

Element B: Risk Assessment Requirements

B1-c. Does the plan describe the extent for each identified hazard?

The plan must provide the extent of the hazards that can affect the planning area. When describing extent using charts or scales (e.g., Saffir-Simpson scale for hurricane wind speed; Enhanced Fujita scale for tornado), the plan must document how the scale applies to each jurisdiction.

Extent is defined as the range of anticipated intensities of the identified hazards. The information must relate to each of the plan participants or the planning area, depending on the hazard. Extent is most commonly expressed using various scientific scales.” – FEMA Local Mitigation Planning Policy Guide (pg. 22, effective April 19, 2023)

*Be sure to address how the selected scale applies to the planning area. Remember that **extent** defines the characteristics of the hazard regardless of the people, property, and other assets it affects. While **impact** means the consequence of the hazard on governments and assets ([IS-350](#)).*

The following discussion of hazard types and of hazard specific Forecast, Warning, Occurrence, and Extent/Intensity sources or scales refers primarily to inland hazards and those most common to the Northern Great Plains states, excluding coastal Marine or Hurricane hazards. Hazard definitions are based on official FEMA (National Risk Index: NRI), NOAA (National Centers for Environmental Information: NCEI, and National Weather Service: NWS), and/or other sources as appropriate.

Extent, as applied to North Dakota Specific Hazards.

(Note, examples of each can be found in the [2024-2029 ND Enhanced Mitigation MAOP](#))

Geologic Hazards.

- **Earthquake. Extent:** Referenced in terms of Magnitude or Intensity, [USGS Podcast](#). ND Quake Map at: https://www.dmr.nd.gov/ndgs/documents/Publication_List/pdf/geoinv/GI_94_2012.pdf
 - **Magnitude:** based on Intensity measured at the source. [Richter Scale](#).
 - **Intensity:** based on the disturbance felt at locations. [Modified Mercalli Intensity Scale](#).
- **Erosion. Contact local NRCS-USDA** soils people. (Fred Anderson: number of acres or feet lost)
- **Expansive Soils. Contact local NRCS-USDA** soils people. [Web Soil Survey - Home \(usda.gov\)](#).
(ref. Fred Anderson, ND-DMR: The **Brenna Formation** in the shallow subsurface of the Red River Valley is quite expansive. So far, DMR has mapped the Brenna Formation Mapping in [Pembina](#), [Walsh](#), [Grand Forks](#), and [Cass](#) Counties, with others in progress. A suggested measurement could be Coefficient of Linear Extensibility (**COLE Values**) for this hazard. Consider adding other types of problem soil and rock hazards. For example, collapsible soils (measured by the reduction of air space when wetted).
- **Radon. Extent:** check **local test results**, measured in picocuries per liter, though no known safe level ([EPA Radon](#), [EPA: ND Radon Zone MAP](#)). (ref. Fred Anderson: measured by prevalence through short or long- term testing. Checking if we have ND GIS database and/or maps)
- **Landslide. Extent:** see **prevalent areas** <https://www.dmr.nd.gov/dmr/ndgs/landslides>

(ref. Fred Anderson: **areas** based on soil type and steepness of slope)

- **Subsidence. Extent:** (**percent** of land surface contractions)
(ref. ND Public Service Commission/Abandoned Mine Lands:
<https://ndgov.maps.arcgis.com/home/webmap/viewer.html?webmap=0c4eb5ce19a84a069c1d04b449c39d43>)

Dam Failure Hazard. Extent: Combination of 1) **Hazard Class**, 2) Dam Condition, and 3) Likelihood.

Hazard Class for all federal and state regulated dams is in the **National Inventory of Dams (NID)**.

- Hazard Class: based on downstream impacts [ND Dam Safety Standards, Tbl 6.1, p.26; Deffs, p.66](#),
- Dam Condition: based on Inspection Reports (contact DWR, Dam Safety, Karen Goff),
- Failure Likelihood (Risk): based on [Joint Federal Risk Categories](#), Table 1, p. 30.
([National Dam Safety Program Hazard Classifications](#) (pg. 30), [Inundation Mapping](#), etc.)

