Multi-Hazard Mitigation Plan

2015

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Executive Summary

The City of Bismarck has developed a community specific 2015 Multi-Hazard Mitigation Plan (MHMP). The plan identifies and profiles the hazards to assess risk and vulnerability relating to natural, technological, and human-caused hazards, and identifies mitigation strategies and specific mitigation actions for reducing impact.

Throughout the planning process, Bismarck conducted a thorough analysis of each hazard including vulnerability assessments and identified new opportunities to mitigate each of the hazards. Additionally, various mitigation efforts and capabilities previously established are highlighted in plan sections 3 and 6.

Although emergencies and disasters have impacted Bismarck, and can impact Bismarck in the future, actions can be taken ahead of time to reduce or eliminate the negative impacts. The 2015 MHMP represents the City's commitment to take action to lessen the impacts potential disasters may have on life, the economy, infrastructure and our ability to continue to operate as a community and city.

Much of the work in hazard mitigation and sustainable development must be carried out at the local level. It is at the local level where land use decisions are made, growth and development take place, and where the impacts of hazards are most direct.

The major hazards as noted in the table below, are each profiled for the purpose of identifying our risk and significant vulnerabilities, and ultimately, to identify feasible mitigation opportunities.

Based on probability, potential impacts, and current response and mitigation capabilities, the hazards are prioritized as follows for the City of Bismarck:

	Natural Hazards	**Technological or Human Caused**
High	Winter Storm Tornado	
Moderate	Severe Summer Weather Flood Communicable Disease	Shortage or Outage of Critical Materials or Infrastructure; Hazardous Materials Release Train Derailment Active Shooter
Low	Biological Infestation: *Urban Forest* Drought Geologic Hazard Wildland Fire	Fire Dam Failure Aircraft Accident

The Bismarck Multi-Hazard Mitigation Plan identifies over 60 mitigation action items to enhance our status of mitigating all hazards. The plan also identifies over 150 mitigation measures already completed or integrated into Bismarck city departments as standard or on-going operations. For each hazard addressed in the plan, pre-existing mitigation is identified to illustrate the mitigation status of each hazard.

Some of the hazards with potential for catastrophic impact require that primary mitigation efforts be pursued by key partners including private industry, state and federal government. Based on combined mitigation and response capability status at the local, state, and national level, the most significant of these for the City of Bismarck would include Shortage or Outage of Critical Materials, Train Derailment (involving Fire and/or Hazardous Materials), and Dam Failure. Although likelihood of these potentially catastrophic incidents are considered of lower probability, they are possible.

Mitigation Strategy

The following purpose statement and goals are outlined in the plan's mitigation strategy:

Purpose: Minimize the vulnerability of the life and health of people, property, environment, and economy of Bismarck from the impacts of natural, technological, and human-caused hazards.

Protection of:

- Life
- Property and Environment
- Economy

Goal 1: Enhance local planning efforts related to hazard understanding and mitigation.
Goal 2: Enhance the public's awareness of hazards and participation in mitigation planning.
Goal 3: Reduce the impact future development has on potential losses and vulnerabilities.
Goal 4: Reduce impacts natural disasters may have on people and property.
Goal 5: Reduce impacts of technological and human-caused disaster may have on people and property.

Plan sections 2 through 6 outline the mitigation strategy and identify, prioritize, and assign the mitigation action items which support the multi-hazard mitigation plan purpose and goals. Plan Section 3 entitled "Hazard Vulnerability & Mitigation Actions Summary" provides for a summary of the hazard related vulnerabilities and mitigation action items by hazard name. The "Hazard Vulnerability & Mitigation Actions Summary" section also provides for a summary of the "pre-existing" hazard mitigation capabilities in place prior to the development of this plan.

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RESOLUTION

ADOPTING THE 2015 BISMARCK MULTI-HAZARD MITIGATION PLAN FOR THE CITY OF BISMARCK, ND

WHEREAS, the City of Bismarck has been and continues to be committed to the protection of life, property, and the environment from natural, technological, and human-caused hazards; and

WHEREAS, the City of Bismarck recognizes the threat that natural, technological, or human-caused hazards pose to people and property within the City; and

WHEREAS, the 2015 Bismarck Multi-Hazard Mitigation Plan is the result of an extensive planning effort coordinated by Bismarck Emergency Management in cooperation with governmental and non-governmental stakeholders to develop a community specific mitigation plan which identifies hazards that have the potential to impact the City and establish mitigation strategies to address these hazards; and

WHEREAS, Bismarck Emergency Management and applicable City departments will coordinate implementation of the plan and continue to engage stakeholders in the review and update of the plan; and

WHEREAS, an adopted Multi-Hazard Mitigation Plan is required as a condition of future funding for mitigation projects under multiple Federal Emergency Management Agency (FEMA) pre and post-disaster mitigation grant programs; and

WHEREAS, City of Bismarck, ND Department of Emergency Services, and Federal Emergency Management Agency Regional VIII officials have reviewed the 2015 Bismarck Multi-Hazard Mitigation Plan and have approved it contingent upon this official adoption of the plan by the Bismarck City Commission; and

NOW, THEREFORE, BE IT RESOLVED by the Board of City Commissioners of the City of Bismarck, North Dakota, a municipal corporation, that the 2015 Bismarck Multi-Hazard Mitigation Plan as approved by FEMA is hereby **adopted** by the Bismarck City Commission as the City's Multi-Hazard Mitigation Plan

Adopted this 26th day of May, 2015.

STATE OF NORTH DAKOTA)
)ss
COUNTY OF BURLEIGH)

I, Keith J. Hunke, do hereby certify that I am the duly appointed, qualified Assistant City Administrator of the City of Bismarck, North Dakota, and that the foregoing is a full, true and correct

copy of a resolution adopted by the Board of City Commissioners at its regular meeting of May 26, 2015.

IN WITNESS WHEREOF, I have hereunto set my hand and the seal of the City of Bismarck, North Dakota, this 26th day of May, 2015.

(SEAL)

Keith J. Hunke
Assistant City Administrator
Bismarck, North Dakota

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Introduction

Defining Mitigation
Mitigation is the effort to reduce loss of life and property by lessening the impact of potential disasters. Mitigation is taking action *now*—before the next disaster—to reduce human and financial consequences later (analyzing risk, reducing risk, insuring against risk). Effective mitigation requires that we *all* understand local risks, address the hard choices and invest in long-term community well-being. Without mitigation actions, we jeopardize our safety, financial security and self-reliance.

Mitigation: Sustained action taken to reduce or eliminate **long-term** risk. Although actions are taken during the response phase to mitigate hazards, the focus of this multi-hazard mitigation plan focus is to identify mitigation actions taken before the incident occurs.

Purpose
The Bismarck Mitigation Plan has been developed to serve the Bismarck community through mitigation of potential impacts of natural and human caused hazards. By avoiding unnecessary exposure to known hazards, a community may save lives, protect property, and minimize the social, economic, and environmental disruptions that commonly follow hazard events.

The primary purpose of the plan is to identify mitigation strategies. Therefore, in developing the plan, the focus was to identify mitigation strategies based on the significant vulnerabilities identified through the planning process.

The purpose of mitigation planning and implementing the plan is to protect life, property, environment, economy, and quality of life within the City of Bismarck from hazards/disasters.

The purpose of the mitigation plan is to:

- Serve as a consolidated, comprehensive source of hazard information.
- Inform our leaders and the public of our vulnerabilities.
- Prioritize and promote cost-effective mitigation solutions.
- Encourage long-term community sustainability.
- Improve coordination of mitigation efforts.
- Support City of Bismarck Strategic Plan Goals:
    - Community Character Goal #2. Safety: Ensure that Bismarck continues to be a safe community.
    - Community Services Goal #5: Emergency Preparedness: The City will coordinate with others to be prepared to respond to emergency situations in a timely, efficient and organized manner.

Plan Format
The plan document is formatted based on the purpose of the plan (ie: mitigation strategy) and also to ensure the document is user-friendly for those who are assigned to implement mitigation action items. Since the mitigation strategies and action items are the *results* of the planning process, the mitigation strategy including action items are the focus of the plan document. The other plan sections which contribute to and inform the mitigation strategy and specific hazard mitigation actions follow.

Plan Organization – Purpose of Plan Sections

Section 1: Introduction explains the purpose, organization, scope, and authority of the plan.
Section 2: Mitigation Strategy Overview identifies the mitigation plan purpose and overarching goals to minimize potential impact from hazards. Sections 3 thru 6 are integrated and outline mitigation strategy detail.
Section 3: Hazard Vulnerability & Mitigation Actions Summary highlights the results of the mitigation planning process to include identification of mitigation actions based on vulnerabilities as well as identifying pre-existing mitigation to assist in the planning efforts by answering the question "what efforts are we already taking to mitigate this hazard?" This section also summarizes vulnerabilities for each hazard based on each hazard profile.
Section 4: Mitigation Implementation Action Plan identifies the mitigation action item assignments and is organized by name of city department. This section will allow for effective tracking of mitigation action items.
Section 5: Mitigation Actions – Prioritizing outlines the priority level of mitigation action items identified.
Section 6: Integration of Plans and Program and Mitigation Capabilities Inventory is an assessment of local mitigation capabilities and identifies the informational resources (ie: plan, programs) that were reviewed and integrated into the plan. Additional hazard specific mitigation capabilities are identified in Section 3 where applicable (see pre-existing mitigation per hazard name).
Section 7: Community Profile provides an overview of the City of Bismarck, ND.
Section 8: Community Assets identifies critical facilities, critical infrastructure, vulnerable populations, and hazardous materials facilities. This inventory is used to assist in the planning efforts in developing each of the hazard profiles (ie: vulnerabilities per hazard).
Section 9: Risk Assessment Overview provides an overview of hazards identified to be addressed in the plan as well as a summary of comparative hazard ranking based on risk (probability) and overall impact. The methodology, including additional considerations for hazard ranking and integration of the Threat and Hazard Identification and Risk Assessment (THIRA) process is explained.
Section 10: Hazard Profiles provides detail on each of the hazards including a hazard description, risk assessment, and vulnerability assessment. Vulnerability summaries (in section 3) are based on the vulnerability assessment within each hazard profile.
Section 11: Plan Maintenance describes the approach to monitoring, evaluating, and updating the plan.
Section 12: Planning Process and Public Input explains who was involved and how the plan was prepared and describes public input opportunity and plan integration.
Appendices include Acronyms used throughout the document and a listing of generator capabilities. Generators within city-owned critical facilities are an asset that minimizes potential impact as a result of power outages that may occur as a result of various hazards addressed in this plan.

Scope
The Bismarck Mitigation Plan was prepared to address those hazards identified which pose significant risk to Bismarck, with emphasis on the natural hazards for this initial community specific mitigation plan. Additional hazards may exist that were not apparent to the mitigation plan stakeholders through the development of this plan, and certainly, disasters can occur in unexpected ways. Future planning efforts may address additional hazards as determined appropriate.

Mitigation actions taken during the response phase are not within the scope or purpose of this mitigation plan.

Authority
The North Dakota Century Code, Chapter 37-17.1 Emergency Services, requires cities and to develop and maintain an emergency management program (or participate in a county or regional program).

The Disaster Mitigation Act of 2000 requires local governments to develop and submit mitigation plans as a condition of receiving Hazard Mitigation Grant Program (HMGP) and Pre-Disaster Mitigation (PDM) project grants. The Disaster Mitigation Act of 2000 became law on October 30, 2000, and amends the Robert T. Stafford Disaster Relief and Emergency Assistance Act (the "Stafford Act") (P.L. 93-288, as amended). Regulations for this activity can be found in 44 CFR, Part 201.

This Bismarck Multi-Hazard Mitigation Plan has been prepared by the Bismarck Emergency Management, a division of the Bismarck Fire Department.

Overview of Bismarck, North Dakota.
See plan section 7: Community Profile.

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Mitigation Strategy Overview

This mitigation strategy section overview section identifies the community's mitigation **purpose** and **goals.** As part of the mitigation strategy, mitigation action items are identified in these subsequent plan sections:

- Section 3: Hazard Vulnerability & Mitigation Actions Summary
- Section 4: Mitigation Implementation Action Plan
- Section 5: Mitigation Actions - Prioritizing

Purpose: Minimize the vulnerability of the life and health of people, property, environment, and economy of Bismarck from the impacts of natural, technological, and human-caused hazards.

Protection of:

- Life
- Property and Environment
- Economy

Goal 1: Enhance local planning efforts related to hazard understanding and mitigation.
Goal 2: Enhance the public's awareness of hazards and participation in mitigation planning.
Goal 3: Reduce the impact future development has on potential losses and vulnerabilities.
Goal 4: Reduce impacts natural disasters may have on people and property.

- Biological Infestation (pests)
- Communicable Disease
- Drought
- Flood
- Geologic (ie: slope failure)
- Severe Summer Weather
- Tornado
- Wildland Fire (wildland urban interface)
- Winter Storm

Goal 5: Reduce impacts of technological and human-caused disaster may have on people and property.

- Active Shooter / Active Threat
- Aircraft Accident
- Dam Failure (ie: intentional, technological)
- Fire
- Hazardous Materials Release
- Shortage or Outage of Critical Materials
- Train Derailment

The mitigation purpose statement and goals were developed during the initial kick-off meetings with the intent to remain consistent with statewide mitigation goals. The mitigation purpose and goals are also the result of the hazard identification and hazard profiling planning process (ie: risk and vulnerability assessments).

Methodology:

As part of the initial hazard mitigation planning meetings *(Mitigation Plan Development Coordination Meeting and Stakeholder Meeting),* hazards were identified to be included in the mitigation plan. Also, hazard specific mitigation planning teams made up of various city departments and community stakeholders were identified to address each hazard for the purpose of profiling each hazard, identifying vulnerabilities, and identifying and evaluating mitigation ideas. The results of the hazard specific mitigation planning teams were then reviewed by the Community Emergency Response Committee (CERC) represented by City Administration, Fire Department, Police Department, Public Health, and Public Works for evaluation and consensus.

The mitigation strategy supports the mission and goals of the Bismarck "Strategic Plan" as noted in the Executive Summary. The City of Bismarck Strategic Plan is located on the city's website: http://www.bismarcknd.gov/index.aspx?NID=1360

Mitigation Strategy Continued

Additional plan components make up the "Mitigation Strategy." In addition to this mitigation strategy overview section, the following plan sections illustrate the results of the local mitigation planning process:

- Section 3: Hazard Vulnerability & Mitigation Actions Summary
    - Identifies mitigation action items per hazard name, as well as applicable vulnerabilities and pre-existing efforts to mitigate each hazard.
- Section 4: Mitigation Implementation Action Plan
    - Identifies the mitigation action items per city department assigned primary responsibility for implementation of specific mitigation actions.
- Section 5: Mitigation Actions - Prioritizing
    - Identifies priority level of mitigation action items based on methodology as explained within Section 5.

Hazard Vulnerability & Mitigation Actions Summary

- Mitigation Actions Per Hazard
- Vulnerability Summary per Hazard
- Pre-Existing Mitigation per Hazard

This plan section outlines the mitigation actions identified to address each hazard and includes a vulnerability assessment narrative summary for each hazard based on the hazard profiles in Section 10. The identified vulnerabilities validate the need or purpose of the identified mitigation actions. Not all vulnerabilities are addressed by specific mitigation actions. In some cases, mitigation may not be feasible or within the authority or jurisdiction of the city. Regardless, vulnerabilities are identified, even if there is not a current solution or related mitigation action identified.

This plan section also identifies mitigation projects or actions which were completed or were in place prior to the development of this community specific mitigation plan. These "pre-existing" mitigation projects/actions follow the mitigation action and vulnerability summary for each hazard.

The pre-existing mitigation projects/actions are identified to illustrate the existing efforts of the city and stakeholders to mitigate the various hazards prior to the development of this multi-hazard mitigation plan. Identifying the pre-existing mitigation efforts also assists in the planning process to better determine the extent a hazard is mitigated.

This plan section is an overview. More background regarding each hazard including the identification of vulnerabilities is available within Section 10 Hazard Profiles.

Natural Hazards	**Technological/Human Caused/Adversarial**
Biological Infestation	Active Shooter
Communicable Disease	Aircraft Accident
Drought	Dam Failure
Flood	Fire
Geologic Hazard	Hazardous Materials Release
Severe Summer Weather	Shortage or Outage of Critical Materials
Tornado	Train Derailment
Wildland Fire: Wildland Urban Interface	
Winter Storm	
In some cases, hazards may be the result of natural, technological, and/or human caused. Each hazard is categorized in the above table based on the more likely cause of significant impact.	

A summary of mitigation actions, vulnerabilities, and pre-existing mitigation for each hazard are included alphabetically by hazard name throughout this plan section.

Active Shooter

Note: For purposes of safety and security, specific vulnerabilities and mitigation ideas will not be presented in this plan for this hazard. General mitigation recommendations and existing mitigation are identified. A hazard profile for this hazard is included in Section 10 of this plan.

