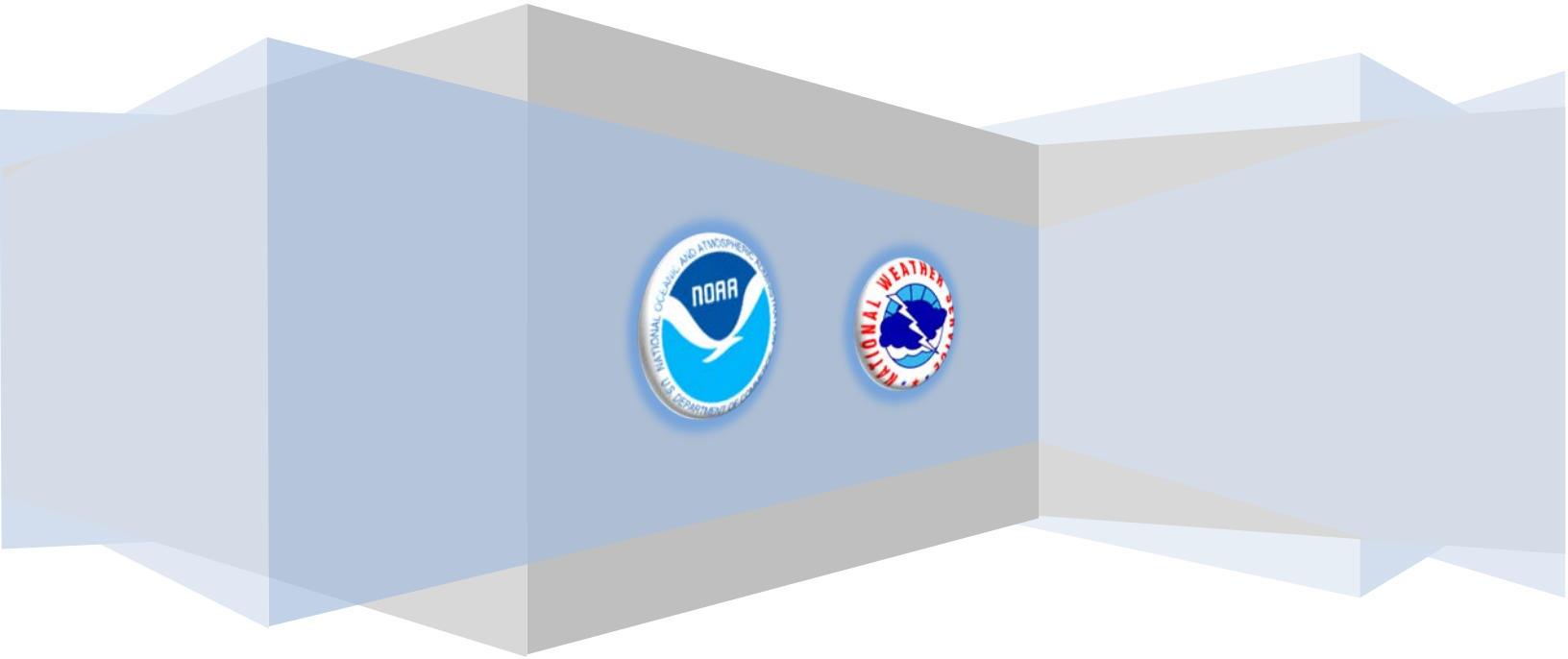
Natural Hazards Assessment

Wabasha County, MN

Prepared by: NOAA / National Weather Service La Crosse, WI



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for
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Prepared by NOAA / National Weather Service – La Crosse
Last Update: October 2013

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Overview

Wabasha County is in the Upper Mississippi River Valley of the Midwest with terrain ranging from rolling hills to relatively steep bluffs and valleys. It is bordered by the Mississippi River to the northeast.

The area experiences a temperate climate with both warm and cold season extremes.