Drought Hazard. Extent: based on **drought category** as per [Weekly U.S. Drought Monitor](#), [USDM Scale](#).

Alternate references include the monthly and historical [Palmer Drought Severity Index](#), or the daily [Standard Precipitation Index](#).

Flood Hazards.

- **River Flood. Extent:** **River Flood Stages**, if an official forecast point. Also based on [probability of occurrence](#), [forecast flood level](#), and/or [inundation](#).
 - *Do you have a river or a body of water that constitutes a river? If so,*
 - *Use forecast flood level – targeted by FEMA as it’s mostly related to flooding based on a river forecast or flood level.*
 - *Inundation is measured in surface areas, length of road, and depth.*
- **Flash Flood. Extent:** **inundation or depth** based on soil saturation and rainfall rate using [Flash Flood Guidance](#).
 - *How much rainfall needs to occur in one hour, three hours, and six hours to produce a flash flood event?*
- **Areal Flood. Extent:** **inundation or depth** based on saturation, rainfall, and [inundation](#) using [Flash Flood Guidance](#).

For additional references check the [NWS Bismarck](#) and [NWS Grand Forks](#) flood event websites, or contact your local NWS Service Hydrologists.

- *This occurs at rainfall or excessive snowmelt above flash flood levels.*
- *Overland (Areal) Flooding will occur if rainfall or snowmelt exceeds the levels identified in Flash Flooding.*

Severe Summer Weather Hazards.

- **Excessive Heat. Extent:** based on temperature and humidity **Heat Index**, for general use. Other references may include: Wet-Bulb Globe Temperature ([WBGT](#)), for outdoor sports, workers, and First Responders; [Heat Risk](#) as test approach (scroll on map to ND location of choice). Contact the [local forecast office](#) to identify locally measured highest and lowest recorded temperatures.
 - *Length of time in days and intensity.*
 - *Have cooling centers been established?*
 - *In the heat scale at which it becomes severe differs between states based on injury*

and death data specific to said state(s).

- **Hail. Extent:** based on **Hail Size** (national [SPC Outlook](#), local [GHWO](#)).
 - *Cross compare with NCEI data pulled for each specific jurisdiction.*
 - *Also analyze impact to crops, which intensity of impact is high influenced hail size.*
 - *Larger hail will do more damage, but smaller-sized hail that is wind driven may be more impactful to crops and structures.*
- **High Wind (summer). Extent:** **Sustained** GTE 40 mph, **or Gusts** GTE 58 mph (Events as recorded in [StormData](#)). Forecasts sources: natl. [WSSI](#), loc. [GHWO](#). Sustained wind speeds can be estimated using the [Beaufort Wind Scale](#).
 - *In the NWS, strong winds are nonhazardous below high wind warning or damaging thunderstorm wind warning criteria.*
 - *Strong wind is less than 40 mph sustained or less than 58 mph gusts according to NWS.*
 - *High wind is above 40 mph sustained or above 58 mph gusts.*
- **Lightning. Extent:** Based on CG Lightning forecast (*potential LAL*): [Lightning Activity Level](#).
 - Daily LAL Forecast: Daily Fire Weather Forecast and/or online Point-and-Click ([BIS example](#)).
 - Past Week's actual CG Lightning Occurrence: Daily Record Maps ([BIS example](#))
 - Historic Strike Frequency: NCEI CG Lightning Strikes, 1/1/1991 to 12/31/2012 (ltd access).
 - Damage and Casualty Reports: [NCEI Storm Events Database](#), 1996 thru present. – *not the best resource*
 - *Positive lightning strikes tend to occur outside the heavy rain and therefore are more prone to fire-starts in dry conditions. It is the most frequent severe summer weather hazard impact that occurs. [Thunder Roars Go Indoors](#).*
- **Thunderstorm Wind. Extent:** **Wind gusts** GTE 50 kts/58 mph (Events as recorded in [StormData](#)). Forecasts sources: national [SPC Outlook](#), local [GHWO](#). Wind speed can be measured, estimated, and/or based on damage ([weather.gov](#)) due to gusts GTE 50 kts.
 - *Wind gusts of 58 mph or greater.*
- **Tornado. Extent:** based on **damage Enhanced Fujita Scale** (Events as recorded in [StormData](#)). Forecasts sources: national [SPC Outlook](#), local [GHWO](#).
 - *Ask about damage path and ground scour.*

Severe Winter Weather Hazards.