Mitigation Actions

1. Conduct on-going public education regarding Active Shooter hazard.

Existing Mitigation

1. The Bismarck Police Department has developed various crime prevention programs and conducts crime prevention presentations for the public upon request.
   - **Crime Prevention Programs include** Neighborhood Crime Watch, Operation Identification, Security Surveys, Crime Stoppers, Apartment Association Background Checks, and Safe Rental Housing Program. http://www.bismarcknd.gov/index.aspx?NID=399
   - Crime Prevention Presentations topics and descriptions are available on the web at http://www.bismarcknd.gov/index.aspx?NID=398
2. The Bismarck Police Department offers facility security assessments. Upon request, a specially trained officer will come to your home or business and make an assessment of your physical security. The officer will then make recommendations, if needed, on areas where it can be improved.
3. Bismarck PD, in conjunction with the Bismarck Public School system, has developed a Threat Assessment Team. The team includes both police and school representatives including investigators, counselors, and applicable parents. Threats are analyzed to determine viability or credibility and to determine if prosecution or other action (ie: referral) is necessary.
4. Bismarck PD conducts lethality assessments to determine the likelihood of domestic violence situations (case by case basis). As part of the lethality assessment protocol, appropriate referrals may be made.
5. Bismarck PD shares intelligence with ND State and Local Intelligence Center (ND SLIC).
6. The ND SLIC provides for public education including facility security assessment guidelines.
7. ND SLIC promotes "If You See Something, Say Something" public education awareness campaign. Signs are currently posted at the Bismarck Airport ("If You See Something, Say Something").
8. Personnel at Bismarck PD have participated in the ALERRT train the trainer program. http://alerrt.org/
9. MOCIC (Mid-States Organized Crime Information Center) alerts are received by Bismarck PD officials which provide information about criminal activity in the upper Midwest.
10. Bismarck PD coordinates, conducts and participates in applicable training and exercise activities with area schools and businesses, including recent full scale "active shooter" exercises.
11. Bismarck PD response capabilities include:
    - Bismarck PD Active Threat Response Plan
    - SWAT (regional team)
    - Bomb Team (FBI Certified)
    - Mutual Aid with other law enforcement agencies

Mitigation Recommendations

Building Security Risk Mitigation Recommendations (ie: Active Shooter Hazard)

Procedures:

- Conduct a realistic security assessment to determine the facility's vulnerability to an active shooter attack.
- Identify multiple evacuation routes and practice evacuations under varying conditions; post evacuation routes in conspicuous locations throughout the facility; ensure that evacuation routes account for individuals with special needs and disabilities.
- Designate shelter locations with thick walls, solid doors with locks, minimal interior windows, first-aid emergency kits, communication devices, and duress alarms.
- Designate a point-of-contact with knowledge of the facility's security procedures and floor plan to liaise with police and other emergency agencies in the event of an attack.
- Incorporate an active shooter drill into the organization's emergency preparedness procedures.
- Vary security guards' patrols and patterns of operation.
- Limit access to blueprints, floor plans, and other documents containing sensitive security information, but make sure these documents are available to law enforcement responding to an incident.
- Establish a central command station for building security.

Systems:

- Put in place credential-based access control systems that provide accurate attendance reporting, limit unauthorized entry, and do not impede emergency egress.
- Put in place closed-circuit television systems that provide domain awareness of the entire facility and its perimeter; ensure that video feeds are viewable from a central command station.
- Put in place communications infrastructure that allows for facility-wide, real-time messaging.
- Put in place elevator systems that may be controlled or locked down from a central command station.

Training:

- Train building occupants on response options outlined by the Department of Homeland Security in "Active Shooter: How to Respond" when an active shooter is in the vicinity.

    - **Evacuate**: Building occupants should evacuate the facility if safe to do so; evacuees should leave behind their belongings, visualize their entire escape route before beginning to move, and avoid using elevators or escalators.
    - **Hide**: If evacuating the facility is not possible, building occupants should hide in a secure area (preferably a designated shelter location), lock the door, blockade the door with heavy furniture, cover all windows, turn off all lights, silence any electronic devices, lie on the floor, and remain silent.
    - **Take Action**: If neither evacuating the facility nor seeking shelter is possible, building occupants should attempt to disrupt and/or incapacitate the active shooter by throwing objects, using aggressive force, and yelling.
- Train building occupants to call 911 as soon as it is safe to do so.
- Train building occupants on how to respond when law enforcement arrives on scene: follow all official instructions, remain calm, keep hands empty and visible at all times, and avoid making sudden or alarming movements.

Aircraft Accident

Mitigation Actions

2. Recommend Burleigh County and city of Lincoln adopt city of Bismarck aeronautical zoning where applicable based on the city of Lincoln growing nearer to the Airport.
3. Complete the current Wildlife Hazard Assessment. This plan is a yearlong study on the wildlife around the airport. The final assessment will provide recommendation on how to reduce the wildlife present on and around the airport.
4. Maintain the current airport hazard mitigation and emergency response plans and planning efforts identified as "existing mitigation."

Vulnerability Summary

1. The city of Lincoln, as it continues to grow, will be within the air traffic pattern of the Bismarck Airport (within the Accident Potential Zone).
2. The highest population and number of properties within 15,000 feet (within the Accident Potential Zone (APZ)) of the Bismarck Airport are northwest of the airport based on the alignment of the runway running NW/SE. Properties and populations within that distance include CHI St. Alexius Health, Sanford Health, the State Capitol, five mobile home parks, twelve schools, and Bismarck critical facilities including Bismarck Police Department, the City/County Building and Bismarck Burleigh Public Health.
3. The most vulnerable population are the crew members and frequent travelers based on extensive use of aircraft (higher use equals higher risk or probability).

Pre-Existing Mitigation: Aircraft Accident Hazard

1. The City of Bismarck utilizes ordinances to control land use and building height, as well as minimize or eliminate lighting, radio or wildlife interference with airport operations. See Title 10-09 (airport zoning regulations) and Title 14 (zoning). http://www.bismarcknd.gov/index.aspx?NID=90
2. The Bismarck Airport maintains the following Hazard Mitigation and Emergency Response Plans and Programs:
   - Airport Certification Manual
   - Airport Emergency Plan
   - Airport Security Program
   - Wildlife Hazard Management Plan
   - Environmental Assessments
   - Wetland Mitigation
   - Spill Prevention Control and Countermeasure (SPCC)
   - Bismarck Airport Master Plan Update: http://www.bismarckairport.com/index.aspx?nid=122

The Airport Certification Manual (ACM) provides direction and lines of responsibility in the day-to-day operation of the Bismarck Airport. Various other plans including the Airport Emergency Plan, Hazardous Materials, Wildlife Hazard Management Plan, are found in the ACM. The ACM outlines specifically the duties and responsibilities of individuals responsible for meeting the requirements set forth in the various manuals.

The Airport Emergency Plan Assigns responsibility to organizations and individuals for carrying out specific actions at projected times and places in responding to an emergency. As a requirement of the

Airport Emergency Plan the airport must conduct on a triennial basis a "Full Scale Emergency Exercise." The purpose of the exercise is for local emergency organizations to gain practice and preparedness for a response in the event of a major aircraft disaster.

The Airport Security Program outlines specific guidelines to ensure security. The security program includes not only airport personnel but Transportation Security Administration and Security Personnel. This includes but is not limited to access control systems, background checks for hiring employees, identification systems, TSA screening, as well as response procedures for emergencies such as a civil disturbance, hijacking, bomb threat and other situations that may occur at the Bismarck Airport.

The wildlife hazard management plan developed in conjunction with the USDA is a plan to mitigate hazards before they occur and to respond to wildlife hazards whenever they are detected or reported. The plan spells out duties and responsibilities of personnel responsible for mitigating wildlife hazards. The plan established responsibilities such as a wildlife coordinator, a wildlife hazard committee that meets annually to discuss current wildlife issues, update permits, as well as changes in ongoing actions that result in preparedness and reduction of wildlife hazards. It also established a wildlife hazard patrol and spells out ongoing mitigation steps for airport staff.

Spill Prevention Control and Countermeasure provides a plan for discharge reporting procedures, containment, inspection and testing, personnel training, and security at the oil storage facilities located on site. The Airport also has a Storm Water Pollution Plan to comply with environmental laws and to protect storm water from contaminants and procedures in the event of storm water pollution. Environmental Assessments are done whenever a project could potentially impact the environment. They provide the airport with information about the impact of the project on the environment and what needs to be done in order to disturb the environment the least.

Biological Infestation

(Urban Forest Damaging Pests)

Mitigation Actions

1. Continue programs to monitor for forest damaging pests including Emerald Ash Borer and Dutch Elm Disease.
2. Continue public education efforts to diversify tree plantings and reduce potential for transporting pests (biological infestations) from other areas of the country.
3. Continue existing mitigation efforts including the systematic approach to removing ash trees in decline.
4. Maintain the "City of Bismarck Emerald Ash Borer Response Plan" developed and approved by the Forestry Advisory Board and the City Commission.

Vulnerability Summary

1. Currently, Dutch Elm Disease is the most prevalent disease impacting trees in Bismarck on an annual basis. Approximately twenty Elm trees are removed in Bismarck each year due to Dutch Elm Disease.
2. The most significant risk and vulnerability to our city urban forest is the potential for Emerald Ash Borer.
3. When Emerald Ash Borer impacts Bismarck's urban forest, extensive resources will be required to combat the spread of the disease, compromising capabilities to address Dutch Elm Disease. The two diseases combined have potential to reduce our tree population by 50%.
4. Infested firewood may be transported by campers/travelers.

Pre-Existing Mitigation: Biological Infestation

1. The City of Bismarck has developed an Emerald Ash Borer Response Plan:

   Plan Purpose: By implementing this plan, the City is attempting to lessen the impact and disruption to its urban forestry program caused when Emerald Ash Borer (EAB) is introduced to Bismarck and the surrounding area. Taking a proactive approach to this threat enables the City to address public and private needs in an efficient and effective manner.
   http://www.bismarck.org/DocumentCenter/Home/View/2124
2. Bismarck has a Dutch Elm Disease control program consisting of firewood inspections in March to identify properties that have Elm firewood. Bismarck has forestry staff that monitors the city looking for symptoms of DED. Positive identification of infected Elms are abated for private trees and public trees are promptly removed if tested positive for DED.
3. The City has ordinances and policies that affect the City's urban forest. The City Forester does have the authority to abate "nuisance" trees on private property:

   13-01-01 (16). Definitions. "Public nuisance" means any dangerous or unsafe trees or portions thereof; any trees encroaching on public sidewalks or impeding vehicular travel on the streets in violation of standards set by the City Forester pursuant to Section 13-02-01(3); any trees located in the sight triangle in violation of Section 14-03-05(3); and any tree harboring insect or disease organisms of a contagious and fatal nature which pose a serious threat to surrounding trees if not immediately removed and disposed of, or treated with proper arboricultural procedure.

13-02-08 (4). Removal, Planting and Replacement. "If any part or the whole of any tree on private premises is found after proper investigation to be dangerous or unsafe, or otherwise constitute a public nuisance, the city forester shall declare the tree or portion thereof a public nuisance and cause the nuisance to be abated pursuant to Section 13-02-14."

The Forestry Advisory Board (FAB) made a motion and approved to include EAB into this "nuisance" tree category at the February 2010 meeting. The Forestry Advisory Board also approved a "Structured Removal Plan". This will address removal of ash trees that are in the "poor and severe decline" condition class, ash trees impacted by water service construction projects, or needing cabling and bracing before EAB arrives. The intent is to slow the spread of EAB by reducing host trees, and gaining time in future removals.

4. Bismarck has a Forest Advisory Board to provide direction and recommendations to the City Forester regarding the health of the urban forest.
   http://www.bismarcknd.gov/index.aspx?nid=929
5. Bismarck participated in a USDA Forest Service/APHIS EAB EOC response exercise.
6. Bismarck has participated in the EAB Awareness week for the last 4-5 years.
7. Bismarck also has participated in the EAB trapping program with the ND Dept. of Agriculture.
8. Public Education is provided via City Forestry web pages regarding biological infestations.
   http://www.bismarcknd.gov/index.aspx?NID=1399
   http://www.bismarck.org/DocumentCenter/Home/View/2697
9. Several organizations and agencies are currently involved in various preparation activities, including: NDSU Extension, ND Department of Agriculture, ND Forest Service, ND Game and Fish Department, ND Parks and Recreation Department, ND Urban and Community Forestry Association, USDA-APHIS, USDA-NRCS, and others. Most of these organizations are represented in the ND EAB Response Committee, chaired by the ND Department of Agriculture. Given that EAB has not yet arrived in North Dakota, each organization currently has similar roles – prepare their own employees, their customers and additional natural resource professionals.
   http://www.ag.ndsu.edu/programplanning/program-teams/horticulture-forestry/documents/eabactionplan.pdf
   http://www.bismarck.org/DocumentCenter/Home/View/2697

Communicable Disease

(Includes Pandemic Influenza, Bioterrorism, and other infectious disease)

Mitigation Actions

1. Sterilization of foot care equipment with an autoclave to decrease spread of communicable disease.
2. Standard Awareness Training: Course covering bio-terrorism and terrorism information including agents with signs and symptoms.
3. Assess willingness among local health care providers to work collaboratively to address bacterial resistance and anti-biotic stewardship.
4. Identify appropriate locations for isolation or quarantine.
5. Continue Existing Mitigation Efforts (See pre-existing mitigation section)
6. Provide education when conducting food service inspections.
7. Implement risk-based inspection frequency for food establishments.
8. Require bi-monthly water analysis for pools and recommend superchlorination if chlorine levels are observed to be low when collecting water samples.
9. Provide mosquito control & surveillance services.

Vulnerability Summary

1. If other areas of the North Dakota (or neighboring states) are impacted, our medical facilities could be overwhelmed due to demands placed on our facilities. *The same facilities would be overwhelmed by a locally affected population as well.*
2. Although all people are vulnerable, the elderly population and the population with underlying medical conditions or suppressed immune systems are more vulnerable.
3. Common social practices such as community cup or exchange of peace at area churches (and regionally) enhance the vulnerability to communicable diseases.
4. Bismarck has many facilities and other venues that are primarily an asset to the community, but also create vulnerability to the spread of communicable disease within our community:
    a. Bismarck Airport
    b. Bismarck Civic Center
    c. MDU Community Bowl at BSC
    d. Schools
    e. Shopping Centers
    f. Churches
    g. Long term care centers
    h. Hospitals
5. Jurisdictions with the higher populations are at greatest risk from communicable diseases. Bismarck is the 2nd most populated community in ND.
6. Universities located in Bismarck are particularly vulnerable as their student populations often live and study in close quarters, thus heightening the probability of transmission.
7. Almost any highly contagious, incapacitating disease that enters the North Dakota population would quickly overwhelm local and state health resources. Similarly, any rapidly spreading bioterrorism event for which little vaccination or containment capability exists is a high magnitude event.
8. Communicable diseases are most likely to spread quickly in institutional settings such as dormitories, long-term care facilities, day care facilities, schools, correctional institutions, etc.
9. Those in who live or work in close proximity – within institutional settings are at higher risk.
    a. Our cold winter season promotes vulnerability as people spend more time indoors. In some cases, heating systems may promote the circulation of contaminants.

10. Not all parents choose to vaccinate their children. Consequently, parents who don't vaccinate their children are in essence depending on the vaccination of other children to protect their child from getting vaccine preventable diseases.
11. Eleven percent (11%) of North Dakotans are uninsured according to the ND Department of Human Services. Source: 2014 ND DES Mitigation Plan.
12. Bismarck, including the Bismarck Airport, does not have authority to quarantine without sufficient supporting information.
13. Foodborne illnesses have the greatest impact on the young, elderly and people who may be immune-compromised or have other existing health conditions.
14. Anyone who swims in man-made or natural bodies of water is susceptible to recreational water illness.
15. Anyone living in an area where West Nile virus is present in mosquitoes can get infected. West Nile virus has been detected in all lower 48 states (not in Hawaii or Alaska). The risk of infection is highest for people who work outside or participate in outdoor activities because of greater exposure to mosquitoes. People with certain medical conditions, such as cancer, diabetes, hypertension and kidney disease are also at greater risk for serious illness.

Pre-Existing Mitigation: Communicable Disease
(Includes Pandemic Influenza, Bioterrorism, and other infectious disease)

1. Hand-sanitizers and masks are available to clients to prevent spread of disease.
2. Surveillance is done at the state level and communicated to local public health. Local public health monitors and provides case management of communicable disease.
3. Medical assets exist to appropriately respond. NDDoH and its medical partners have most of the anticipated materials needed for biological response. These materials are stored in a warehouse supported by an internal transportation which can be supplemented by contract or by assistance request to DES. Some materials are pre-deployed around the state and additionally local public health units have medical assets stored in their health units.
4. Annual flu clinics are held at the BBPH Office.
5. Immunization clinics are held at BBPH Office.
6. Emergency Preparedness SWC Regional Coordinator updates plans on communicable disease, isolation and quarantine and bioterrorism.
7. N95 fit-testing is completed for nursing staff.
8. Bismarck/Burleigh Public Health maintains emergency preparedness plans and conducts training and exercising of those plans.
9. Bismarck/Burleigh provides on-going public education efforts to help individuals protect themselves and the community from the spread of communicable diseases.
10. Specific diseases that are primarily mitigated through on-going routine vaccination programs include *diphtheria, tetanus, and polio.*
11. Continuity of Operations Plans have been developed by Bismarck and by Bismarck/Burleigh Public Health. The plans include orders of succession for purposes of sustaining leadership and critical functions (ie: emergency services).
12. The USPS has a bio-detection system in place at the sorting facility to detect anthrax.
13. It is required to inform the ND Department of Health regarding incidence of reportable diseases per statutory authority NDCC 23-07-01. Reportable disease are listed at http://www.ndhealth.gov/disease/disease%20reporting/diseasecall.htm

14. A regional Health Advisory Coalition is established with the goal to provide information/education and support to healthcare facilitates, private industry and the community so they can prepare for emergency situations by developing plans and creating awareness.
15. All food establishments in Bismarck are inspected once every six months to verify that they are operating in compliance with the food code.
16. The ND Department of Health (NDDoH), Division of Disease Control monitors and investigates Foodborne illnesses.
17. Diagnosed foodborne illness is mandatory reporting to the NDDoH.
18. Food employees who are symptomatic with vomiting or diarrhea must be excluded from work until they are asymptomatic for 24 hours.
19. All public and semi-public pools are inspected annually by Bismarck's Environmental Health Division.
20. All public and semi-public pools are tested twice a month for bacteriological analysis.
21. All public and semi-public pools are required to have a pool operator that is certified by the National Swimming Pool Foundation.
22. The North Dakota Department of Health (NDDoH), Division of Disease Control monitors and investigates all Recreational Water Illnesses.
23. Bismarck currently has a vector control program that performs mosquito surveillance, educates residents on how to avoid getting bitten by mosquitoes, fogs public parks and walking paths and treats standing water with larvacide.
24. The North Dakota Department of Health monitors West Nile surveillance throughout the state.