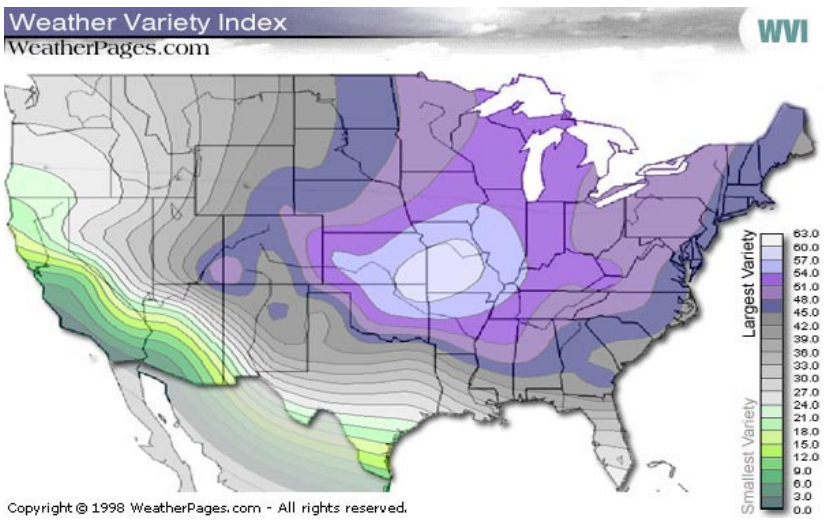
Winter months can bring occasional heavy snows, intermittent freezing precipitation or ice, and prolonged periods of cloudiness. While true blizzards are rare, winter storms impact the area on average about 3 to 4 times per season. Occasional arctic outbreaks bring extreme cold and dangerous wind chills.

Temperatures between river valleys and surrounding ridges can vary greatly. Typically high temperatures on ridges are 3° to 5°F colder than valleys. This can lead to slightly more average snowfall on ridge tops and occasionally a difference in winter precipitation types from ridge to valley.

Thunderstorms occur on average 30 to 50 times a year, mainly in the spring and summer months. The strongest storms can produce associated severe weather like tornadoes, large hail, or damaging wind. Both river flooding and flash flooding can occur, along with urban-related flood problems. The terrain can lead to mud slides and generally increases the flash flood threat. Heat and high humidity is occasionally observed in June, July, or August.

The autumn season usually has the quietest weather. Valley fog is most common in the late summer and early fall months. On calm nights, colder air settles into valleys leading to colder low temperatures compared to ridge top locations. High wind events can also occur occasionally, usually in the spring or fall.

The variability in weather can be seen in the following graphic, created by a private company (weatherpages.com) that rated each city on variations in temperature, precipitation, and other factors. La Crosse, WI ranked 27th highest and Rochester, MN ranked 3rd highest in variability out of 277 cities.

