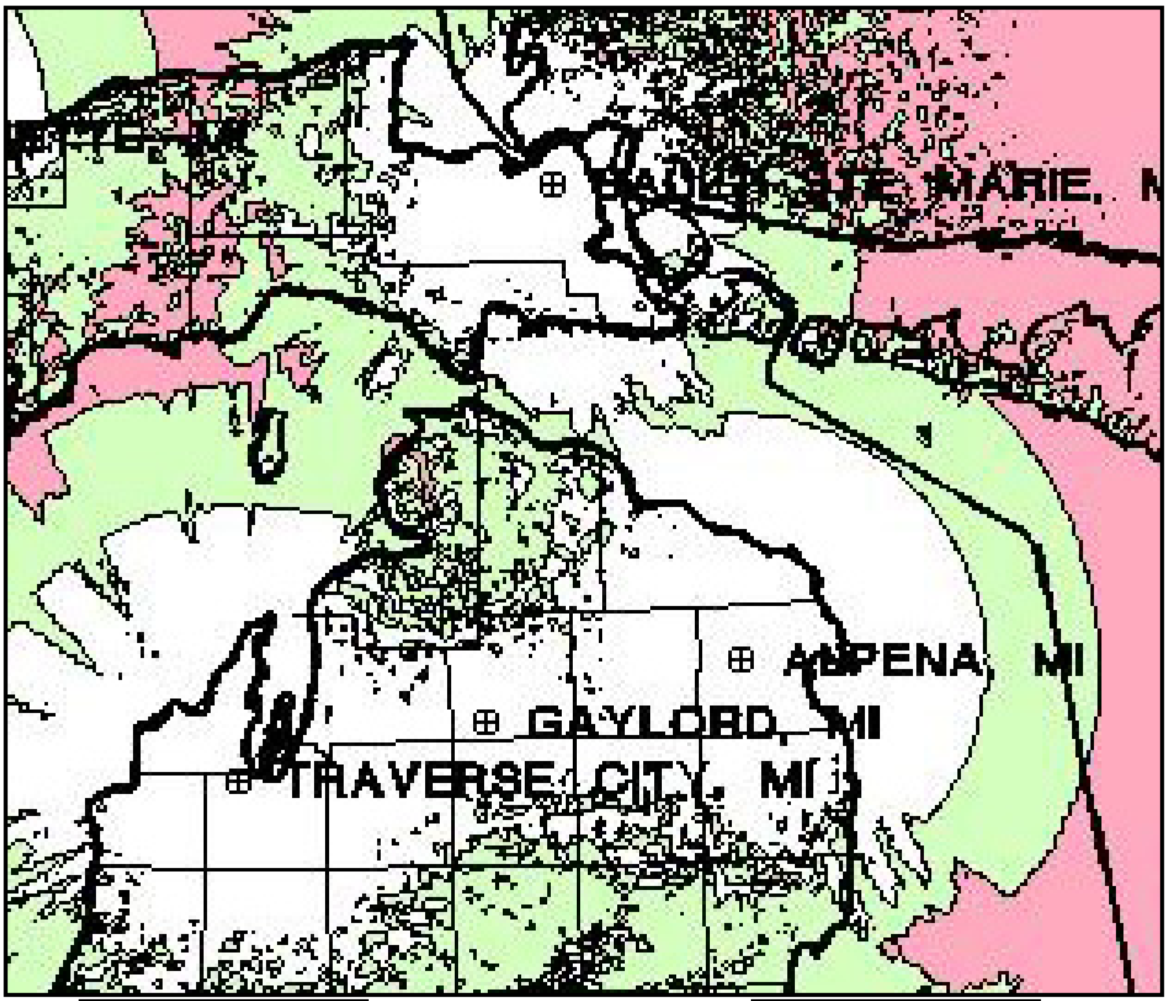
NOAA Weather Radio broadcasts warnings and post-event information for all types of hazards - weather (such as tornadoes, hurricanes, and floods), natural (such as earthquakes, forest fires, and volcanic activity),technological (such as chemical releases, oil spills, nuclear power plant emergencies, etc.), and national emergencies. Working with other Federal agencies and the Federal Communications Commission (FCC) Emergency Alert System (EAS), NOAA Weather Radio is an all-hazards radio network, making it the single source for the most comprehensive weather and emergency information available to the public.