Dam Failure

(Garrison Dam)

Mitigation Actions

1. Locate new critical facilities outside inundation area when possible: When building, remodeling, or relocating critical facilities, the City of Bismarck should provide additional consideration or preference for location options outside of the dam failure inundation area. Because the probability of a catastrophic dam failure is very low, locating critical facilities outside the inundation area is NOT a requirement. However, assuming there are viable location options outside of the inundation area of equal value and functionality, locating outside the inundation area would reduce the loss potential.

Vulnerability Summary (based on catastrophic dam failure)

1. The City of Bismarck has a significant investment in a number of critical facilities within the inundation area as mapped including the Water Treatment Plant, Wastewater Treatment Plant, Police Department, South Fire Station, Airport, Northern Plains Commerce Centre, Civic Center, Combined Communications & Emergency Operations Center, Public Health, and Public Works.
2. The Critical Functions of the Combined Communications Center would have to be re-established due to the location of the facility. Calls could not be transferred to State Radio nor the Mandan/Morton PSAP, also located within the inundation area.
3. Continuity of Government and Continuity of Operations capability would be compromised as a result of personal impact to city staff as well as direct impact to an extensive number of critical facilities as noted above in #1.
4. The city's water and waste-water treatment plants are a significant vulnerability to a dam failure. Impact to these critical facilities / critical infrastructure utilities would have an adverse impact to the entire community, including the properties and population not directly flooded.
5. The most vulnerable population would be those within the inundation area who are non-ambulatory and require evacuation assistance. There is a limited amount of time to identify those persons and ensure assistance is provided after notification of a dam failure.
6. The population of those within the hospitals and other institutions requiring evacuation are highly vulnerable. Evacuation requirements for facilities and populations outside of the inundation area would depend on impact to the water treatment plant and other utility lifelines.
7. The population of the ND State Penitentiary is of high vulnerability due to limited time to evacuate.
8. Both the BNSF railroad and the DMVRR railroad are within the mapped inundation area for dam failure.
9. Structural mitigation to minimize or eliminate the inundation threat for the city is not feasible or practical; therefore, all critical facilities, property, structures, and critical infrastructure within the inundation area are vulnerable.

Pre-Existing Mitigation: Dam Failure

1. Dam owners are responsible for maintenance of their dams, so their commitment is essential to reducing the risk of dam failures. (2014 ND DES Mitigation Plan)
2. Pursuant to North Dakota Century Code, the North Dakota State Engineer and the North Dakota State Water Commission have the power, authority and general jurisdiction to regulate, control, and supervise the construction and operation of dams within the State of North Dakota. As such, the Dam Safety Program is administered by the North Dakota State Water Commission.
3. A primary function of North Dakota's dam safety program is to conduct dam inspections in order to identify deficient dams in need of maintenance or repair. Dam safety program staff currently inspect 108 high and medium hazard dams on a rotational basis. These dams include all non-federally owned high hazard dams and all non-federally owned medium hazard dams greater than 10 feet high. Every dam on the list is fully inspected at least once every ten years. High hazard dams are inspected at least once every four years. The findings and recommendations from these inspections are provided to the dam owners. In addition, each spring, 142 dams are given a partial inspection to check on the status of the dams after the spring runoff season. These dams include non-federally owned high and medium hazard dams, and selected low hazard dams. Additional inspections are conducted on request from dam owners or the public, or when there are concerns at a dam, such as during flood events. (2014 ND DES Mitigation Plan)
4. Although North Dakota has very low risk to seismic activity, the U.S. Army Corps of Engineers has strong motion sensors installed at the Garrison Dam site near Riverdale that measure intense ground movement. There are an additional 30 seismic monitoring stations throughout the state. (Source: 2014 ND DES Mitigation Plan)
5. The US Army Corp of Engineers (USACE) maintains an extensive dam safety program to ensure the integrity of Garrison Dam. The USACE has a system of; relief wells, instrumentation (for monitoring water pressures and movement within the embankment), and a comprehensive inspection system. As part of the inspection program, the USACE conducts formal annual inspections and more comprehensive periodic inspections every five years. All of these steps are taken to help insure the integrity of the Garrison Dam to allow the USACE to continue to operate for the eight authorize purposes of; flood control, navigation, irrigation, hydropower, water supply, water quality, recreation and fish & wildlife.
6. The USACE updated the Dam Failure Inundation Map (January 2015) regarding the Garrison Dam Project. The inundation maps are made available to approved Emergency Action Plan holders.
7. The USACE has an Emergency Action Plan that would be followed in any event where the USACE's ability to operate as designed would be in jeopardy.

   - Dam Safety Program Information: http://www.usace.army.mil/Missions/CivilWorks/DamSafetyProgram/ProgramActivities.aspx
   - Garrison Dam and Lake Sakakawea Information: http://www.nwo.usace.army.mil/Missions/DamandLakeProjects/MissouriRiverDams/Garrison.aspx

Drought

Mitigation Actions: No new mitigation actions. In addition to local response capabilities, the pre-existing mitigation identified below adequately address vulnerabilities identified.

Pre-Existing Mitigation

1. The City of Bismarck water treatment plant has two water intake systems.
   - A new Horizontal Collector Well intake was placed in operation in November 2014. This water intake is 80 feet below the river's surface and collects ground water that is recharged from the river bed. This intake has a capacity of 34 MGD (million gallons per day) and is not impacted by fluctuations in river levels or short term changes in river water quality.
   - The intake constructed in the 1950's provides direct withdrawal of the river via four 20 inch diameter pipes. The quality and quantity of water from this intake is potentially impacted by changes in the river's level and the migration of sandbars. This intake will be maintained as a backup to the horizontal collector well intake.
2. The Bismarck Code of City Ordinances uses Chapter 2-08-03 to give the President of the Board of City Commissioners the power to issue an emergency or disaster declaration and to utilize twenty-three specific emergency powers. These powers include…
   - Require the continuation, termination, disconnection, limitation, or suspension of natural gas, electrical power, water, sewer, or other public utilities or services.
   - Control, restrict, allocate, or regulate the use sale, production, or distribution of food, water, fuel, clothing, and/or other commodities, materials, goods, services, and resources.

Vulnerability Summary

In the United States, a well-developed economy and agricultural system generally protect citizens from the most critical effects of drought such as shortages of food and water. However, drought still causes extreme hardship for farm and ranch families, and individual wells may run dry.
Source: National Drought Mitigation Center

1. Typically, the most profound impact of drought is to the economy:
   a. Farm and ranching community
   b. Impact to local businesses (and employees) associated with the agricultural industry
   c. Economically disadvantaged – increased cost of food
   d. Tourism / recreation
2. Economically disadvantaged may be vulnerable due to the likelihood of increased cost of food during extended drought conditions regardless of geographic area impacted by severe drought conditions.
3. Heat waves associated with droughts create additional risk for vulnerable populations such as the elderly, young, and those required to work outdoors including first response community.
4. Drought increases fire risk. See Fire and Wildland Fire hazards for information regarding vulnerabilities and mitigation ideas.
5. The environment is vulnerable to drought:
   a. Air quality
   b. Loss of wetlands
   c. Insect infestations
   d. Invasive vegetative species (ie: leafy spurge)

Fire

Mitigation Actions

1. Continue to update and enforce zoning, building and fire code regulations.
2. Promote (not require) residential fire sprinkler systems to minimize fire risk and vulnerability.

Public Education topics:

3. Provide public education to the community at large.

Vulnerability Summary

1. Occupancies that do not have working smoke detectors are at risk. Statistics indicate a higher fatality rate in fires that occur in occupancies without working smoke detectors.
2. Non-sprinklered property is at a higher risk of sustaining more damage or life loss compared to property that is protected by sprinkler systems.
3. The young (ie: Daycare) and elderly population is more vulnerable for several reasons. Age, mental state and physical limitations may make it difficult to evacuate a building involved in fire or they can become confused and not be able to take the correct actions. Many daycares and schools do not have fire sprinkler systems.
4. Some mobile homes are vulnerable due to their construction materials and close proximity to each other.
5. Apartment houses without sprinkler systems or working alarm systems are also at higher risk.

Pre-Existing Mitigation: Fire

1. Fire stations are strategically located throughout the city for optimum response times.
2. All fire stations are adequately staffed to provide response capability for fires that may range from a single family dwelling to a large commercial property.
3. The city has a modern dispatch center with many capabilities.
4. Fire hydrants are spaced throughout the city for uniform coverage.
5. Fire hydrants are flow tested to assure adequate water supply.
6. A fire inspection program is in place. All commercial properties are inspected annually to identify and reduce fire hazards.
7. Fire and Building codes have been adopted to ensure fire and life safety requirements are met for new and existing buildings. The following codes are currently enforced by the City of Bismarck, Fire Department:
    - International Building Code – 2012
    - International Fire Code - 2012
    - International Residential Code - 2012
    - International Mechanical Code - 2012
    - International Fuel Gas Code - 2012
    - North Dakota State Plumbing Code - 2009
    - National Electrical Code - 2011
    - Laws, Rules, and Wiring Standards of North Dakota - 2011

- NFPA 13 Installation of Sprinkler Systems - 2010
- NFPA 13R Installation of Sprinkler Systems in Residential Occupancies up to and including 4-stories in height - 2010
- NFPA 14 Installation of Standpipe Systems - 2010
- NFPA 72 National Fire Alarm Code - 2010

8. Sprinkler requirements are in place to increase the level of life safety in certain buildings as well as to control fires that do occur.
9. Zoning and other regulations are in place to reduce the risk of fire exposure through orderly development of the community.
10. A permitting process is in place for suppression systems, alarm systems, fireworks displays and building construction.
11. Public education programs are provided to the youth in the school system.

Flood

Mitigation Actions

1. Apply to participate in the National Flood Insurance Program (NFIP) Community Rating System (CRS).
2. Apex Engineering has been contracted to conduct a preliminary investigation into solutions to reduce urban flooding in south Bismarck in the Expressway and South 12th Street areas. (current mitigation activity)
3. Continue Watershed master planning and updating as an on-going mitigation activity conducted jointly by Engineering, Public Works, and Community Development.
4. Develop an Emergency Action Plan for Jackman Coulee Dam #2. (Tom O'Leary Golf Course)
5. Conduct maintenance activities at Jackman Coulee Dam #2 (Tom O'Leary Golf Course) as recommended by the State Water Commission and/or annual inspections conducted by Bismarck Public Works.
6. Maintain existing flood protective measures to minimize vulnerability as a result of ice jams as well as 100-year and 500-year flood events. Note: Refers to maps (Figures 1 thru 5) within "existing mitigation"

Public Education Topics:

7. Coordinate and/or support NFIP flood insurance promotional efforts including the availability of flood insurance for community residents and businesses.
8. Conduct Flood Mitigation and Preparedness Public Education efforts for local citizens and businesses.

Vulnerability Summary

1. Although flood protective measures including levee structures are in place to protect south Bismarck, those protective measures are not certified by FEMA. There are also required response actions to fill gaps. Properties, population, and infrastructure within the 100 Year and 500 Year flood plains remain vulnerable to those flood events.
2. Vehicles and occupants may inadvertently enter a flooded underpass at the 7th Street or 9th Street location following an urban flooding event. There is pumping capability at the 7th Street underpass location. The 9th street location is drained via gravity flow.
3. Vulnerabilities regarding lack of access following an urban flood event include:
    - Airport and Skyway Village
    - 12th Street (from University Drive to Bismarck Expressway)
    - Bismarck Expressway from 7th to 12th Street
    - South 3rd Street – from Arbor Avenue to Bismarck Expressway
    - Broadway Avenue – from 12th to 14th Street
    - Washington Street and Bowen Avenue
    - 2nd Street and Arbor Avenue
4. Waste Water Treatment Plant operations are affected by the elevation of the river (ie: 500 year flood event or ice jam). Pumping may be required for effluent discharge depending on the river elevation.
5. The South Fire Station is vulnerable to urban flooding (street access).
6. There are an estimated 18 properties at risk should there be a 0.5 PMP flood event or 0.5 PMP flood event with a multiple breach relating to Jackson Coulee Dam #1 and #2 (Tom O'Leary Golf Course).

Pre-Existing Mitigation: Flood

Existing Protective Measures
(post 2011 Flood Event Mitigation Activities)

Also see applicable maps (figures 1 through 5) following this table

1. The Tavis Road flood gate control structure and pumping station have been installed and are operational. Closing the flood gate control structure prevents flood waters from back-flowing into and elevating the drainage ditch level. Additionally, the pumping station establishes the capability of reducing the drainage ditch level to maximize its storage capacity and minimize the potential for flash flood impacts.
2. The floodgate at Washington Street takes properties east of Washington Street out of the 100-Year floodplain. This structure was repaired following the 2011 flood and is fully operational.
3. The grade of Tavis Road has been raised to a flood stage of 20 feet.
4. Following the 2011 flood event, the City of Bismarck installed flood gates on stormwater outfalls.
5. The pumping capability at #8 is permanent. The other locations require response action to set up temporary pumping. See applicable map - Figure 5.
6. A new control gate was also installed on Whisper Drive to prevent flood waters from within Whispering Bay from flooding east into the Traynor Drive area south of Mills Avenue.
7. Additional ice jam protection measures were installed in 2012 by Burleigh County.
8. In 2013, the City of Bismarck began the construction of the Riverwood Drive and Mills Ave reconstruction projects. These projects included grade raises of the existing roadways to a flood stage of 20-feet. Riverwood Drive was completed from Expressway Ave to the north entrance of Southport Loop. The grade raise portion of Mills Avenue was completed and paved in 2014 The project included several control structures with sluice gates located on the storm water outfalls and a control structure on the Mills Avenue causeway. The new sluice gates and control structure are operation and ready to be manually closed during a flood event.

River Gage Locations: See map on right.

9. A new river gaging station has been installed by the USGS to collect river elevation data for both open water and ice covered periods on the Missouri River. The USGS installed the stage gage near Fort Lincoln on the west side of the river: USGS 06349070, Missouri River below Mandan, ND. This gage will provide timely stage information for South Bismarck.