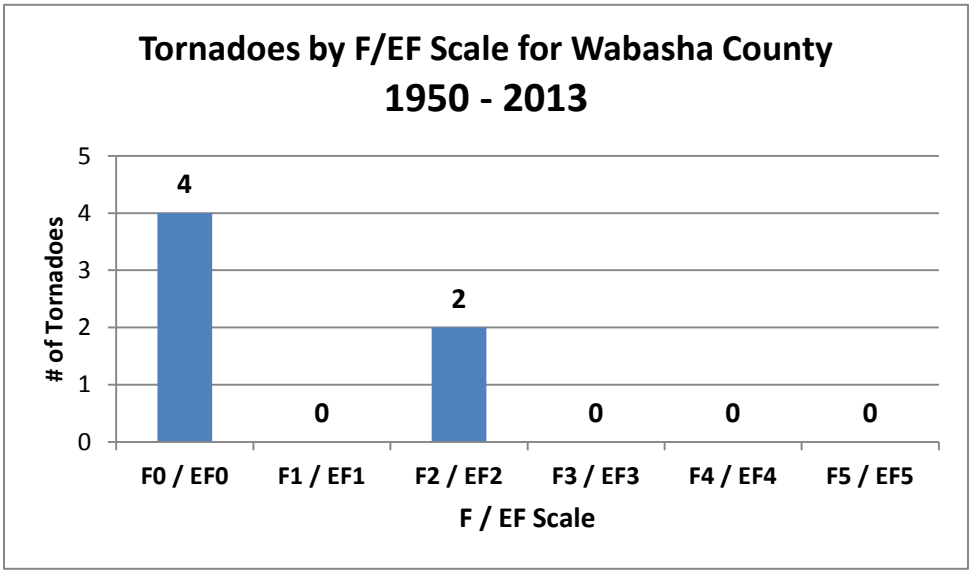


Since 1998, Wabasha County has been included in a FEMA Federal Disaster Declaration 4 times:

1998 – Severe storms
2001 – Flooding
2007 – Severe storms / flooding
2010 – Severe storms / flooding

Tornadoes

Even though Minnesota averages about 24 tornadoes per year, Wabasha County has only had 6 tornadoes since 1950, averaging about one tornado every 9-10 years. Most tornadoes are short-lived and small. May and June are the peak months and most occur between 3 and 9 p.m., but they can occur nearly any time of year and at all times of the day.



Most recent tornadoes:

- Mar.29, 1998 (F0)
- June 17, 1984 (F0)
- May 17, 1982 (F2)
- June 7, 1971 (F0)
- May 5, 1965 (F0)
- Aug.28, 1964 (F2)

One of the strongest tornadoes to hit Wabasha County occurred on July 21, 1883. It hit the community of Elgin, MN and damaged about 20 homes and 8 businesses, killing one person and injuring 8 others. More recently, a small tornado touched down a few miles west of Wabasha in late March 1998, the same day several larger tornadoes hit the communities of St. Peter and Comfrey, MN when a tornado outbreak hit the state. The terrain in the county may limit some tornadoes from forming but brief touchdowns and tracks are still possible even through bluffs and valleys.

Strongest tornadoes: (1850-2013)

- July 21, 1883 (F2) – 8 inj, 1 dead
- May 17, 1982 (F2) – 3 inj, 0 dead
- Aug.28, 1964 (F2) – 0 inj, 0 dead
- Apr.13, 1883 (F2) – 0 inj, 0 dead
- Mar.29, 1998 (F0) – 0inj, 0 dead

Wabasha County Tornado Facts:

- Limited tornado database
- No documented tornadoes stronger than F2
- One fatality and 11 injuries since 1850
- Tornadoes have occurred March – August
- Most have occurred in May and June (2)

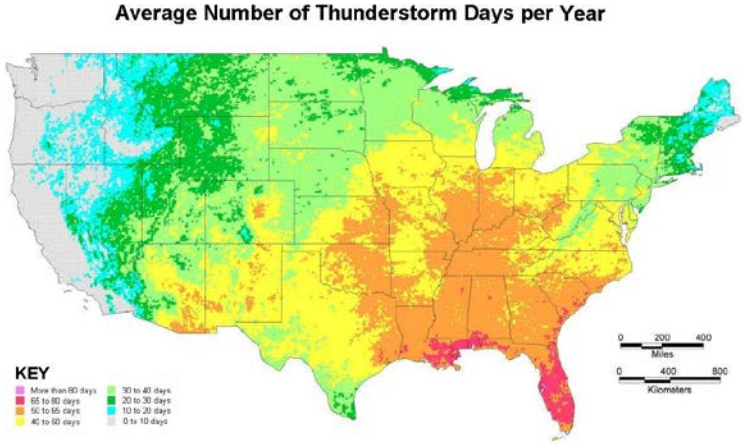
Tornado Watches		Tornado Warnings	
Year		Year	
2013	3	2013	0
2012	2	2012	1
2011	3	2011	1
2010	5	2010	1
2009	4	2009	0
2008	7	2008	0
2007	4	2007	0
2006	4	2006	0
2005	8	2005	0
2004	8	2004	0
2003	5	2003	0

Enhanced Fujita (EF*) Scale	
EF0	65-85 mph
EF1	86-110 mph
EF2	111-135 mph
EF3	136-165 mph
EF4	166-200 mph
EF5	>200 mph

* Started February 1, 2007

Severe Thunderstorms / Lightning

Wabasha County averages 38 thunderstorm days per year. The National Weather Service (NWS) considers a thunderstorm severe when it produces wind gusts of 58 mph (50 knots) or higher, 1 inch diameter hail or larger, or a tornado.