- **Blizzard. Extent:** based on **visibility, wind speed, and duration** in SN/BS (Events recorded in [StormData](#)). Forecasts sources: national [WSSI](#), local [GHWO](#).
 - *Low visibility of less than a quarter mile, wind speed GTE to 35 mph and duration of three or greater hours in length.*
 - *Winds greater than 45 MPH and temperatures 10 or 12 degrees below Fahrenheit was classified as a Blizzard.*
 - *These above conditions with convective snow is now called a snow squall – see below.*
- **Extreme Cold. Extent:** based on a **cooling rate** table [Wind Chill/Extreme Cold](#), for people exposed to cold. For livestock, pets, etc. contact local veterinarian, animal specialists.
 - *-40 degrees is the trigger point for a wind chill warning*
 - *-25 or -30 degrees is the trigger point for a wind chill advisory for multiple counties for multiple hours in length.*
- **Heavy Snow. Extent:** based on **snow accumulation** in 12 or 24 hours (natl. [WSSI](#), local [GHWO](#)).
 - *Six inches in 12 hours and 8 inches in 24 is considered heavy snow.*

- **Ice Storm. Extent:** based on **ice accumulation** in 12 or 24 hours (national [WSSI](#), local [GHWQ](#)).
 - *A quarter of an inch of ice accumulation on power lines and/or tree branches and surrounding surfaces in general. This is the base level for an Ice Storm Warning.*
 - *Half an inch and or a quarter inch of ice accumulation combined with wind is highly impactful and more extreme. No extremity scale or Level 2 Ice Storm Warning has been developed yet.*
- **High Wind (winter). Extent:** **Sustained** GTE 40 mph, or **Gusts** GTE 58 mph (natl. [WSSI](#), local [GHWQ](#)). Sustained wind speeds can be estimated using the [Beaufort Wind Scale](#).
Estimates are based on the Beaufort wind scale, which is for sustained wind.
- **Winter Storm. Extent:** **combo** of SN, IC, WND, WC in 12 or 24 hours (national [WSSI](#), local [GHWQ](#)).
 - *Any combination of three or more Advisory or Warning conditions with impacts below the trigger points described for all other forms of severe winter weather.*
- **Snow Squall (convective). Extent:** based on **vsby, wind, w/brief duration** ([safety](#), local [GHWQ](#)). Note: the local NWS Graphical Hazardous Weather Outlook (GHWQ) incorporates a few more of the winter hazards applicable to North Dakota than the national Winter Storm Severity Index (WSSI), though both use collaborated guidance as incorporated in the National Digital Forecast Database (NDFD).
 - *Snow Squall are short/intense winter storms events, not quite a blizzard because of duration.*
 - *Impactful, but may not lead to prolonged impacts like Blizzards.*

Space Weather Hazards.

- **Geomagnetic Storms. Extent:** based on impacts to power, pipelines, and satellites using [G-Scale](#).
 - *May 10 to 11, 2024, a G-5 storm occurred resulting in two days of internet outages/delays.*
 - [Aurora Dashboard \(Experimental\) | NOAA / NWS Space Weather Prediction Center](#)
- **Radio Blackouts. Extent:** based on impacts to HF Radio and navigational systems using [R-Scale](#).
- **Solar Radiation Storms. Extent:** impacts aircraft passengers and crew members, along with HF Radio and satellite navigation systems using [S-Scale](#).

Wildfire Hazard. Extent: Based on Fire **Size** (final, acres). NWCG Glossary: enter [Size Class of Fire](#).