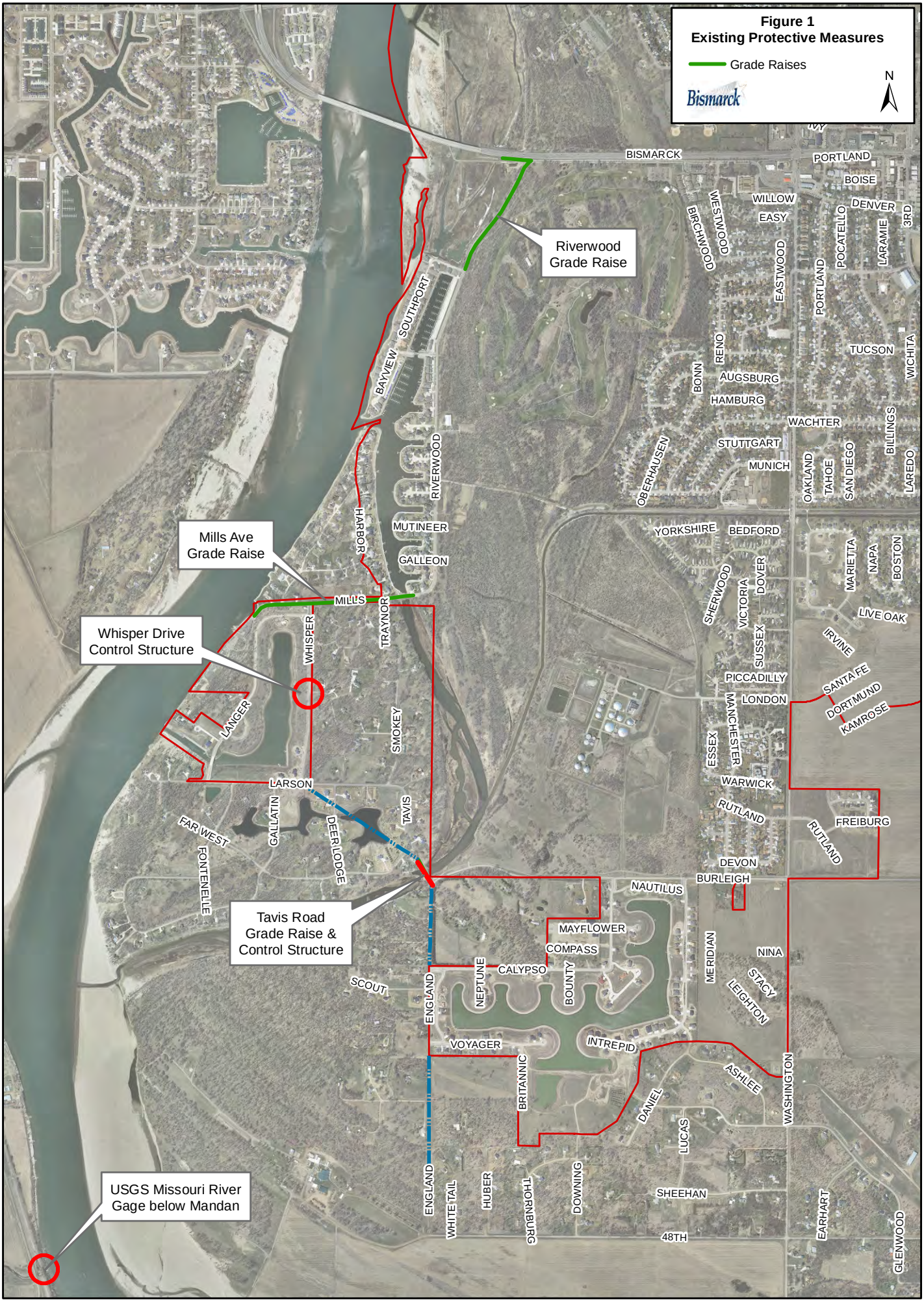
Figure 1
Existing Protective Measures
Grade Raises
Bismarck
N
Riverwood Grade Raise
Mills Ave Grade Raise
Whisper Drive Control Structure
Tavis Road Grade Raise & Control Structure
USGS Missouri River Gage below Mandan
BISMARCK
PORTLAND
BOISE
WILLOW
EASY
DENVER
3RD
BIRCHWOOD
WESTWOOD
EASTWOOD
PORTLAND
POCATELLO
LARAMIE
SOUTHPORT
BAYVIEW
RENO
TUCSON
WICHITA
BONN
AUGSBURG
HAMBURG
WACHTER
BILLINGS
STUTTGART
MUNICH
OBERHAUSEN
OAKLAND
TAHOE
SAN DIEGO
LAREDO
RIVERWOOD
HARBOR
MUTINEER
GALLEON
YORKSHIRE
BEDFORD
MARIETTA
NAPA
BOSTON
MILLS
TRAYNOR
SHERWOOD
VICTORIA
DOVER
LIVE OAK
WHISPER
SUSSEX
IRVINE
PICCADILLY
SANTA FE
LONDON
DORTMUND
KAMROSE
LANGER
SMOKEY
MANCHESTER
ESSEX
LARSON
WARWICK
RUTLAND
FREIBURG
FAR WEST
GALLATIN
DEER LODGE
TAVIS
DEVON
BURLEIGH
FONTENELLE
NAUTILUS
MAYFLOWER
COMPASS
NINA
MERIDIAN
CALYPSO
NEPTUNE
BOUNTY
STACY
SCOUT
ENGLAND
LEIGHTON
VOYAGER
INTREPID
ASHLEE
BRITANNIC
WASHINGTON
DANIEL
LUCAS
WHITE TAIL
HUBER
THORBERG
DOWNING
SHEEHAN
48TH
EARHART
GLENWOOD

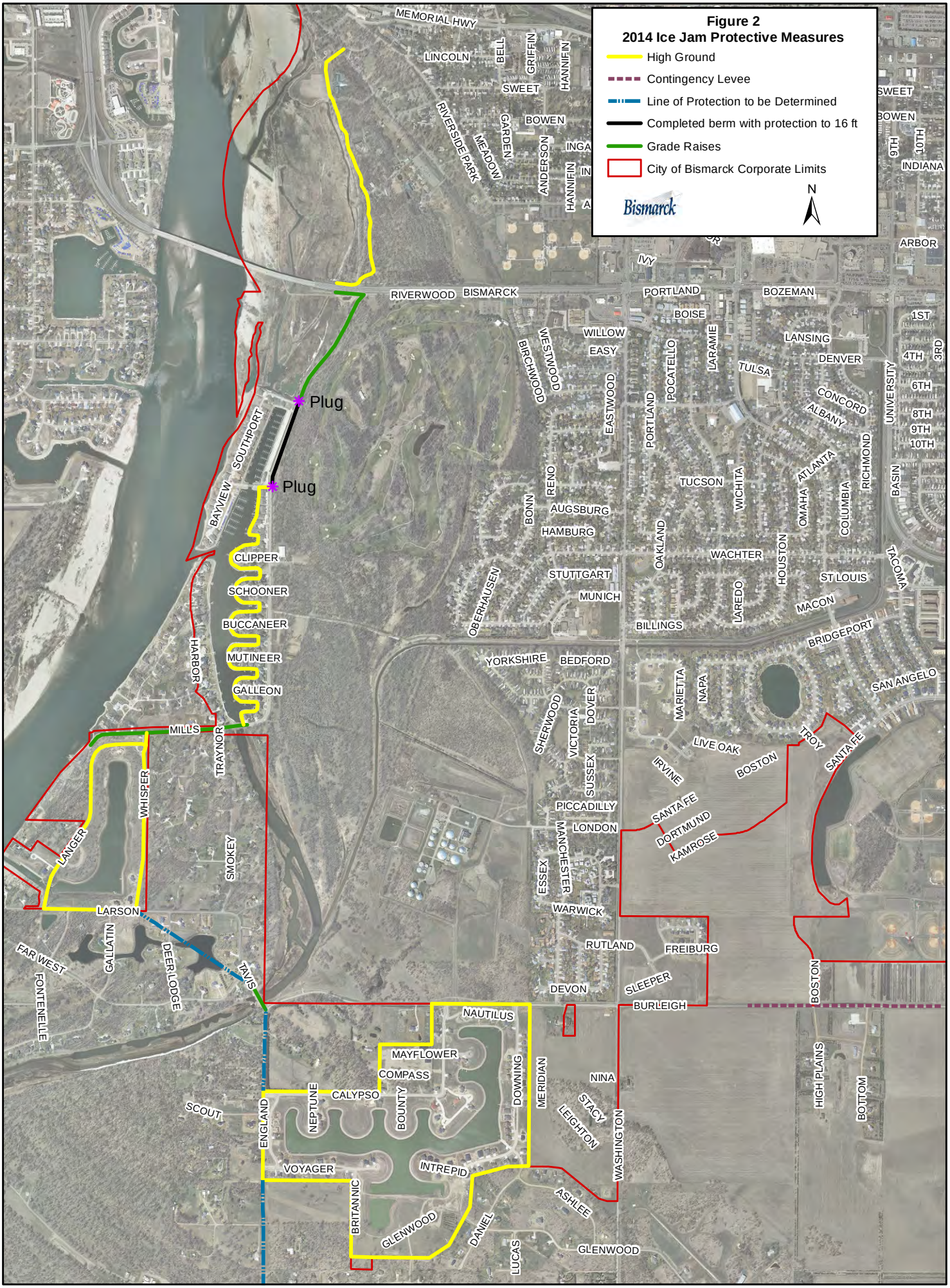
Figure 2
2014 Ice Jam Protective Measures
High Ground
Contingency Levee
Line of Protection to be Determined
Completed berm with protection to 16 ft
Grade Raises
City of Bismarck Corporate Limits
Bismarck
N
Plug
Plug
MEMORIAL HWY
LINCOLN
BELL
GRIFFIN
HANNIFIN
SWEET
BOWEN
RIVERSIDE PARK
MEADOW
GARDEN
ANDERSON
INGA
IN
A
SWEET
BOWEN
9TH
10TH
INDIANA
ARBOR
IVY
RIVERWOOD
BISMARCK
PORTLAND
BOZEMAN
BOISE
1ST
WILLOW
EASY
WESTWOOD
BIRCHWOOD
LARAMIE
POCATELLO
LANSING
DENVER
TULSA
4TH
3RD
UNIVERSITY
6TH
CONCORD
ALBANY
8TH
9TH
10TH
EASTWOOD
PORTLAND
SOUTHPORT
BAYVIEW
RENO
TUCSON
WICHITA
ATLANTA
RICHMOND
BASIN
BONN
AUGSBURG
HAMBURG
OAKLAND
OMAHA
COLUMBIA
CLIPPER
WACHTER
HOUSTON
TACOMA
SCHOONER
STUTTGART
ST LOUIS
OBERHAUSEN
MUNICH
LAREDO
MACON
BUCCANEER
BILLINGS
BRIDGEPORT
HARBOR
MUTINEER
YORKSHIRE
BEDFORD
SAN ANGELO
GALLEON
MARIETTA
NAPA
SHERWOOD
VICTORIA
DOVER
MILLS
TRAYNOR
LIVE OAK
TROY
SANTA FE
BOSTON
IRVINE
SUSSEX
WHISPER
PICCADILLY
SANTA FE
LONDON
DORTMUND
KAMROSE
LANGER
SMOKEY
MANCHESTER
ESSEX
LARSON
WARWICK
RUTLAND
FREIBURG
FAR WEST
GALLATIN
DEER LODGE
TAVIS
DEVON
SLEEPER
BOSTON
FONTENELLE
BURLEIGH
NAUTILUS
MAYFLOWER
COMPASS
NINA
HIGH PLAINS
BOTTOM
CALYPSO
NEPTUNE
BOUNTY
DOWNING
MERIDIAN
STACY
SCOUT
ENGLAND
LEIGHTON
WASHINGTON
VOYAGER
INTREPID
ASHLEE
BRITANNIC
GLENWOOD
DANIEL
LUCAS
GLENWOOD

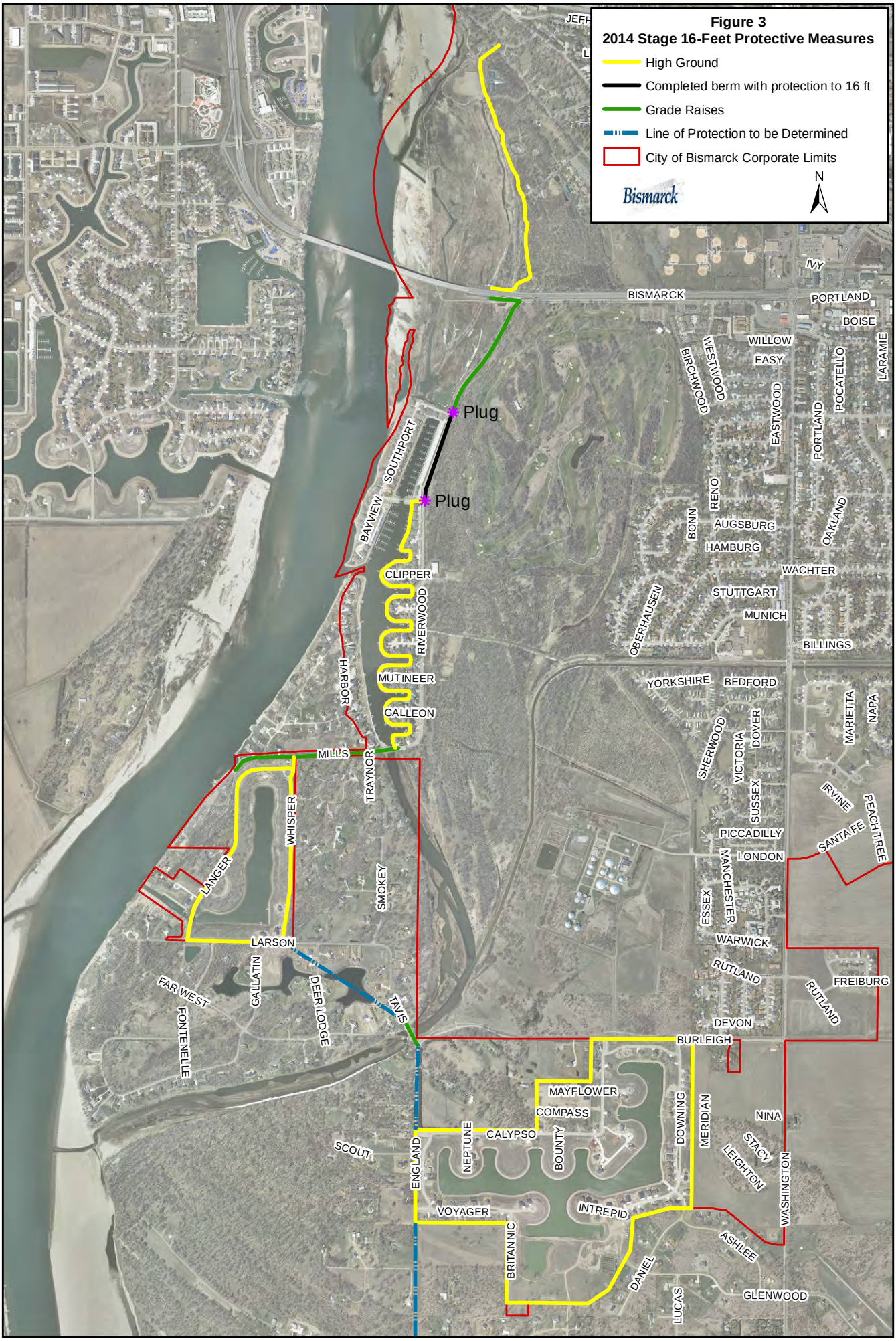
Figure 3
2014 Stage 16-Feet Protective Measures
High Ground
Completed berm with protection to 16 ft
Grade Raises
Line of Protection to be Determined
City of Bismarck Corporate Limits
Bismarck
N
Plug
Plug
BISMARCK
IVY
PORTLAND
BOISE
WILLOW
EASY
WESTWOOD
BIRCHWOOD
EASTWOOD
PORTLAND
POCATELLO
LARAMIE
SOUTHPORT
BAYVIEW
RENO
BONN
AUGSBURG
HAMBURG
OAKLAND
WACHTER
CLIPPER
STUTTGART
MUNICH
OBERHAUSEN
RIVERWOOD
BILLINGS
HARBOR
MUTINEER
YORKSHIRE
BEDFORD
GALLEON
MARIETTA
NAPA
MILLS
TRAYNOR
SHERWOOD
VICTORIA
DOVER
WHISPER
SUSSEX
IRVINE
PEACHTREE
PICCADILLY
SANTA FE
LANGER
LONDON
SMOKEY
MANCHESTER
ESSEX
LARSON
WARWICK
RUTLAND
FREIBURG
FAR WEST
GALLATIN
DEER LODGE
TAVIS
RUTLAND
DEVON
FONTENELLE
BURLEIGH
MAYFLOWER
COMPASS
NINA
DOWNING
MERIDIAN
CALYPSO
NEPTUNE
BOUNTY
STACY
SCOUT
ENGLAND
LEIGHTON
WASHINGTON
VOYAGER
INTREPID
ASHLEE
BRITANNIC
DANIEL
GLENWOOD
LUCAS

Figure 4
2014 Stage 20-Feet Protective Measures
Line of Protection to be Determined
2014 Temporary Protection
Grade Raises
City of Bismarck Corporate Limits
Bismarck
N
ARBOR
IVY
RIVERWOOD
BISMARCK
BISMARCK
WILLOW
EASY
WESTWOOD
BIRCHWOOD
EASTWOOD
SOUTHWOOD
PORTLAND
SOUTHPORT
BAYVIEW
RENO
BONN
AUGSBURG
HAMBURG
WASHINGTON
WACHTER
CLIPPER
SCHOONER
MUNICH
OAKLAND
OBERHAUSEN
BUCCANEER
MUTINEER
HARBOR
BEDFORD
YORKSHIRE
DOVER
GALLEON
VICTORIA
MARIETTA
MILLS
TRAYNOR
IRVINE
SUSSEX
WHISPER
PICCADILLY
LONDON
LANGER
SMOKEY
MANCHESTER
ESSEX
LARSON
WARWICK
RUTLAND
FAR WEST
DEER LODGE
TAVIS
DEVON
GALLATIN
FONTENELLE
BURLEIGH
NAUTILUS
MAYFLOWER
COMPASS
DOWNING
ENGLAND
NEPTUNE
CALYPSO
BOUNTY
SCOUT