Downdraft winds from a severe thunderstorm can produce local or widespread damage, even tornado-like damage if strong enough. Most severe thunderstorm winds occur in June or July and between the hours of 4 and 8 p.m., but can occur at other times. Most damage involves blown down trees, power lines, and damage to weaker structures (i.e. barns, outbuildings, garages) with occasional related injuries. In 1998, a large squall line moved through the region with numerous wind gusts in of 70 mph or higher. Hundreds of trees were blown down and many buildings were damaged. Power was also out in many communities. In June 1999 a wind gust of 78 hit Elgin, MN and in July 2010 a gust near 75 mph in Lake City caused widespread damage. There have been 85 damaging wind reports since 1982 in the county.

Large hail can also occur in a severe thunderstorm. June is the peak month with the most common time between 1 and 9 p.m., but it can occur in other warm season months and at any time of day. Hail is typically a crop damaging hazard but can damage roofs, windows, and vehicles if large enough (> 1”). Expenses can be high. Injuries or fatalities are rare for hail. In July 1999, two inch diameter hail fell in the county, the same day a tornado hit Lewiston, MN. In July 2008, hail larger than two inches fell in Lake City, MN causing major damage. There have been 75 large hail (≥ 3/4”) reports in the county since 1982.

Non-severe thunderstorms still pose a lightning risk. According to the Vaisala Group, an average of nearly 400,000 cloud-to-ground strikes hit Minnesota each year based on data from 1997 to 2010. Nationally, Minnesota ranks 28th in lightning related fatalities with 64 deaths reported between 1959 and 2013. There has been at least 1 lightning fatality in Minnesota in 2007, 2009, 2012, and 2013.

(Photos below: Thunderstorm wind damage in June 1998)

Severe Thunderstorm Watches		Severe Thunderstorm Warnings	
Year		Year	
2013	6	2013	11
2012	10	2012	16
2011	9	2011	9
2010	13	2010	13
2009	4	2009	5
2008	9	2008	7
2007	21	2007	7
2006	16	2006	6
2005	14	2005	8
2004	13	2004	6

Flooding and Hydrologic Concerns

On occasion intense, heavy rain producing thunderstorms or consecutive thunderstorms ("training") can bring excessive rainfall leading to flash flooding in Wabasha County. The hilly terrain promotes rapid run-off and enhances the threat. Mudslides can occur in extreme cases. Intense rainfall rates also lead to occasional urban street flooding.

Flash Flood Warnings	
Year	
2013	0
2012	2
2011	2
2010	2
2009	0
2008	0
2007	2
2006	0
2005	2
2004	2
2003	0

June is the most common month for flash floods, but they can occur from May through September. They are most common in the evening hours, between 8-10 p.m., but can occur at other times and typically last from 3-6 hours. There were 18 flood related fatalities in Minnesota between 1995 and 2013.

In mid August 2007, 12 to 17 inches of rain fell in one evening across southeast Minnesota leading to record and widespread flash flooding. Runoff and erosion were extreme leading to evacuations and road closures in many communities, including Plainview, Millville, and Zumbro Falls. At least 44 families in Elgin were impacted alone. The county was declared a federal disaster area with an estimated 3 million dollars in damage. Elgin, MN reported 9.31" of rain over that weekend, and 17.35" for the month (all-time record).

In September 2010, rainfall amounts of 5 to 7 inches in two days caused flash flooding and major flooding along the Zumbro River leading to the evacuation of Zumbro Falls. Damage to homes and related erosion was extensive from southeast Minnesota into western Wisconsin.