- *Equates to Burn Area or essentially the footprint or physical extent of the wildland fire.*
- *This can be calculated in total acres burned/impacted in a fire season, and in a single incident or occurrence.*

Additional fire hazard planning resources include:

- Pre-Fire/Wildfire Awareness - [ND Burn Restrictions and Fire Danger Maps](#).
 - Current Conditions - ND Daily Burn Restrictions
<https://experience.arcgis.com/experience/c5da309af17b4c48a3b953675a77f654>
 - Current - ND Adjective Fire Danger <https://gis.des.nd.gov/NDDSEFireIndex.png>
- Post-Fire/Wildfire Reporting: ND Insurance... NFIRS, eNFIRS, ESO
<https://www.firemarshal.nd.gov/fire-rescue/reporting>, ph. 701-328-2440.

----- Wind Hazard addenda -----

Wind Hazard. Wind as a hazard refers to either sustained winds (2-minute average) or wind gusts (3-second, or instantaneous peaks). A longer duration sustained wind can produce similar damage to much shorter duration but higher intensity wind gust. Extent/Intensity estimates:

- Sustained wind can be estimated, using the [Beaufort Wind Scale](#).
- Wind gusts can be estimated, using NWS Table A.7 [Estimating Wind Speed from Damage, p. A-71](#).
 - *In the NWS, strong winds are nonhazardous below high wind warning or damaging thunderstorm wind warning criteria.*
 - *Strong wind is less than 40 mph sustained or less than 58 mph gusts according to NWS.*
 - *High wind is above 40 mph sustained or above 58 mph gusts.*

Terminology:

NWS High Wind refers to sustained winds of 35 knots (40 mph) or greater, over one hour or longer, or any wind gust of 50 knots (58 mph) or greater which are common to large scale extratropical storm systems in both winter and summer seasons. The local [NWS offices](#) issue High Wind Watches and Warnings for this potential. Storm occurrence is based on measured wind speed (sustained or gusts) or estimates of wind speed based on damages as reported in [NCEI Storm Data](#).

NWS Thunderstorm Wind/Damaging Wind refers to convective season wind gusts of 50 knots (58 mph) or greater. The NWS [Storm Prediction Center](#) (SPC) issues Severe Thunderstorm Watches and local [NWS offices](#) issue Severe Thunderstorm Warnings for this potential. *Storm occurrence is based on measured wind speeds, estimates of wind speed, or wind damages commensurate with winds of 50 knots (58 mph) or greater as reported in [NCEI Storm Data](#).* A wind gust of 65 knots (75 mph) or greater is considered especially damaging for SPC Watch verification purposes. NWS Warnings adds damage tags for potential wind gusts of 70 mph (Considerable) and 80 mph (destructive), above the base severe level of 58 mph.

NRI Strong Wind refers to damaging convective season winds and is the equivalent of NWS Thunderstorm Wind. However, [NRI Strong Winds](#) are based on measured wind gusts of 50.4 knots or greater, as extracted from NCEI Storm Data records. Note that the NWS uses somewhat different terminology whereby *NWS Strong Wind* is considered non-damaging and non-severe.

References:

- Federal Emergency Management Agency. (2023, March). *National Risk Index*. FEMA. <https://hazards.fema.gov/nri/>
- Federal Emergency Management Agency. (2023, March). *National Risk Index, Technical Documentation*. FEMA. https://www.fema.gov/sites/default/files/documents/fema_national-risk-index_technical-documentation.pdf
- (alt) Zuzak, C., Goodenough, E., Stanton, C., Mowrer, M., Sheehan, A., Roberts, B., McGuire, B., & Rozelle, J. (2023). *National Risk Index, Technical Documentation*. Federal Emergency Management Agency, Washington. https://www.fema.gov/sites/default/files/documents/fema_national-risk-index_technical-documentation.pdf
- National Centers for Environmental Information. (2023, November 30). *Storm Events Database (Storm Data)*. Retrieved from: <https://www.ncdc.noaa.gov/stormevents/>
- National Weather Service. (2021, July 26). *Storm Data Preparation, NWSI 10-1605*. Performance and Evaluation. <https://www.nws.noaa.gov/directives/sym/pd01016005curr.pdf>