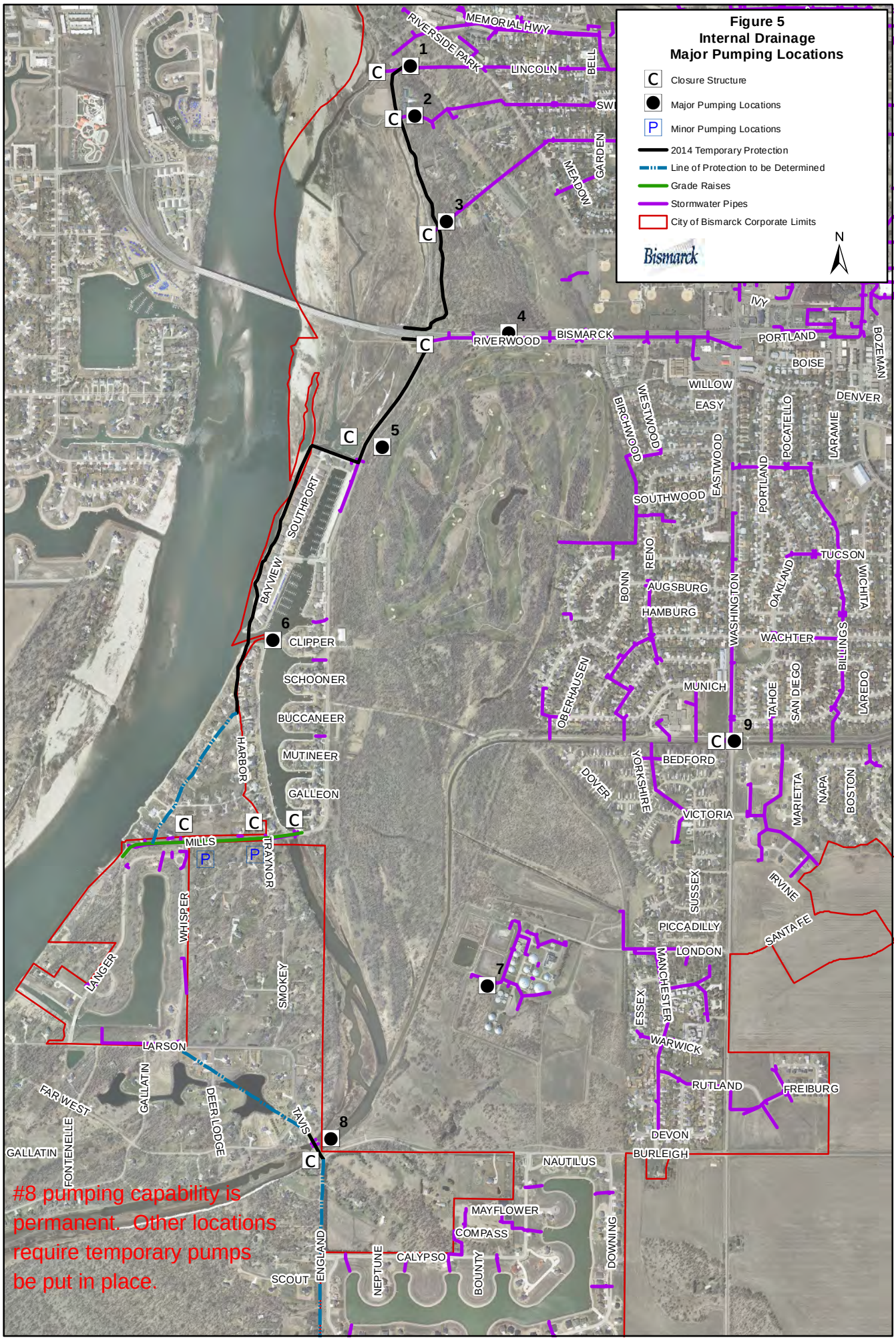
Figure 5
Internal Drainage
Major Pumping Locations
Closure Structure
Major Pumping Locations
Minor Pumping Locations
2014 Temporary Protection
Line of Protection to be Determined
Grade Raises
Stormwater Pipes
City of Bismarck Corporate Limits
Bismarck
N
MEMORIAL HWY
RIVERSIDE PARK
LINCOLN
BELL
GARDEN
MEADOW
RIVERWOOD
BISMARCK
IVY
PORTLAND
BOISE
BOZEMAN
WILLOW
EASY
DENVER
BIRCHWOOD
WESTWOOD
EASTWOOD
POCATELLO
LARAMIE
SOUTHWOOD
TUCSON
RENO
BONN
AUGSBURG
HAMBURG
WASHINGTON
OAKLAND
WICHITA
WACHTER
BILLINGS
OBERHAUSEN
MUNICH
TAHOE
SAN DIEGO
LAREDO
BEDFORD
DOVER
YORKSHIRE
VICTORIA
MARIETTA
NAPA
BOSTON
IRVINE
SUSSEX
PICCADILLY
SANTA FE
LONDON
MANCHESTER
ESSEX
WARWICK
RUTLAND
FREIBURG
DEVON
BURLEIGH
NAUTILUS
MAYFLOWER
COMPASS
CALYPSO
BOUNTY
DOWNING
NEPTUNE
ENGLAND
SCOUT
TAVIS
DEER LODGE
GALLATIN
FONTENELLE
FAR WEST
LARSON
LANGER
WHISPER
SMOKEY
TRAYNOR
MILLS
HARBOR
BAYVIEW
SOUTHPORT
CLIPPER
SCHOONER
BUCCANEER
MUTINEER
GALLEON
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C
P
#8 pumping capability is permanent. Other locations require temporary pumps be put in place.

Pre-Existing Mitigation Continued: Flood

10. The Bismarck 100-Year and 500-Year Floodplain Maps (Flood Insurance Rate Map) are both updated as of 2014.
11. Bismarck is a participating community in the National Flood Insurance Program. (CID#380149). Participation in the NFIP requires communities to adopt floodplain regulations that meet NFIP objectives, which are: New buildings must be protected from flooding damages that occur as a result of the 100-year flood, and new development must not cause an increase in flood damages to other property.
12. **Floodplain Ordinance:** The floodplain ordinance is contained with the Bismarck Zoning Ordinance – Title 14. The purpose of the regulations set forth by the floodplain ordinance (14-04-19) is to promote public health, safety, and general welfare, and to minimize public and private losses due to flood conditions. A "Floodplain Administrator" is designated by the City of Bismarck to administer the City's floodplain regulations. More information: http://nd-bismarck.civicplus.com/DocumentCenter/Home/View/1962
13. Floodplain management is addressed through our Floodplain Administrator and Community Development via regular planning meetings where storm water management and floodplain issues are addressed.
14. As part of the 2014 Growth Management Plan, the future land use plan (FLUP) identifies an urban service area boundary (USAB). The USAB identifies the area within which the City of Bismarck can reasonably provide municipal infrastructure services (water, stormwater, sanitary sewer and transportation). As a secondary benefit, maintaining infrastructure development within the USAB helps to limit potential impact to the City of Bismarck following any future flood events.
15. Stormwater Management Program – Mitigation Capabilities: Bismarck has a Stormwater Management Program implemented jointly by Community Development, Engineering, and Public Works and a Stormwater Program Coordinator within the Public Works Department. Mitigation capabilities of the Stormwater Management program are identified through Community Development via City Ordinance Title 14.1 (Zoning Ordinance). The city has authority to regulate and enforce stormwater management requirements to promote health, safety, and welfare of the people and property within Bismarck and its extraterritorial jurisdiction. The requirements, permitting and detailed review process are in place to mitigate the impacts of development and land disturbance, protect natural resources, maintain water quality, and minimize stormwater runoff, erosion, and urban flooding issues. More Information: http://www.bismarck.org/index.aspx?nid=138
16. Flood Insurance Study: The special flood hazard areas are identified by the Federal Emergency Management Agency (FEMA) in a scientific and engineering report titled "The Flood Insurance Study for Burleigh County, North Dakota and Incorporated Areas", dated July 19, 2005, with an accompanying flood insurance rate map (FIRM), and as subsequently updated by any Letter of Map Amendment (LOMA), Letter of Map Revision (LOMR) and/or Letter of Map Revision Based on Fill (LOMR(f)) issued by the Federal Emergency Management Agency (FEMA). The Flood Insurance Study (FIS) is on file in the office of the Floodplain Administrator. Special flood hazard areas may also be designated in a storm water management plan prepared for a development, plat or watershed. Flood Insurance Study and Flood Insurance Rate Maps are available via State Water Commission: http://www.swc.nd.gov/4dlink9/4dcgi/GetContentRecord/PB-1976
17. The National Weather Service issues warnings, watches, and advisories for flooding.

Additional completed and on-going flood mitigation (pre-existing).

18. Apex Engineering has been contracted (year 2014) to conduct a preliminary investigation into solutions to reduce urban flooding in south Bismarck in the Expressway and South 12th Street area.
19. The 7th Street underpasses has permanent pumping capability to address urban flooding events. The 9th Street location relies on gravity flow.
20. The Jackman Coulee Dam #2 (within Tom O'Leary Golf Course), is inspected by the State Water Commission every 4 years and inspected by Bismarck Public Works annually.

21. Commitment to Stormwater Management :

Throughout its existence Bismarck has devoted considerable resources to ensuring the safe and adequate discharge of stormwater within the community.

A number of diversified watersheds within and adjacent to our city, such as the Apple Creek watershed, the Hay Creek watershed, the Jackman Coulee watershed, and the Tyler Coulee watershed, has resulted in the need for a proper stormwater management planning to minimize the potential for damages to already developed downstream properties as development and growth continued. Early solutions to stormwater issues tended to deal mainly with accommodating runoff volume and provided little else as far as erosion control or water quality. Stream channelization was viewed as an acceptable solution. For a more complete listing of the stormwater projects completed in Bismarck over the years, please consult the City of Bismarck Stormwater Management Plan, dated April 1, 1997.

Since the passage and adoption of the City of Bismarck Stormwater Management Ordinance in 1997 with an implementation date of January 1, 1998, increased emphasis has been placed on requiring developers to properly control stormwater runoff from their property so that post development runoff is equal to, or less than, predevelopment runoff. This has typically been accomplished through an extensive network of detention ponds, some of a local nature meaning the pond detains runoff from a limited area, and some of a regional nature where the pond collects runoff from a larger area involving multiple property owners and neighborhoods.

Working collectively with developers and grant monies obtained from federal, state, and local sources, recent projects have resulted in stormwater systems that more closely resemble natural stream streambeds and ponds. Recreational trails have been constructed adjacent to and within some stormwater areas. For example, the restoration of the Hay Creek Greenway, complete with a shared use path, now serves as an asset to our community and has generated appreciative comments from our citizens.

Stormwater management, both nationwide and in Bismarck, is a much more complex matter than it was even a half century ago. Through continued proper planning, design, construction, operation and maintenance, our stormwater resources can provide safe, reliable protection for our community and residents for years to come.

National Flood Insurance Program Compliance
(NFIP Compliance)

Bismarck is a participating community in the National Flood Insurance Program. (CID#380149). Participation in the NFIP requires communities to adopt floodplain regulations that meet NFIP objectives, which are: New buildings must be protected from flooding damages that occur as a result of the 100-year flood, and new development must not cause an increase in flood damages to other property.

Bismarck has procedures implemented to address and maintain NFIP compliance.

1. A floodplain ordinance has been adopted and remains in effect. The floodplain ordinance is contained with the Bismarck Zoning Ordinance – Title 14. The purpose of the regulations set forth by the floodplain ordinance (14-04-19) is to promote public health, safety, and general welfare, and to minimize public and private losses due to flood conditions. A "Floodplain Administrator" is designated by the City of Bismarck to administer the City's floodplain regulations.
   More information: http://nd-bismarck.civicplus.com/DocumentCenter/Home/View/1962
   See ordinance – next page.
2. Residents are provided information on flood hazards, floodplain map data, and availability of flood insurance.
3. An interactive floodplain map is available on the city's website:
   http://bismarck.maps.arcgis.com/apps/PublicGallery/index.html?appid=1ace5bf2d2cf48ff8a4b72f9b25c4b07&group=30f58515bb0d4410bd71846a1c89521e
4. Floodplain management is addressed through our Floodplain Administrator and Community Development via regular planning meetings where storm water management and floodplain issues are addressed.
5. Mitigation Actions highlighted below illustrate commitment to maintain NFIP compliance. These mitigation actions are also identified in Section 4: Mitigation Implementation Action Plan.
   - Apply to participate in the National Flood Insurance Program (NFIP) Community Rating System (CRS).
   - Coordinate and/or support NFIP flood insurance promotional efforts including the availability of flood insurance for community residents and businesses.
   - Conduct Flood Mitigation and Preparedness Public Education efforts for local citizens and businesses.
6. Additional actions supporting NFIP compliance are noted in within this plan section (ie: Flood Hazard mitigation actions and pre-existing mitigation)

National Flood Insurance Program (NFIP)

The Federal Disaster Protection Act of 1973 requires state and local governments to participate in the NFIP as a condition to the receipt of any federal loan or grant for construction projects in flood prone areas. Participation in the NFIP requires communities to adopt floodplain regulations that meet NFIP objectives. The first objective is that new buildings must be protected at a 100-year flood level. The second objective is that new development must not cause an increase in flood damage to other property. In 2012, the Biggert-Waters Reform Act was signed and contains many reforms that will impact the NFIP moving forward. These changes include the phasing out of subsidies, new insurance policies to be issued at full-risk rates, and grandfathered rates being phased out over five years. Communities have been provided assistance through the North Dakota Floodplain Management Act of 1981 which directs the state engineer to aid local governments in reducing flood damages through sound floodplain management. The state legislature provided the state engineer with an appropriation to be used in assisting communities to obtain base flood (100-year) elevation data.

Floodplain Ordinance

NFIP Compliance Continued

Floodplain Ordinance: http://nd-bismarck.civicplus.com/DocumentCenter/Home/View/1962

14-04-19. FP Floodplain District. In any FP floodplain district, the following regulations shall apply:

1. Statement of purpose. It is the purpose of this section to promote the public health, safety, and general welfare, and to minimize public and private losses due to flood conditions in specific areas by provisions designed:

a. To protect human life and health;
b. To minimize expenditure of public money for costly flood control projects;
c. To minimize the need for rescue and relief efforts associated with flooding, generally undertaken at the expense of the general public;
d. To minimize prolonged business interruptions;
e. To minimize damage to public facilities and utilities located in special flood hazard areas such as water and gas mains, electric, telephone, and sewer lines, streets, and bridges;
f. To help maintain a stable tax base by providing for the use and development of special flood hazard areas so as to minimize future flood blight areas;
g. To ensure that potential buyers are notified that property is located in a special flood hazard area;
h. To ensure that those who occupy the special flood hazard areas assume responsibility for their actions; and
i. To provide an increased level of protection in anticipation of future increases in the base flood elevation (BFE).

2. Methods of reducing flood losses. In order to accomplish its purposes, this section includes methods and provisions for:

a. Restricting or prohibiting uses which are dangerous to health, safety, and property due to water or erosion hazards, or which result in damaging increases in erosion, flood water elevations or flow velocities;
b. Requiring that uses vulnerable to flooding, including attendant utilities and facilities which serve such uses, be protected against flood damage at the time of initial construction;
c. Controlling the alteration of natural floodplains, stream channels, and natural protective barriers, which help accommodate or convey flood waters;
d. Controlling filling, grading, dredging, and other development which may increase flood damage; and
e. Preventing or regulating the construction of flood barriers or obstructions which will unnaturally divert flood waters or which may increase flood hazards in other areas.

Geologic Hazard

Mitigation Actions

1. Finalize and approve the Ash and Ward Coulee Stormwater Master Plan.
2. Continue to include recommendations regarding development control lines in geological sensitive areas as future planning is done.

Public Education topics:

3. Identify opportunities to inform or remind property owners of property related information regarding potential geologic conditions that may impact them or their property.
4. Do Not stockpile snow within any geological sensitive areas.

Vulnerability Summary

1. The properties along Burnt Boat Drive are built on backfill. Backfill is more prone to failure or settling if not compacted properly. Numerous properties in northwest Bismarck were constructed on extensive backfill along steep topography.
2. The DMVW railroad tracks run adjacent to Hay Creek through much of Bismarck. Hay Creek crosses under the tracks at five locations between 57th Street and Divide Avenue. The DMVW tracks run adjacent to Hay Creek for a distance of approximately 25,000 feet (4.7 miles) through Bismarck. The vulnerability of concern is the potential washout of the track bed and stability of the slope adjacent to the tracks.
3. Burnt Boat Drive is vulnerable (potential loss of street) based on adjacent slopes. Burnt Boat Drive provides critical access to residential properties and to River Road in north Bismarck.
4. Previously land disturbance control lines were established for the Promontory Point developments and other areas surrounding the Tyler Coulee. Promontory Points I, II and III had no land disturbance control lines when they were developed. The platting of Promontory Point IV established a 50 ft development control line for those lots adjacent to the bluff, but there wasn't a geotechnical determination to support this requirement.
5. The platting of the bluffs adjacent to Hay Creek, such as the Pebble Creek Developments and the Edgewood Developments, did not establish any land disturbance control lines.
6. River Road from Highway 1804 to Fraine Barracks is vulnerable due to the adjacent bluffs / slopes.
7. Property owners may not be aware of easements and setback requirements or other property geologic issues. Lack of awareness may potentially cause problems as a result of over-watering or overloading unstable areas.

Pre-Existing Mitigation: Geologic Hazard
1. The city has contracted with Advanced Engineering and Environmental Services, Inc (AE2S) to develop the Ash and Ward Coulee Storm Water Master Plan. As one component of the plan, areas that are potentially geographically vulnerable and should be preserved are identified. This storm water master plan was started in 2013 and identifies soil types, soil data, and soil stress based on a range of storm events such as the 2-year and 100-year event. The plan is not yet finalized or approved. 2. The Tyler Coulee Storm Water Master Plan prepared in 2002 and updated in 2007 establishes setback lines to limit development in areas with steep slopes. 3. A report entitled "Geologic and Hydrogeologic Conditions Affecting Land Use in the Bismarck-Mandan Area" via Department of Mineral Resources ND Geologic Survey includes maps intended to provide geologic and hydrogeologic technical input as an aid to future planning. https://www.dmr.nd.gov/ndgs/documents/Publication_List/pdf/RISeries/RI-70.pdf 4. Bismarck's 2014 Growth Management Plan includes a Future Land Use Plan (FLUP) which illustrates the anticipated and desirable land uses in the potential growth areas of the city. One of the assumptions in developing the concept is that "Streams, slopes, and other significant constraining factors are left as open space, although they may be incorporated as open space owned by public entities or within private development."

Hazardous Materials Release

See Also "Train Derailment"

Mitigation Actions

1. Identify "higher risk" inspections to be designated to Fire Marshals for in-depth code enforcement and increased inspection frequency.
2. Consider permitting occupancies in accordance with codes.
3. Develop preplans specific to hazardous materials fixed facilities.
4. Identify Hazmat Routes within Bismarck.