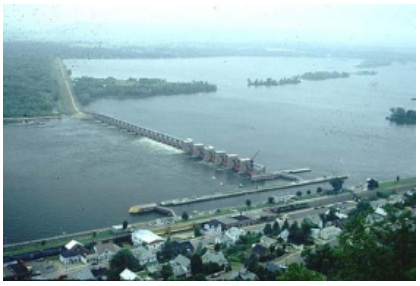
Mississippi River @ Wabasha Top 5 Crests (FS: 12 feet)	
Date	Crest
4/19/1965	20.05'
4/16/2001	18.22'
4/16/1969	17.63'
4/18/1952	16.71'
4/11/1997	16.53'

Two main rivers can impact Wabasha County – the Mississippi River and the Zumbro River. There are numerous other watersheds or larger creeks though that can and have flooded. The Mississippi River is often highest in the spring associated with the seasonal snowmelt, but on rare occasions can reach flood stage during the summer or fall from heavy rain patterns. The combination of up-river snowmelt and area rain brought major flooding along the Mississippi River in April 2001, setting the 2nd highest crest levels in many locations. The record crest year remains 1965.

Flooding along the branches of the Zumbro River and other creeks in the county usually stems from excessive rainfall. Water levels rise and fall far more quickly than the Mississippi River leading to more short-duration, dangerous situations.
(Photos below: Mississippi River flooding at Wabasha, MN in 1993 and 2001)

Zumbro River @ Zumbro Falls Top 5 Crests (FS: 18 feet)	
Date	Crest
9/24/2010	35.82'
7/22/1951	30.80'
4/1/1888	30.50'
3/2/1965	28.40'
3/29/1962	28.20'

The US Army Corps of Engineers maintains a Lock and Dam at Alma, WI (#4) that is used to manage navigational water levels, not for flood control.



Winter Storms and Extreme Cold

Hazardous winter weather can bring a variety of conditions to Wabasha County. The terrain in the eastern parts of the county does limit the number of true blizzards (only 3 since 1982) but heavy snow, blowing snow, ice, and sleet all occur.

The average seasonal snowfall in Wabasha County is about 43-47 inches, but there can be a difference of several inches between valleys and ridge tops. There are occasions where milder daytime temperatures in valleys produce rain when a wintry mix or snow is falling on ridges. Blowing snow is more common on higher terrain or ridge tops. The bulk of snow falls between December and March. The largest winter storms tend to form over the central or southern Plains, then move northeast towards the western Great Lakes.

On February 23-25, 2007, a major winter storm impacted southeast Minnesota. A combination of significant heavy snow, sleet, and ice accumulation paralyzed the area with unofficial totals of 18" at Plainview and 15.8" near Elgin, MN. Blizzard conditions impacted the region the second night with drifts of 4 to 5 feet. Another major storm hit less than a week later, leading to the snowiest week on record (27.2" in a 7-day period, ending 3/2/07). A blizzard in December 2010 dropped 16.9" of snow on Theilman and 15.7" on Wabasha, MN

Top 5 Seasonal Snowfalls in Theilman	
Years	Snowfall
2010-11	75.4"
2012-13	73.1"
1961-62	63.6"
2006-07	57.0"
1944-45	56.7"

March can often be a snowy month. Even though snowfall may be less frequent, heavy wet snow can form from large spring storms. In 1997, a large winter storm dropped 14 inches of wet snow in the Theilman, MN area on March 13-14th. On March 19th, 2005, 13.2" fell at Theilman, 12.2" fell at Wabasha, and 11.1" fell at Lake City marking one of the snowiest days on record in Wabasha County.

Ice storms (1/4" of ice or more) can occur but are relatively rare with only 5 occurrences since 1982.

Arctic cold outbreaks can occur in the upper Midwest as well. Snow depth can modify these cold temperatures leading to sub-zero readings on average 26 times a winter. Occasionally strong northwest winds will combine with arctic outbreaks to create dangerous wind chill conditions as well. The coldest temperatures are usually in January and February with average lows in the single digits and record lows colder than -25°F most days. The all-time record low is -44°F set in 1967.