Another source of weather related vulnerability for the Cheboygan County, and the northern tip of the Lower Pensinula has to do with distribution of NOAA Weather Radio signal. At this time there is no NOAA Weather Radio coverage for counties located in that area. **(Figure 7-3)**

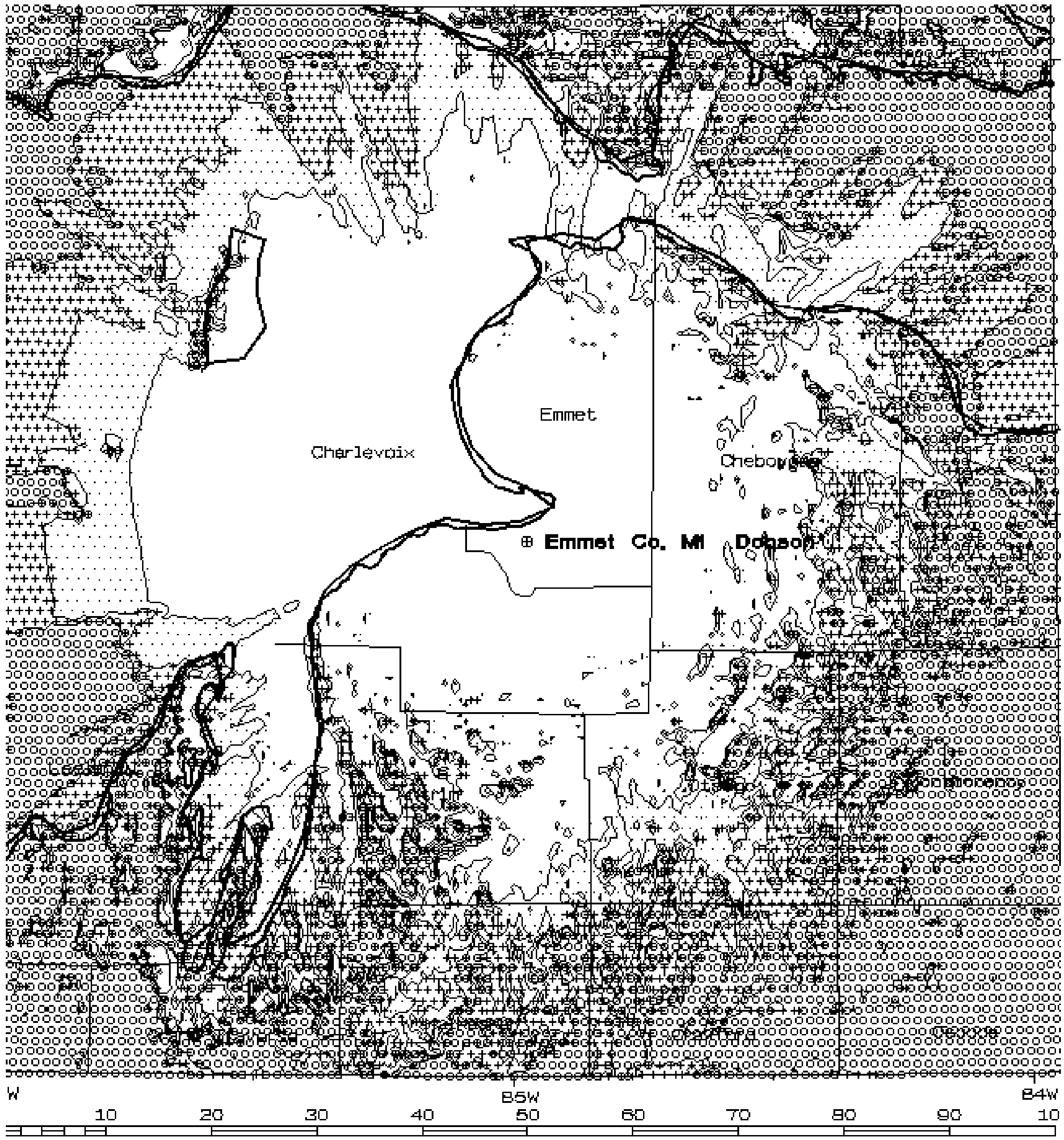
Figure 7.3 – Current NOAA Radio Coverage
Source: NOAA, Gaylord, MI