Public Education topics:

5. Continue Public Education regarding Shelter In Place and Evacuation procedures

Vulnerability Summary

1. Hospital locations: Both are in close proximity to truck routes (hazmat trucks). Both hospitals could potentially be impacted as a result of an incident because of hospital proximity to each other.
2. Critical facilities in close proximity (< ¼ mile) to pipeline, truck route, or fixed facilities include Public Works, Police Department, South Fire Station, Sanford Health, CHI St. Alexius Health, Fraine Barracks, Metro Area Ambulance South, State Penitentiary, Burleigh County Detention Center, and Public Health.
3. The Water Treatment plant and Wastewater treatment plant are critical facilities which must utilize hazardous materials (ie: chlorine).
4. There are eighteen schools and daycares in close proximity (< ¼ mile) to truck (hazmat) routes. Impact to more than one school based on any transportation incident is not likely.
5. There are two private schools in close proximity to a fixed facility. Emmanuel Christian School and Ehrmantraut Academy are both near Ferrelgas.
6. Vulnerable Populations in close proximity to the WBI natural gas pipeline in NW Bismarck include Bismarck State College, Centennial Elementary, Horizon Middle School, Pinehurst Shopping Center, Women's Health Center, Touchmark Assisted Living, Horizon Care Home, and Primrose Assisted Living.
7. Vulnerable populations adjacent to truck (hazmat) routes include Primrose Assisted Living, Maple View, Kirkwood Mall. Numerous churches are adjacent to designated truck routes as well.
8. Montessori Daycare is adjacent to I-94. This may be perhaps the most vulnerable special population along I-94 should an incident occur near that location or directly impact that location. The daycare is approximately 200 feet from the interstate. The slope from the interstate to Montessori school is relatively steep. One factor reducing the likelihood of an incident at this location is the fact there is no curvature to I-94 at this location or in the general approach of this location.

Pre-Existing Mitigation: Hazardous Materials Release

1. Annual Inspections of all Fixed Facilities are conducted by the Bismarck Fire Department.
2. Zoning: Title 14 (14-03-08) identifies permitted zoning areas (industrial and agricultural) for special use bulk storage plants with the purpose of storage and distribution of flammable, combustible, or hazardous materials and identifies installation requirements to limit impact to waterways, drainage ways, and residential areas.
3. International Fire Code is adopted by Bismarck. Mitigation examples of the code include:
    - Regulations regarding quantity and type of materials stored.
    - Separation of incompatible materials is required.
    - Multiple control areas must be established in some cases based on quantity and type of material.
    - Suppression systems must be in place.
4. The City of Bismarck (ie: Fire Department) is aware of hazardous materials used and stored within Bismarck:
    - Tier II Reports are submitted to Bismarck Fire by local facilities (requirement).
    - Railroad hazmat shipments are shared by the railroad industry
    - 2012 Burleigh County Hazmat Flow Study identifies hazardous materials transported through the community. The flow study was conducted to assist in emergency planning. This study may be updated as needed via the Local Emergency Planning Committee (LEPC).
    - Crews document hazardous materials within RMS (including non-reportable quantities) Data within RMS includes documenting the location or storage area within the facility
    - Hazardous Materials facilities are mapped via Bismarck GIS division for planning and response purposes.
5. Bismarck has a year-round household hazardous waste and electronics recycling program via the Public Works Department.
6. The Bismarck Water and Wastewater Treatment Plants have both developed and implemented Risk Management Plans as required by Federal Regulations (Chemical Accident Prevention Rule under the Clean Air Act). These plans cover risk assessment, chemical handling and operating procedures, training, equipment inspection and maintenance, and emergency response procedures. The Plans also include periodic audits.
7. Bismarck Fire Department firefighters are trained to the hazmat technical level.
8. Bismarck Fire Department has strong working relationships with ND National Guard Civil Support Team, ND regional response partners, and mutual aid with neighboring jurisdictions.
9. Bismarck Fire and Emergency Management conduct on-going public education to promote “shelter-in place” and evacuation planning.
10. Shelter in place brochures are distributed throughout community.
    a. Shelter-in-Place brochures developed, printed, and mailed to local citizens and businesses in 2003 and 2006 (mass mailing).
    b. Shelter-In-Place public education remains on the city’s emergency management website.

Severe Summer Weather

See Also "Tornado"

Mitigation Actions

See Tornado Hazard Mitigation Actions which address the similar vulnerabilities noted below.

Public Education topics:

1. Continue participating in the Severe Summer Weather Awareness campaign.
2. Extreme Heat: Do not leave children or pets in the unattended vehicle. Heat is the #1 killer for all weather related hazards (year 2013 nationwide).

Vulnerability Summary

Note: See Flood hazard for vulnerabilities relating flash flood.

1. Those caught outdoors during a severe thunderstorm are at higher risk.
    a. High wind related injuries/deaths are caused by flying debris.
    b. Those taking shelter under or near tall trees are vulnerable to lightning strikes.
    c. Potential injury from large hail stones
2. Mobile homes are impacted (damaged) at lower winds speeds compared to typical "stick construction" homes and other building types.
3. Those who do not have access to warning or alert systems are at risk. Lack of access or availability to hear or monitor warnings/alerts would compromise the individual's ability to take appropriate actions.
    a. A low percentage of the population own NOAA All Hazards Weather Radios:
        i. NOAA Weather Radio is one of the best indoor warning systems available. Unfortunately, studies have show that only 5-10 percent of the population owns a weather radio (Wolf, 2009). http://www.crh.noaa.gov/dmx/?n=preparesvrwarning
4. Many residents mistakenly expect to hear "outdoor" warning sirens indoors.
5. As Bismarck expands, the existing outdoor warning system (sirens) may not provide adequate coverage for outdoor recreational areas, residential areas, etc.
6. Overhead power lines, especially those near trees, are vulnerable to high wind events.
    a. Children and others who may first come across downed power lines are vulnerable.
7. Overhead lines impacted create some fire risk (ie: nearby trees, homes, etc).
8. Those who are most vulnerable to extreme heat include elderly persons, small children, chronic invalids, those on certain medications or drugs, and persons with weight and alcohol problems are particularly susceptible to heat reactions. Others vulnerable to extreme heat are those who must work outdoors, including first responders (ie: Fire, Law, EMS).
    a. Those who do not have access to air-conditioned rooms.
    b. Short term power loss is more likely to occur during heat waves as a result of high energy demands.

Pre-Existing Mitigation: Severe Summer Weather

1. MDU manages tree trimming services (via local tree services contractor) to avoid power pole and power line damages.
2. The NWS has in place a system to initiate alert procedures (advisories or warnings) when the Heat Index is expected to have a significant impact on public safety.
3. Bismarck has 19 outdoor warning sirens within city limits.
4. NWS provides alerts/warnings and activates both EAS and NOAA All Hazards Weather Radio.
5. Schools and City Government buildings utilize the NOAA All Hazards Weather Radio.
6. Bismarck is recognized as a "Storm Ready" community.
7. Public education: Severe Weather Awareness Campaign
8. Bismarck has adopted the International Building Code. Chapter 16 is applicable, however, mobile homes are governed by HUD are not required to comply with the International Building Code.

International Building Code - Chapter 16 Structural Design - Section 1609 Wind Loads:
1609.1 Applications states "Buildings, structures and parts thereof shall be designed to withstand the minimum wind loads prescribed herein. Decreases in wind loads shall not be made for the effect of shielding by other structures."

- 105 MPH (3 second gust) 33 feet above ground for Risk Category I Buildings and other Structures
- 115 MPH (3 second gust) 33 feet above ground for Risk Category II Buildings and other Structures
- 120 MPH (3 second gust) 33 feet above ground for Risk Category III and IV Buildings and other Structures

Source: http://publicecodes.cyberregs.com/icod/ibc/2012/icod_ibc_2012_16_par090.htm
Information regarding wind speeds is derived from the link above.

Shortage or Outage of Critical Materials or Infrastructure

Mitigation Actions

1. Identify critical facilities and infrastructure having or needing back-up generators (ie: critical facilities and shelter locations). Gap Analysis
2. Ensure back-up generators are in place at all city-owned Critical Facilities. Ensure the back-up generators allow for continued operations of critical and essential functions.
3. Develop an Emergency Agreement with private vendors for delivery of fuel for generators.
4. Explore use of Natural Gas based on generator size needed - natural gas is a more reliable source of fuel
5. Conduct an assessment of back-up power capabilities for traffic lights.
6. Encourage the state to enhance the "Energy Assurance Plan" to acknowledge and address the EMP threat.
7. Encourage state involvement in electric utility hardening against EMP attack.
8. Public Education (minimum of 3 day supplies – recommend enhancing preparedness to 1 or 2 weeks)

Vulnerability Summary

1. The Bismarck Community is reliant on private industry for most critical infrastructure and key resources including energy resources, food supplies, medicines, medical equipment, communications, transportation, and fuel for heating and transportation. The exception is water and sewer are provided by Bismarck. See "Existing Mitigation" plan section for information regarding critical facility and critical infrastructure generator capabilities.
2. According to the ND State Energy Assurance Plan (as of 2014), fuel storage in ND represents about 12 days-worth of consumption for gasoline and 13 days-worth of consumption for distillates (diesel).
3. The vast majority of local citizens do not have back-up power (generator) capability in the event of an extended power outage. Since power outages in Bismarck are repaired quickly (typically within 2 to 3 hours or less), local citizens are likely not prepared for extended power outages (ie: several days or weeks).
    a. Our winter season poses additional challenges with any extended power outages, especially for the more vulnerable populations.
4. The use of portable generators pose risks for those using them as well as for utility line workers if not used or connected correctly. Risks include electrocution, fire, and carbon monoxide poisoning.
5. The Bismarck Community is reliant on mitigation stakeholders to deter, prevent, and mitigate the impacts of an electro-magnetic pulse (EMP) attack or other intentional attacks on utility infrastructure. Stakeholders include state and federal government as well as the utility industry and scientific community.
6. The electric utility industry on a nationwide basis is not hardened against the electro-magnetic pulse threat. In turn, communities nationwide including Bismarck are vulnerable.
    a. Assuming a significant EMP event would impact the transportation infrastructure, our population would be vulnerable due to lack of deliveries: food, medicines, fuel, etc.
7. Maintenance of inventory (ie: critical supplies of food, medicines, fuel, etc) requires consistent deliveries. Inventories are generally "just in time" inventories to minimize need for storage and to maximize efficiencies.
8. In general, our society has become reliant on the electric utility industry to maintain operations for

other critical infrastructure, and to sustain life and quality of life. Additionally, other critical infrastructures are reliant on computer and other sophisticated electronics which are very susceptible to the effects of an EMP attack.

Pre-Existing Mitigation: Shortage or Outage of Critical Materials or Infrastructure

1. The Bismarck Code of City Ordinances uses Chapter 2-08-03 to give the President of the Board of City Commissioners the power to issue an emergency or disaster declaration and to utilize twenty-three specific emergency powers. These powers include…
   - Prohibit or limit the sale of gasoline or other flammable liquids.
   - Require the continuation, termination, disconnection, limitation, or suspension of natural gas, electrical power, water, sewer, or other public utilities or services.
   - Control, restrict, allocate, or regulate the use sale, production, or distribution of food, water, fuel, clothing, and/or other commodities, materials, goods, services, and resources.
2. The City of Bismarck has two water intake systems.
   - A New Water Intake system with **a** Horizontal collector well water intake was placed in operation in October 2013. The water intake is 80 feet below the river's surface.
   - An upgrade of main water pumping station located near BSC is in progress.
3. Bismarck has both MDU and Central Power Electric Cooperative (CPEC) utility service areas mapped via GIS.
4. Public Works has back-up power capabilities to maintain street lights (partial).
5. Back-up generators are in place within city-owned critical facilities and infrastructure. See Appendix B.
6. ND State Energy Assurance Plan
   http://www.communityservices.nd.gov/renewableenergyprograms/EnergyAssurance/
   Preparation Strategies for Possible Electrical Supply Shortage Balancing Authorities:
   a. North Dakota has two Balancing Authorities within the state; these are Otter Tail Power and the Western Area Power Administration (WAPA) Upper Great Plains East These balancing authorities are required to maintain load-interchange-generation balance within a Balancing Authority Area, and supports Interconnection frequency in real time.
   b. The Balancing Authorities will follow their procedures to comply with regulations for meeting customer load. Some of these actions could include adjusting generation, purchasing additional imports, or utilizing the NERC Energy Emergency procedures for bulk electrical system reliability.
   Source: ND Energy Assurance Plan
7. Century Code Chapter 37-17.1 Emergency Services:
   "…In addition to any other powers conferred upon the governor by law, the governor may: Make provisions for the control, allocation, and the use of quotas for critical shortages of fuel or other life and property sustaining commodities….
   ARTICLE III - PARTY STATE RESPONSIBILITIES
   1. It shall be the responsibility of each party state to formulate procedural plans and programs for interstate cooperation in the performance of the responsibilities listed in this article. In formulating such plans, and in carrying them out, the party states, insofar as practical, shall: Protect and assure uninterrupted delivery of services, medicines, water, food, energy and fuel, search and rescue, and critical lifeline equipment, services, and resources, both human and material."

Private Utility (ie: electricity) Pre-Existing Mitigation – Shortage of Critical Materials:

1. Montana Dakota Utilities (MDU) receives alerts regarding potential GMD (solar flare events with a K7 or higher rating).
2. MDU conducts six drills per year to switch controls from Bismarck/Mandan and vice versa.
3. Bismarck/MDU has three system inputs (redundancies): Garrison, Heskett and WAPA.
4. Bismarck is strategically located for power restoration based on logistics/proximity to power generation and distribution.

5. MDU has mutual aid assistance agreements with other utility companies.
6. MDU has pre-determined priority considerations including hospitals, police station, etc.
7. MDU Electric System Compliance Manager serves as a liaison between MDU and the North American Electric Reliability Corporation (NERC).
8. Materials needed by MDU are readily available per MDU plans/agreements with their vendors.
9. Central Power Electric Cooperative (CPEC), formerly Capital Electric Cooperative, has assistance agreements with other utility companies (mutual aid).
10. CPEC utilizes multiple contractors for restoration which provides for a force multiplier and quicker response.
11. CPEC has two system inputs: Heskett and WAPA.
12. CPEC has capability to monitor individual meters to determine if a facility or home is receiving power.
13. CPEC has generator power to sustain operations at its facility.
14. CPEC has the ability to redirect existing power through its distribution system.
15. CPEC ownership of transmission lines will transfer to Central Power of Minot in 2014. Central Power will then oversee preparedness requirements set by the Federal Energy Regulatory Commission (FERC).

Tornado

Mitigation Actions

1. Include a Tornado Safe Room to EF4 standards within any new construction of city owned critical facilities where applicable based on occupancy.
2. Identify Community Planning Group to study/identify Community Tornado Shelter Location(s) within existing facilities (determine feasibility).
3. Increase the frequency of Outdoor Warning Siren Test - 2 per month (May thru August).
4. Outdoor Warning Sirens - identify need as city grows.
5. Install Outdoor Warning Sirens as city grows per identified need.
6. Explore Mobile Home Skirting Mitigation Landscaping to Eliminate wind access to reduce uplift. This may be a research question for NWS and/or FEMA (any potential benefit would be limited to F0 or F1 (most frequent tornado intensities).
7. Ensure NOAA All Hazards Weather Radios are located in all city owned buildings.
8. Recommend via Local NWS that NOAA ensure multiple language / language selection option is available for the NOAA All Hazards WX Radio
9. Public Education topics:
    - Safe Room construction and protecting property from high winds
    - Encourage mobile home owners and park owners to conduct joint shelter planning
    - Encourage mobile home owners to explore potential sheltering options (agreements) with area facilities (such as place of employment, membership, etc).
    - Continue existing public education efforts

Vulnerability Summary

1. Most tornado injuries/deaths are caused by flying debris. Those caught outdoors during a tornado event are at higher risk.
    a. Loose debris
    b. Outdoor items not anchored
    c. Construction sites may contain unsecured construction materials (ex: plywood) and debris
    d. Trees are impacted at lower wind speeds (small branches – flying debris).
2. Mobile homes are impacted (damaged) at lower winds speeds compared to typical "stick construction" homes and other building types. Occupants of mobile homes during a tornado event are at higher risk. Bismarck has several mobile home park neighborhoods. The vast majority of mobile home parks within Bismarck do not have designated storm shelters on site.
3. Bismarck does not restrict future development of mobile home parks. This allows for more affordable housing, however, future construction of mobile home parks would create additional vulnerability.
4. Those who do not have access to warning or alert systems are at risk. Lack of access or availability to hear or monitor warnings/alerts would compromise the individual's ability to take appropriate actions.
5. A low percentage of the population own NOAA All Hazards Weather Radios:
    i. NOAA Weather Radio is one of the best indoor warning systems available. Unfortunately, studies have shown that only 5-10 percent of the population owns a weather radio (Wolf, 2009). http://www.crh.noaa.gov/dmx/?n=preparesvrwarning
6. Some residents expect to hear "outdoor" warning sirens indoors, which is not the purpose of the

outdoor warning sirens.