Coldest Lows at Theilman, MN	
Low	Date
-44°F	1/18/1967
-40°F	1/17/2009
-40°F	1/16/2009
-40°F	1/19/1994
-40°F	1/19/1970

In January 1970, the Theilman area went 5 consecutive days with temperatures below zero degrees (F), hitting low temperatures of -35°F, -40°F, -20°F, -38°F, and -20°F during that stretch. In late January and early February 1965, low temperatures were -12°F or colder for 10 straight days, including a low of -38°F.

The La Crosse National Weather Service issues Wind Chill Advisories when wind chill readings of -20°F to -34°F are expected. Wind Chill Warnings are issued when wind chill values at or below -35°F are expected or occurring. On January 30, 2008, Plainview, MN had wind chill values of -36°F.

Heat, Drought, and Wildfires

On occasion the weather pattern across the upper Midwest favors prolonged heat and humidity, leading to heat waves. June through August are the warmest months with average high temperatures in the 80s and record highs above 100°F most days. The warmest temperature on record at Theilman, MN is 104°F set on August 1, 1988.

Warmest Highs at Theilman, MN	
High	Date
104°F	8/1/1988
103°F	7/31/1988
103°F	6/10/1985
102°F	8/16/1988
101°F	7/3/1990

In Wabasha County, there have been 8 heat waves since 1993. During that same time period, there were 16 fatalities directly related to heat in Minnesota.

One of the longest heat waves on record occurred in 1988 when Theilman hit 90°F or higher a total of 46 times. Ironically the high temperature only hit 100°F or warmer five times during that stretch. Other heat waves occurred in 1995, 1999, and 2001. In July 2011 heat indicies across southeast Minnesota topped off at or above 105 for 5 days (July 16-20).

Prolonged dry spells can also lead to drought causing extreme damage to crops. Droughts vary in length and intensity but abnormally dry to moderate drought conditions can occur quite frequently. Severe to extreme droughts occur far less frequently.

Droughts have occurred in Minnesota as recently as 1999, 2000, and 2006 through 2013.

Dry weather can also lead to a wildfire threat, especially in the spring before foliage has emerged (i.e. before green up) or in the fall after vegetation has started to die off. Warm, dry (i.e. lower relative humidities), and windy conditions all favor higher fire danger and can lead to sporadic grass or cropland field fires in Wabasha County. Thick, wooded areas also pose a threat for wildfires under extremely dry conditions but occur far less frequently.

Local Climatology

Here are some basic climatology figures for the Wabasha County area. Data is valid for Theilman, MN based on normals from a 30-year period (1981-2010).

Month	Normal Maximum Temperature	Normal Minimum Temperature	Average Temperature	Precipitation	Snowfall
JAN	25.9	5.4	15.7	0.88"	8.4"
FEB	30.9	9.1	20.0	0.88"	6.4"
MAR	43.1	22.1	32.6	1.82"	6.7"
APR	59.0	34.0	46.5	3.05"	0.3"
MAY	70.8	44.6	57.7	3.69"	0.0"
JUN	79.6	54.4	67.0	4.31"	0.0"
JUL	83.6	59.2	71.4	4.30"	0.0"
AUG	81.5	56.7	69.1	4.72"	0.0"
SEP	73.2	48.4	60.8	4.42"	0.0"
OCT	60.4	36.0	48.2	2.09"	0.2"
NOV	42.7	24.4	33.6	2.10"	1.3"
DEC	28.4	10.1	19.2	1.26"	9.0"
Year	56.6	33.7	45.2	33.37"	47.4"

Note: Climatological data for Wabasha County is very limited. The longest database is at Theilman that began in 1962.