Coverage

No Coverage

Figure 7.4 – Proposed NOAA Radio Coverage
Source: NOAA, Gaylord, MI



Miles

Field Intensity (dBuv/m)

	Greater than 20.00	+ + + + +	**5.00 to 12.00**
. . . .	**12.00 to 20.00**	○○○○○○○	**Less than 5.00**

A site for a NOAA Weather Radio transmitter has been identified in Emmet County. Development of this transmitter would provide coverage for almost all of Cheboygan County. **(Figure 7-4)** This would open the entire region to the hazard mitigation advantages inherent in the NOAA Weather Radio system.

Riverine and Urban Flooding

Major flooding was recorded in Cheboygan on the Little Black River in 1923, 1925, 1929, 1935, 1938, 1943, 1948 and 1954. The largest of these floods was the 1923 flood, followed be the 1938 flood. Average annual floodwater damages were primarily to urban property in the City of Cheboygan estimated from Work Plans to be $35,612.07 at current dollar value. The installation of flood prevention structural measures has had a very significant effect in reducing floodwater damages in the flood plain area of the Little Black Watershed.

In September of 1997, the U.S. Department of Agriculture, Natural Resource Conservation Service published a Flood Plain Management Study for the Little Black River. The approximate areas of inundation for the 100-year and 500-year floods were shown and indicated minimal vulnerability to the areas. The Plan suggested several Non-structural Measures to help mitigate flooding in the Little Black Watershed"

- Develop and implement, or update a flood plain protection and zoning ordinance based on the 100-year frequency high water profile and the flood plain delineation.
- Flood-proof existing buildings and residences in the flood plain to reduce flood damages.
- Develop alternate routes for automobile, truck and emergency vehicle traffic around those roads the will be inundated during flooding.
- Debris, fallen trees and brush should be removed from the floodway at least yearly. Snow and ice from road clearing operations should not be piled in floodway.
- Owners and occupants of all types of buildings and mobile homes should obtain flood insurance coverage for the structure and content, especially if located within or adjacent to delineated flood hazard areas.

In addition the following structural measures were suggested in the Little Black Flood Management Study:

> Flood stages can be reduced by improving flow conditions within the channel by increasing stream and storm sewers' carrying capacity. The existing series of dams and open channels generally provide protection from a 100-year flood. It was assumed during the planning and design phase (1960's) that Campbell Road and Inverness Trail Road below Structure A would be inundated during the 100-year flood. Inverness Trail Road was reconstructed in 1996 and has capacity of a 100-year flood. In addition, Pinehill Avenue, located above structure C was to be inundated during the 100-year flood. The 100-year flood will top Court Street located just below Structure c by approximately 0.3 foot.

In January of 2004 the Sturgeon River in the Village of Woverine experienced an episode of "Anchor Ice Flooding" along a swift flowing section of the river. Local citizens indicate that the weather conditions that cause this problem recurs about once every five years. After meetings with local officials and representatives from the Michigan Department of Environmental Quality, it is apparent that some of the same measures suggested in the Little Black Flood Mangement Plan, above, apply to the Wolverine situation, specifically:

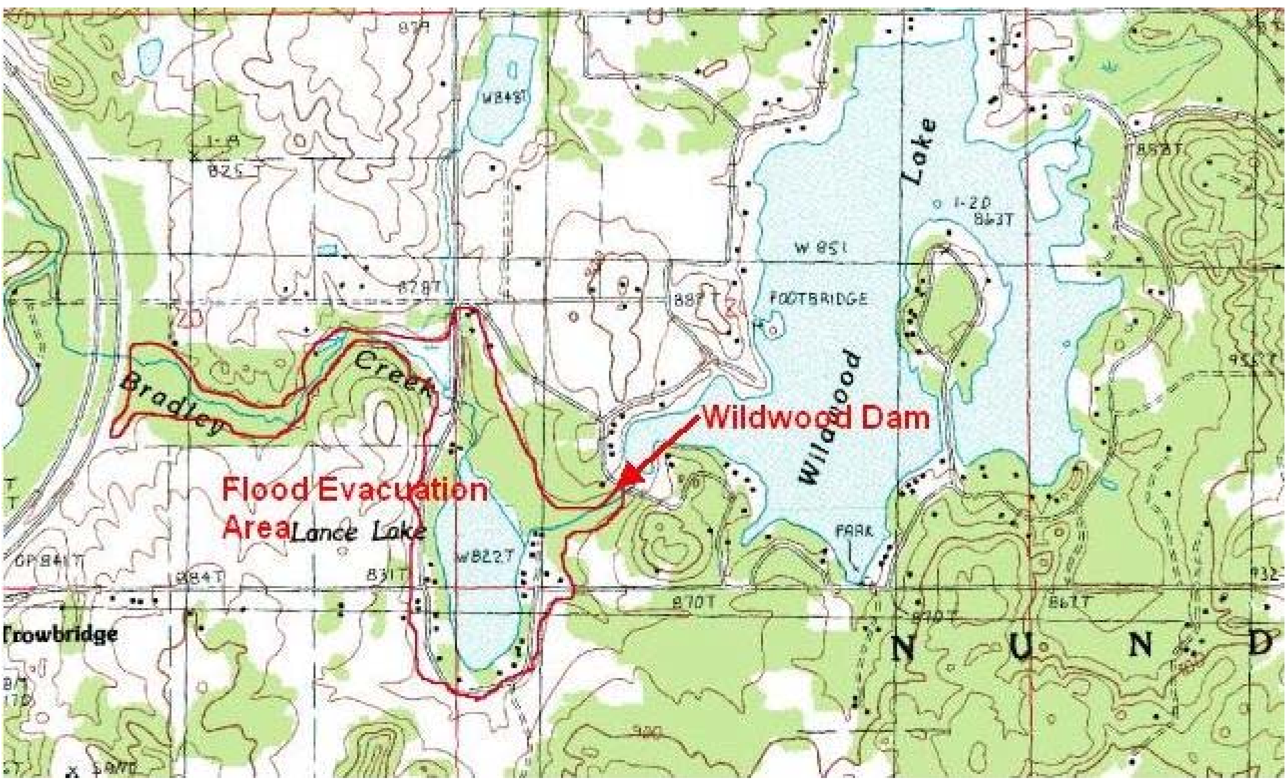
- Develop and implement a flood plain protection and local zoning ordinance based on a 100-year flood plain delineation
- Flood-proof existing buildings and residences in the flood plain
- Steps be implemented to promote owners and occupants of all buildings to obtain flood insurance.

Dam Failure

The Wildwood Lake Dam is located in Nunda Township on the Bradley Creek Tributary to the Sturgeon River. The reservoir size of Wildwood Lake covers 222 acres. The dam is an earth fill dam approximately 305 feet long and 200 feet wide. The dam was constructed in 1961.

In 2002, flooding estimates from dam failure defined a flood inundation map for Wildwood Lake dam, and a Flood Evacuation area identified**. (Figure 7-5)** Twenty-three residences were located in the Flood Evacuation Area for Wildwood Dam, primarily fronting Lance Lake. The total assessed value of these residences was $ 1,191,000

Figure 7-5, Wildwood Evacuation Area



The Wildwood Lake Property Owners Association requested another inspection of the Wildwood Lake Dam by the Spicer Group. The objective of this study was to identify specific problems and estimated the magnitude of materials and construction required to rehabilitate the dam. To implement dam rehabilitation the following procedures are necessary:

- Develop conceptual design alternatives
- Develop preliminary design to meet MDEQ permit requirements
- Develop final design
- Obtain Financing
- Construction

Total estimated construction costs to rehabilitate the dam and reconstruct the inlet, including contingencies, were $503,000. The report to the Wildwood Lake Property Owners Association from the Spicer group made the following recommendations.

> At this time, we would recommend that steps be taken to secure funds to perform the necessary repairs to the earthen embankment, drop structure, and outlet structure. At a minimum, we recommend that the inlet structure with gates and outlet pipe be considered for repair, that the trees be removed from the downstream face of the dam and that road improvements direct all drainage towards the lake.

Although other Cheboygan dams reflect a range of conditions, none have comparable vulnerability conditions similar to the situation at Wildwood Lake Dam.