7. As Bismarck expands, the existing outdoor warning system (sirens) may not provide adequate coverage for outdoor recreational areas, residential areas, etc.
8. Although the Combined Communication Center is designed to withstand an EF4 tornado, the EOC facility is not. Damage to the EOC facility would compromise the ability to continue operations at the Combined Communication Center.
9. Not all tornadoes are able to be detected by Doppler radar – especially if the tornado forms over the top of the radar and over the city itself.
10. The two hospitals are in close proximity. Depending on the event, if one hospital is impacted, both could potentially be within the same tornado path.
11. There are no community (public or private) tornado shelters identified.
12. Who's Most at Risk:
    - People in mobile homes
    - The elderly, very young, and the physically or mentally impaired
    - People who may not understand the warning due to a language barrier
    - People in an unfamiliar place such as tourists
    - People that are outdoors
    - Those in automobiles

Pre-Existing Mitigation: Tornado

1. Bismarck has 19 outdoor warning sirens within city limits.
2. NWS provides alerts/warnings and activates both EAS and NOAA All Hazards Weather Radio.
3. Schools and City Government buildings utilize the NOAA All Hazards Weather Radio.
4. Bismarck is recognized as a "Storm Ready" community.
5. Many traditional construction homes within Bismarck have basements.
6. Public education: Severe Summer Weather Awareness Campaign
7. Bismarck has adopted the International Building Code. Chapter 16 is applicable, however, mobile homes are governed by HUD are not required to comply with the International Building Code.

<u>International Building Code - Chapter 16 Structural Design - Section 1609 Wind Loads:</u>
1609.1 Applications states "Buildings, structures and parts thereof shall be designed to withstand the minimum wind loads prescribed herein. Decreases in wind loads shall not be made for the effect of shielding by other structures."

- 105 MPH (3 second gust) 33 feet above ground for Risk Category I Buildings and other Structures
- 115 MPH (3 second gust) 33 feet above ground for Risk Category II Buildings and other Structures
- 120 MPH (3 second gust) 33 feet above ground for Risk Category III and IV Buildings and other Structures

Source: http://publicecodes.cyberregs.com/icod/ibc/2012/icod_ibc_2012_16_par090.htm

8. Public Education:
    - Severe Weather Spotter Training
    - Promote NOAA All Hazards WX Radio
    - Severe Summer Weather Awareness Campaign

9. Public Information and Warnings: To protect people and property, the **National Weather Service** issues informational products alerting the public to varying degrees of hazardous weather. The following may be issued for severe thunderstorm events:
   - Hazardous Weather Outlook: Hazardous weather outlooks alert the public to the possibility for severe weather in the area from one to seven days in advance.
   - Severe Thunderstorm Watch: Severe thunderstorm watches are issued by the Storm Prediction Center when conditions for severe thunderstorms appear favorable for an area over the next several hours. Watches are typically in effect for 4-6 hours.
   - Severe Thunderstorm Warning: Severe thunderstorm warnings are issued when Doppler radar indicates or the public reports a thunderstorm with wind gusts of 58 mph or greater and/or hail 1 inch or larger in diameter. The warning is usually valid for 30-60 minutes.
   - Tornado Watch: Tornado watches are issued by the Storm Prediction Center when conditions for tornadoes and severe thunderstorms appear especially favorable for an area over the next several hours. Watches are typically in effect for 4-6 hours.
   - Tornado Warning: Tornado warnings are issued when Doppler radar indicates or the public reports a tornado. The warning is usually valid for 15-45 minutes.

Train Derailment

Mitigation Actions

1. Locate new critical facilities at least ¼ mile away from railroad lines: a. When building new or relocating critical facilities, the City of Bismarck should provide additional consideration or preference for location options at least ¼ mile from either railroad line. Assuming there are viable location options at least ¼ mile from the railroad lines of equal value and functionality, locating critical facilities at least ¼ mile away would reduce the loss potential.
2. Clarify bridge ownership and responsibilities for maintenance and inspections.
3. Determine if there are reporting requirements regarding track/bridge inspections.
4. Inversion mapping based on hazardous materials releases (risk area) for airborne gases.
5. Conduct Hazmat Flow Analysis related to train incident (flow away from tracks).
6. Public Education: Evacuation and Shelter-In-Place Emergency Preparedness

Vulnerability Summary

Note: The vulnerability statements below do NOT imply likelihood or high probability of a significant train derailment incident involving fire, hazardous materials, and/or explosion.

1. Hospital locations: Both major hospitals are in close proximity to the BNSF railroad. A significant incident (ie: fire, hazmat, explosion) could potentially affect both hospitals depending on the location of incident occurrence.
2. Continuity of Government Operations: City owned critical facilities in very close proximity to either railroad line include the Water Treatment Plant, Public Health, and Public Works. City facilities, if impacted as a result of a significant incident (ie: fire, hazmat, explosion), would create challenges to sustain continuity of operations. The City/County Building is also within close proximity. There are several additional critical facilities within ½ mile of railroad lines including city, county, state (ie: State Emergency Operations Center), federal, and emergency service facilities. Of note: Public Works is in close proximity to Praxair, which could expand the magnitude of significant train derailment incident near that location.
3. County, State, and Federal facilities may also be impacted, such as the State EOC at Fraine Barracks. An incident impacting county, state, or federal government facilities may impact the ability to provide assistance while re-establishing continuity of operations.
4. There are nineteen schools and daycares within ½ mile proximity to the railroad. Schools and daycares are widely dispersed along the rail lines, therefore, at least one school is likely to be involved following a significant derailment incident (ie: fire, hazmat, explosion). Depending on time of day of a potential incident, elementary school population may be outdoors.
5. Vulnerable populations within ½ mile of the railroad lines and vulnerable properties based on topography include various assisted living and nursing homes, the Elks Pool, Bismarck Community Bowl, Front Street Plaza (based on proximity and topography), and the ND State Penitentiary.
6. Due to evacuation challenges, the ND State Penitentiary is a very vulnerable special population.
7. Based on a relatively even distribution of various facilities and populations, a significant train derailment incident (ie: fire, hazmat, explosion) would likely include impact to several properties and populations including the following categories: critical facilities, critical infrastructure, waterways (Missouri River, Hay Creek, or storm water drainage system), schools, hazmat fixed facilities, and/or special populations. This would overwhelm local response capabilities. Additional resources would be requested including mutual aid, private, state and federal assistance. However, response times of support agencies may not support the immediate incident needs of evacuation and rescue efforts.

8. Based on potential impact to local communications critical infrastructure, emergency messaging capability via radio and television may be diminished, creating a higher vulnerability for those citizens who primarily get their emergency messages from local radio and television.

Pre-Existing Mitigation: Train Derailment

1. Maximum Speed Limits:
    a. 35 MPH – BNSF Line
    b. 10 MPH – DMVW
2. Maximum speed and inspection requirements are regulated by the Federal Railroad Administration.
3. Railroad Crossings and planned improvements per Quiet Rail Zone approved at 3rd, 5th, and 12th Street railroad crossing locations.
4. Bismarck Fire is aware of the hazardous materials transported by rail through Bismarck via reports shared by railroad industry.
5. Bismarck Fire Department continues to enhance training efforts as it relates to the various types of train cars, hazardous materials response, and also participates in training and exercise activities with mutual aid partners and stakeholders including the railway industry.
6. On August 2, 2013 the FRA issued an Emergency Order and Safety Advisory regarding the movements of flammable liquids, which includes crude oil and ethanol.
    a. The FRA Emergency Order contained requirements for unattended trains carrying hazardous material such as chlorine that is classified as Toxic by Inhalation (TIH) or 20 or more loads of certain flammable liquids like crude oil and ethanol.
    b. Trains may not be left unattended per BNSF communications.

BNSF mitigation and safety measures summary (source: BNSF representative):

7. BNSF inspects tracks in Bismarck four times per week. The FRA requirement is two times per week. Inspections of all BNSF bridge structures are performed at least once annually. BNSF has a staff of trained bridge inspectors, as well as structural engineers, consultants and specialized contractors.
8. Rail Industry (BNSF) voluntarily adopted stronger tank car standards in October 2011 and November 2013. The "new" car has ½" or 7/16" jacketed shell (versus 7/16), a ½" protective head shield, roll over protection (top fitting protection), larger pressure release valve, and approximately 47-77% better crashworthiness.
9. Additional BNSF Prevention Measures include:

Human Factor	Equipment/Mechanical	Track/Signal	Miscellaneous
• Training • Remote Monitoring • Positive Train Control • Self-reporting protocol	• Ultrasonic inspection • Detector Network, such as Dragging Equipment • Technology including force-based/strain gage systems • Thermal/infrared scanning for warm bearing detection	• Enhanced track inspection training • Continued elimination of jointed rail • Strong capital program for tie renewal • Technology including ground penetrating radar and enhanced geometry testing	Operating Practices/Alerts: • High Wind: staging and/or speed requirements • Tornado: requirements to stop, inspect trains • Flood: speed restrictions, additional inspections • Cold weather: speed restrictions

Wildland Fire:
Wildland Urban Interface

Mitigation Actions

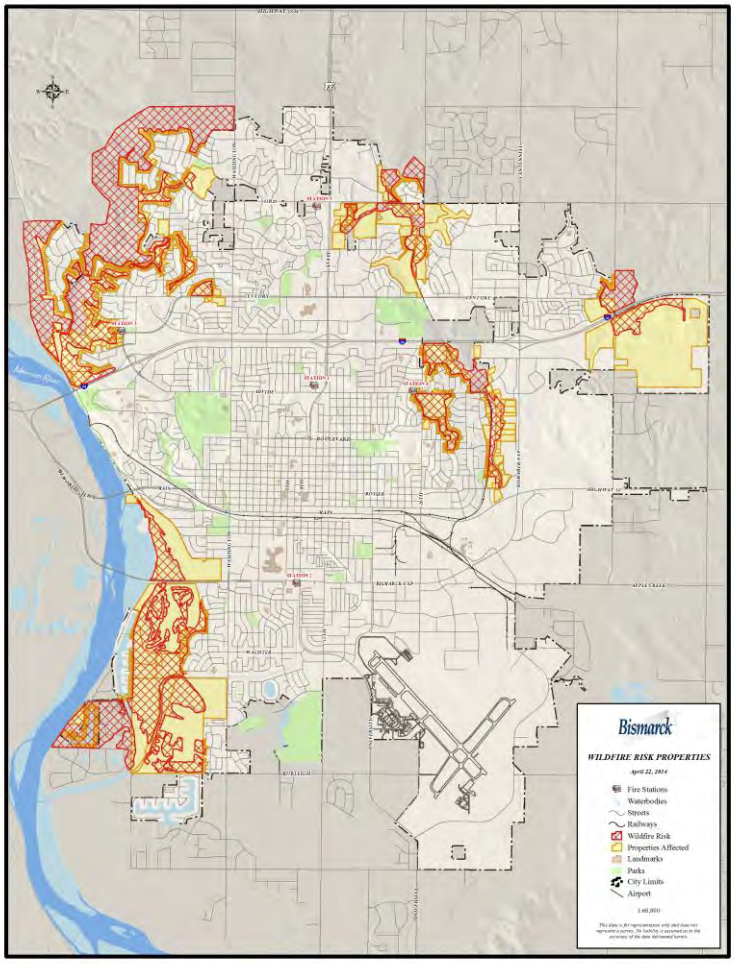
1. Maintain Wildland Fire-Break Trail in Southwest Bismarck.
2. Continue to provide for public education efforts, including media releases, interviews, website updates, and public outreach. Public outreach shall include specific mailings to property owners within the wildland fire risk areas every three years or as applicable based on drought conditions. Public education efforts utilize Firewise program guidance.
3. Share Firewise landscaping concepts with developers and Community Development.

Vulnerability Summary

1. Homes and other structures located in wildland risk areas as mapped are vulnerable to wildland fire due to the proximity to wildland vegetation and relatively steep slopes which can increase the rate of spread of fire. The likelihood of a wildland fire being a high magnitude event is low.

2. Areas within Bismarck that may have more exposure potential compared to other areas include the northwest portion of the city that is adjacent to undeveloped property and the southwest portion of the city that is adjacent to more heavily forested areas.

The map at right illustrates the wildland urban interface areas (red hatch areas).



Pre-Existing Mitigation: Wildland Fire (WUI)

1. Fire Trail – Fuel Mitigation Project – completed 2002. A Fire break was created to reduce vulnerability to homes in southwest Bismarck as illustrated by the map on right. This fire trail/ fire break proved to be beneficial during a fire fight event in April 2005.

2. The bike/walking path west of Solheim to Riverwood Drive serves as a fire break. See map below.

3. Public Education: Public Education materials were distributed in the spring of 2014 to inform property owners adjacent to the wildland risk areas (wildland urban interface) of recommendations as described by the Firewise Program. www.firewise.com

4. Bismarck Fire has completed the activities noted below, some of which are on-going.
   - Created a public education flyer which was handed out door to door in our higher risk areas in the spring of 2014
   - Participated in creating a fire break in the forested area in the southwest part of town
   - Perform Fire Safety Inspections of all local businesses
   - Our firefighters train in the latest methods of fighting all types of fire
   - Bismarck Fire continues public education efforts including:
     - Presentation to grade schools
     - Demonstrations in a smoke trailer that gives kids skills to get out of a home on fire
     - Tours of fire stations to civic groups
     - Safety tips to the public through local media
5. Response Capabilities: The City of Bismarck is protected by a full time fire department including 5 fire stations. We have 2 fully equipped wild-land firefighting apparatus able to access remote areas within the city limits. Many of our Wild-land Urban Interface (WUI) areas border Bismarck City and Burleigh County properties. We have a mutual aid agreement with the Bismarck Rural Fire Department; not only does this aid in fighting fires in the WUI but we can also call on them to assist firefighting efforts within the city limits.

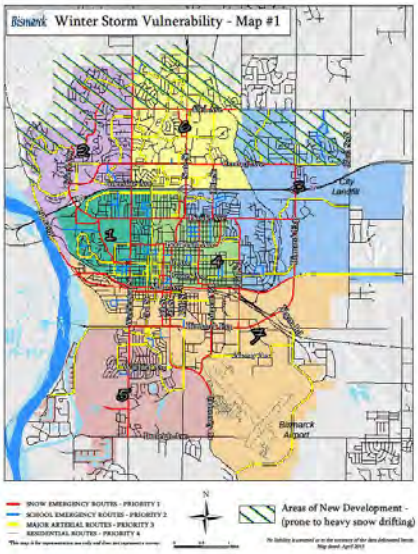
Winter Storm

Mitigation Actions

1. Develop City Office closure policy based on imminent or current conditions.
2. Ensure Back-up generators exist for critical facilities, infrastructure, and shelter locations.
3. Evaluate need and opportunity for snow fences.
4. Coordinate school/city/business closure communications/decisions.
5. Downed Power Line Safety Training
6. Public Information and Warnings (NWS) - continue
7. Public Education - emphasis on dangers of downed power lines and utilizing alternate work start/stop times to minimize rush hour traffic.
8. Public Education: Participate in the Severe Winter Weather Awareness Campaign (on-going).

Vulnerability Summary

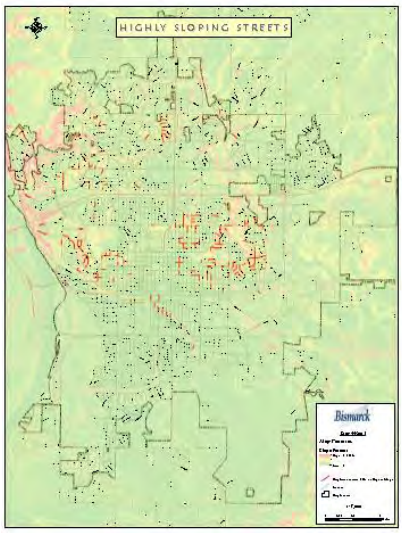
1. Areas of new development are prone to experience heavy snow drifting due to the limited number of mature trees or other vegetation. The hatched areas within the snow emergency route map illustrate the new development areas currently prone to heavy snow drifting. This vulnerability will continue to migrate north and east as the city grows. See hatched area, map on right. A full size map is included in Section 10.
2. As noted on the snow emergency route map, residential areas are the last priority in terms of clearing streets during and after a winter storm event. During a winter storm event, crews focus on keeping the high priority emergency routes and major arterials clear. Therefore, residential areas are more vulnerable (ie: lack of ingress/egress) during, and for several hours following a major snowfall event. However, existing response plans are in place to re-route snow plows for emergency situations. See map on right or web link: http://www.bismarcknd.gov/index.aspx?NID=249

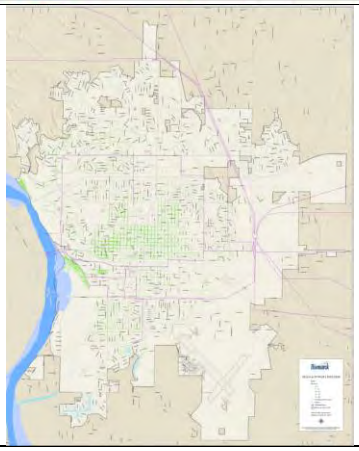


3. Some areas of Bismarck more vulnerable as a result of icy conditions due to a relatively significant slope. These areas are mapped (see right). A full size map is included in Section 10.

   Streets with greater than a 14% slope:
   - 500 Block of S 11TH ST – up to 19.9%
   - 1500-1600 Block of Northview Ln – up to about 16.5%
   - 2300 Block of Pointe Lp – up to 14.8%
   - 800-900 Block of N Mandan St – up to 14.8%
   - 1600 Block of N 35TH ST – up to 14.5%
   - 2900 Block of E C Ave – up to 14.5%
   - 700-800 Block of N 27TH ST – up to 14.5%
   - 2400 Block of Laforest Ave – up to 14.4%
   - 2900 Block of E B Ave – up to 14.3%
   - 1200-1300 Block of Crestview Ln – up to 14%

   Burnt Boat Drive has 10% slope, but is curvy, narrow, and has steep slopes adjacent.