Miscellaneous facts:

- Warmest year on record – 1987 & 1981 (48.6°F)
- Warmest month on record – July 2012 (76.9°F)
- Warmest day on record – August 1, 1988 (104°F)
- Greatest number of days with 90°F or warmer – 1988 (46 times)

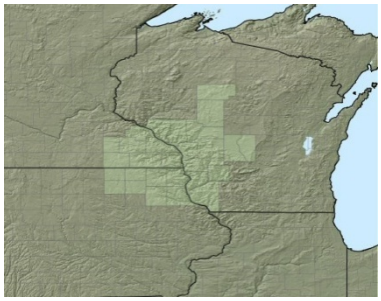
- Coldest year on record – 2008 (40.5F)
- Coldest month on record – January 1979 (+1.4°F)
- Coldest day on record – January 18, 1967 (-44°F)
- Greatest number of days at 0°F or colder – 2008 (60 times)

- Wettest year on record – 2010 (47.20")
- Wettest month on record – August 2007 (15.84")
- Wettest day on record – July 1, 1978 (8.00")
- Driest year on record – 1949 (18.04")
- Driest month on record – February 1987 (0.00")

- Highest seasonal snowfall on record – 2010/11 (75.4")
- Highest monthly snowfall on record – December 2010 (38.1")
- Highest one-day snowfall on record – December 25, 1945 (14.0")
- Least seasonal snowfall on record – 1952/53 (16.6")

NOAA/National Weather Service Support and Weather Monitoring

NOAA's National Weather Service (NWS) forecast office at La Crosse, WI serves Wabasha County with weather information and support on a continuous basis. Operating 24 hours a day, a staff of 23 issues routine and non-routine informational products for the area, including all watches, warnings, and advisories related to natural hazards. Doppler radar (WSR-88D) is co-located with the La Crosse NWS office and covers the region.



NWS La Crosse has a web site at: www.weather.gov/lacrosse

Normal communication during hazardous weather scenarios is via 800 MHz (MN ARMER), telephone, and amateur radio.

NOAA Weather Radio coverage in Wabasha County includes:

- WXK41 (Rochester) on 162.475 MHz
- KJY80 (Red Wing) on 162.450 MHz

Storm spotter groups consist mainly of volunteer fire departments, with some amateur radio operators, law enforcement, and the general public. Spotter training is held nearly every year with an average attendance in the past 5 years of 48.

There are a variety of weather monitoring sources in Wabasha County, including:

Automated weather station(s):

- None, but stations are available at Winona (KONA), Rochester (KRST), and Red Wing, MN (KRGK).

River Gauge(s):

- Mississippi River @ Lake City
- Mississippi River @ Wabasha
- Mississippi River Lock & Dam #4 @ Alma, WI
- Zumbro River @ Zumbro Lake
- Zumbro River @ Zumbro Falls
- North Fork of Zumbro River @ Mazeppa

Cooperative Observers

- Elgin 2SSW
- Lake City
- Theilman 1SSW
- Wabasha
- Zumbro Falls 2NE

In addition, numerous volunteer reports from around the county are received at the La Crosse NWS office including rainfall, snowfall, and temperatures, on a routine basis.

Resources

National Weather Service – La Crosse	www.weather.gov/lacrosse
NWS La Crosse Tornado Database	www.weather.gov/lacrosse/?n=tornadomain
NWS La Crosse River Monitoring	http://www.crh.noaa.gov/ahps2/index.php?wfo=arx
NWS La Crosse Climate	www.weather.gov/climate/index.php?wfo=arx
NWS La Crosse Drought information	www.weather.gov/lacrosse/?n=drought
NWS La Crosse Storm Summaries	www.weather.gov/lacrosse/?n=events
NWS La Crosse NOAA Weather Radio page	www.weather.gov/lacrosse/?n=nwr
NWS Storm Prediction Center	http://www.spc.noaa.gov/
SPC Online Severe Weather Climatology	http://www.spc.nssl.noaa.gov/climo/online/grids/ http://www.spc.noaa.gov/climo/online/rda/ARX.html

Contact information: Todd Shea
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