4. Private streets within Bismarck are not cleared by Bismarck Public Works. These areas may or may not be more vulnerable (ie: ingress/egress) depending on the quality and timeliness of private snow clearing services. See map at right. A full size map is located in Section 10.	
5. Many of the older developed areas within Bismarck have overhead power lines. These areas are more vulnerable during an ice storm to experience power loss and/or a downed power lines. See map on right. A full size map is included in section 10. 6. Overhead power-lines intersecting trees create a vulnerability. However, local utility companies proactively trim the trees to mitigate the hazard. See map on right. A full size map is included in section 10.	

7. Snow plows in operation are likely to be hit by other vehicles during conditions of low visibility. The snow plow operator is at risk, however, the operator of the vehicle is at higher risk for injury/death.
8. Traffic accidents, which may involve hazardous materials in some cases, are more likely to occur as a result of slippery street conditions and/or poor visibility. First responders are more vulnerable during response efforts because of the weather elements.
9. Emergency response times may be delayed as a result of snow and/or ice conditions.
10. Downed power lines as a result of ice storms and/or heavy snow pose a serious life safety risk, especially for children who may come across a downed power line.
11. Power lines near trees (ie: evergreen trees or other trees not trimmed) are vulnerable following an ice storm or heavy snow event. Homeowners are responsible for trimming trees from the transmission line to the home itself.
12. Among the most vulnerable population during winter storm events are the elderly and those with medical conditions (ie: heart). A heavy snow event may delay emergency response to 911 calls.
13. Those who require medications may not be able to fill prescriptions during a winter storm event.
14. Loss of power for a few hours (or longer) poses additional risk to those who require power for life support. Back-up battery or generator power may be needed.
15. Food and medical supplies may be delayed due to highway and interstate conditions and road closures.
16. Those required to work outdoors or student population walking to and from school are highly vulnerable to frost bite or hypothermia as a result of extreme cold temperatures and wind chill.
17. Populations of higher vulnerability include tourists, homeless, and those who've recently moved to North Dakota with no previous experience with the more harsh winter season.

18. Those travelling during winter storm events may become stranded or become involved in a traffic accident due to visibility and/or road conditions. There is also a higher vulnerability for those traveling within the city during any power outages affecting traffic signal lights.
19. Potential roof collapse as a result of heavy snow load, especially on wide span flat roofs such as gymnasiums or auditoriums.
20. Sewer vents may freeze up, creating vulnerability to the occupants (ie: illness).
21. Occupants of homes / facilities without carbon monoxide detectors are vulnerable if venting is blocked or if the occupants are using improper alternative heating sources or using them improperly.
22. Traffic accidents may occur as a result of power loss to traffic signal lights (ie: ice storm impacting power lines)

Pre-Existing Mitigation: Winter Storm

1. Snow Emergency Routes are designated, signed, and communicated to the public via the city's website. Snow Emergency Routes are designated in City Ordinances 10-02-01 and 10-02-02.
2. City Ordinance 10-02-03 provides for capability to issue a "snow emergency declaration" which allows for prohibition of parking on designated (or all) snow emergency routes.
3. Although Bismarck utilizes snow gates on the plows, City Ordinance 10-02-05 allows for snow plow operations to discontinue the use of the snow gates when a snow emergency is declared. The same city ordinance also allows for taking certain actions when necessary including posting no parking signs to aid in snow removal and hiring of temporary personnel for snow removal. Ordinance 10-05-05 addresses placement of mail boxes to avoid the mailboxes becoming snow removal obstacles.
4. Ordinance 12-13-23 provides officers with authority to remove illegally stopped or parked vehicles when the vehicle is parked on a posted "now emergency" route during a declared snow emergency.
5. City sanding operations may start before, during, after, or independently of other plowing operations, as appropriate. Public works strives to obtain an 8% salt content within this sand to prevent the sand from freezing/clumping. Public Works also has liquid brine applicators. Applying liquid brine prevents ice from sticking to the streets. This is applied sparingly to minimize environmental impacts.
6. Local utility companies trim trees around their power poles and power lines to minimize risk of utility infrastructure damage following events that may severely impact trees and/or limbs. The current pruning area for MDU is from the East and West Avenue A up to Boulevard and from Washington to 3rd. This pruning is does not include the house connections (main transmission line to the house), this falls on the responsibility of the home owner.
7. Bismarck has adopted the International Building Code which identifies construction requirements relating to heavy snow loads.
8. Public Education is conducted in concert or partnership with the National Weather Service as well as many other departments at the local, state, and federal government level as well as volunteer agencies promoting emergency preparedness, such as the American Red Cross.
    a. Severe Winter Weather Awareness Campaign – annual
    b. Installation of carbon-monoxide detectors
9. Public Information and Warnings are issued via the National Weather Service (see next page).
10. Emergency Alert System in place
    a. Public Information and Warnings via the National Weather Service
11. NOAA Weather Radio in all Bismarck Public Schools – in place

    National Weather Service - "Storm Ready" recognition – Recertified / approved in 2012

12. A Living Snow Fence was put in place (1990s) to prevent the drifting of snow across Yegan Road to the south and east. Due to the airport chain-link perimeter fence creating a drifting problem, the three rows of shrubs were installed to help drop the snow blowing from across the airport property, potentially blocking Yegan Road. The shrubs planted do NOT attract birds to reduce the possibility of bird strikes on airplanes.

Response Phase Mitigation – Winter Storm:

1. Public Works maintains its Snow and Ice Control Plan. The plan identifies snow removal priorities which are publicized on the city's website.
2. The Bismarck Emergency Operations Plan outlines task force operations for Winter Storm Emergency Response.
3. Bismarck and Burleigh have an agreement with the local Roughrider Snowmobile Club to serve as a resource for critical transportation needs.
4. Public Works has emergency generators and connectivity to maintain functioning of traffic lights following power outages.
5. Existing shelter sites (with generators) may be used as warming sites.

National Weather Service Provides Forecast and Warning Services		
Product Type	**Description**	**When Issued**
Hazardous Weather Outlook	Designed to outline anticipated weather hazards for the next seven days and provide the first heads up to any possible severe winter weather.	At least once per day
Watch	Issued when the confidence level for severe winter weather is at least 50% (uncertainty remains in exact timing and location of the storm).	Normally issued 36-48 hours prior to the event
Warning	Issued when there is a direct threat to life and property from severe winter weather that has a high probability of occurrence (80% or higher), or is imminent or occurring.	Normally issued 12-24 hours prior to the event
Advisory	Issued for winter weather conditions that have a high probability of occurrence, are imminent or already occurring, that may cause an inconvenience. If precautions are NOT taken, a situation may develop that may threaten life.	Normally issued 12-24 hours prior to the event

Product Type	Description
Blizzard Warning	When sustained or frequent wind gusts of 35 mph or greater with visibilities of less than one quarter mile for at least three hours are expected.
Winter Storm Warning	When six inches of snow in 12 hours or 8 inches in 24 hours are expected and/or 1/2 inch of sleet accumulation (mixed precipitation and blowing snow may also be possible).
Ice Storm Warning	When 0.25 inches or more of ice accumulation is expected.
Wind Chill Warning	When wind chill values of -40 F or less are expected.

http://www.crh.noaa.gov/bis/?n=winter_weather_awareness_1

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Mitigation Implementation Action Plan

1. Mitigation Action items will be monitored and evaluated for progress by the applicable city department or division as assigned.
2. Mitigation action items will be incorporated by the applicable department/division into existing annual strategic or work-plans at the department level. Bismarck Emergency Management will also review the status of mitigation action items with the applicable city departments/divisions.
3. City Administration will coordinate with the applicable city department to integrate the requirements of the mitigation plan into other plans and funding mechanisms (ie: annual budgeting process, capital improvement program, growth management plan, future land use plan, plat review process, site plan review process) when appropriate.

Administration

Hazard	Mitigation Action	Support Agencies	Potential Funding Source / Est. Cost	Timeline Initiate	Timeline Complete	On-going	Status
Dam Failure	**Locate new critical facilities outside inundation area when possible: When building, remodeling, or relocating critical facilities, the City of Bismarck should provide additional consideration or preference for location options outside of the dam failure inundation area. Because the probability of a catastrophic dam failure is very low, locating critical facilities outside the inundation area is NOT a requirement. However, assuming there are viable location options outside of the inundation area of equal value and functionality, locating outside the inundation area would reduce the loss potential.**		Planning Function No cost	2015		Yes	
Shortage or Outage of Critical Materials	**Encourage the state to enhance the "Energy Assurance Plan" to acknowledge and address the EMP threat.**		None	2015	2015		

Administration

Hazard	Mitigation Action	Support Agencies	Potential Funding Source / Est. Cost	Timeline Initiate	Timeline Complete	On-going	Status
Shortage or Outage of Critical Materials	**Encourage state involvement in electric utility hardening against EMP attack.**		None	2015	2015		
Train Derailment	**Locate new critical facilities at least ¼ mile away from railroad lines: a. When building new or relocating critical facilities, the City of Bismarck should provide additional consideration or preference for location options at least ¼ mile from either railroad line. Assuming there are viable location options at least ¼ mile from the railroad lines of equal value and functionality, locating critical facilities at least ¼ mile away would reduce the loss potential.**		Planning Function No cost	2015		Yes	
Train Derailment	**Clarify bridge ownership and responsibilities for maintenance and inspections.**		Staff Time	2015	2015		
Train Derailment	**Determine if there are reporting requirements regarding track/bridge inspections.**		Staff Time	2015	2015		
Winter Storm	**Develop City Office closure policy based on imminent or current conditions.**		Staff Time	2015	2016		
Winter Storm	**Coordinate school/city/business closure communications/decisions.**	Bismarck Public Schools	Staff Time	2015		Yes	

Airport

Hazard	Mitigation Action	Support Agencies	Potential Funding Source / Est. Cost	Timeline Initiate	Timeline Complete	On-going	Status
Aircraft Accident	**Recommend Burleigh County and city of Lincoln adopt city of Bismarck aeronautical zoning where applicable based on the city of Lincoln growing nearer to the Airport.**	Burleigh County City of Lincoln	NA	2015	2015		
Aircraft Accident	**Complete the current Wildlife Hazard Assessment. This plan is a yearlong study on the wildlife around the airport. The final assessment will provide recommendation on how to reduce the wildlife present on and around the airport.**		Already Funded	2014	2015		
Aircraft Accident	**Maintain the current airport hazard mitigation and emergency response plans and planning efforts identified as "existing mitigation."**		Staff time	2015		Yes	

Community Development

Hazard	Mitigation Action	Support Agencies	Potential Funding Source / Est. Cost	Timeline Initiate	Timeline Complete	On-going	Status
Flood	**Apply to participate in the National Flood Insurance Program (NFIP) Community Rating System (CRS).**	Building & Inspections	Staff Time	2015	2020	Yes	Annual recertification required
Public Education							
Tornado	**Encourage Wind-Resistant Building Techniques**	Building & Inspections	Staff Time	2015		Yes	
Flood	**Coordinate and/or support NFIP flood insurance promotional efforts including the availability of flood insurance for community residents and businesses.**	Emergency Management	Staff Time	2015		Yes	

Emergency Management							
Hazard	**Mitigation Action**	**Support Agencies**	**Potential Funding Source / Est. Cost**	**Timeline Initiate**	**Timeline Complete**	**On-going**	**Status**
Tornado	**Install Outdoor Warning Sirens as city grows per identified need.**	Administration, Finance	$25,000 Each City Funds	2015		Yes	
Tornado	**Increase frequency of Outdoor Warning Siren Test - 2 per month (May thru August)**	Combined Communications	$5,000 Utility Expense	2015	2016	Yes	
Tornado	**Identify Community Planning Group to study/identify Community Tornado Shelter(s) Location - existing facilities**		NA Planning Function	2015		Yes	
Tornado	**Explore Mobile Home Skirting Mitigation Landscaping to Eliminate wind access to reduce uplift. This may be a research question for NWS and/or FEMA (any potential benefit would be limited to F0 or F1 (most frequent tornado intensities).**	NWS FEMA	None	2015	2015		
Tornado	**Recommend via Local NWS that NOAA ensure multiple language / language selection option is available for the NOAA All Hazards WX Radio**	NWS	None	2015	2015		
Public Education							
All Hazards	**Promote NOAA All Hazards WX Radio (existing mitigation)**	NWS	Staff Time EM Budget	2015		Yes	
All Hazards	**Promote mitigation and emergency preparedness for all hazards.**		Staff Time EM Budget	2015		Yes	
Flood	**Conduct Flood Mitigation and Preparedness Public Education efforts for local citizens and businesses.**	Building & Inspections	Staff Time EM Budget	2015		Yes	
Hazmat	**Continue Public Education regarding Shelter In Place and Evacuation procedures**		LEPC Funds $2,000	2015		Yes	
Severe Summer Weather	**Continue participating in the Severe Summer Weather Awareness campaign.**		Staff Time EM Budget	2015		Yes	

Emergency Management

Hazard	Mitigation Action	Support Agencies	Potential Funding Source / Est. Cost	Timeline Initiate	Timeline Complete	On-going	Status
Severe Summer Weather	**Extreme Heat: Do not leave children or pets in the unattended vehicle.**	NWS	Staff Time	2015		Yes	
Tornado	**Protect property from high winds (FEMA website)**		Staff Time	2015		Yes	
Tornado	**Severe Summer Weather Awareness (existing mitigation)**		Staff Time	2015		Yes	
Tornado	**Safe Rooms**		Staff Time EM Budget	2015		Yes	
Shortage or Outage of Critical Materials	**Public Education (minimum of 3 day supplies – recommend enhancing preparedness to 1 or 2 weeks)**		Staff Time EM Budget	2015		Yes	
Winter Storm	**Public Education (on-going) - emphasis on dangers of downed power lines and utilizing alternate work start/stop times to minimize rush hour traffic.**	Public Works	Staff Time EM Budget	2015		Yes	
Winter Storm	**Participate in the Severe Winter Weather Awareness Campaign (on-going).**		Staff Time EM Budget	2015		Yes	

Engineering

Hazard	Mitigation Action	Support Agencies	Potential Funding Source / Est. Cost	Timeline Initiate	Timeline Complete	On-going	Status
Geologic	**Finalize and approve the Ash and Ward Coulee Stormwater Master Plan.**		Already Funded	2014	2015		
Geologic	**Continue to include recommendations regarding development control lines in geological sensitive areas as future planning is done.**		NA Planning Function	2015		Yes	
Public Education							
Geologic	**Identify opportunities to inform or remind property owners of property related information regarding potential geologic conditions that may impact them or their property.**		TBD based on method of public education	2015		Yes	

Environmental Health

Hazard	Mitigation Action	Support Agencies	Potential Funding Source / Est. Cost	Timeline Initiate	Timeline Complete	On-going	Status
Communicable Disease	**Provide education when conducting food service inspections.**		Staff Time	2015		Yes	
Communicable Disease	**Implement risk-based inspection frequency for food establishments.**	ND DoH	Staff Time	2015	2015	Yes	
Communicable Disease	**Require bi-monthly water analysis for pools and recommend superchlorination if chlorine levels are observed to be low when collecting water samples.**		Staff Time	2015		Yes	
Communicable Disease	**Provide mosquito control & surveillance services.**		$76,000 annual budget	2015		Yes	

Fire Department							
Hazard	**Mitigation Action**	**Support Agencies**	**Potential Funding Source / Est. Cost**	**Timeline Initiate**	**Timeline Complete**	**On-going**	**Status**
Fire	**Continue to update and enforce zoning, building and fire code regulations.**		Staff Time Fire Dept Budget	2015		Yes	
Fire	**Promote (not require) residential fire sprinkler systems to minimize fire risk and vulnerability.**		Staff Time	2015		Yes	
Hazmat	**Develop preplans specific to hazardous materials fixed facilities.**		Staff Time	2015		Yes	
Hazmat	**Identify Hazmat Routes within Bismarck**		Staff Time	2014			
Hazmat	**Identify "higher risk" inspections to be designated to Fire Marshals for in-depth code enforcement and increased inspection frequency.**		Staff Time	2015	2015		
Hazmat	**Consider permitting occupancies in accordance with codes.**		Staff Time	2015	2015		
Wildland Fire	**Maintain Wildland Fire-Break Trail in Southwest Bismarck.**	Forestry	Staff Time	2015		Yes	
Public Education							
Fire	**Provide Fire Safety public education to the community at large.**		Staff Time Fire Dept Budget	2015		Yes	
Wildland Fire	**Continue to provide for public education efforts, including media releases, interviews, website updates, and public outreach. Public outreach shall include specific mailings to property owners within the wildland fire risk areas every three years or as applicable based on drought conditions. Public education efforts utilize Firewise program guidance.**		Staff Time Fire Dept Budget	2015		Yes	
Wildland Fire	**Share Firewise landscaping concepts with developers and Community Development.**		Staff Time Fire Dept Budget	2015		Yes	

Forestry							
Hazard	**Mitigation Action**	**Support Agencies**	**Potential Funding Source / Est. Cost**	**Timeline Initiate**	**Timeline Complete**	**On-going**	**Status**
Biological Infestation	**Continue existing mitigation efforts including the systematic approach to removing ash trees in decline.**		Staff Time Public Works / Forestry Budget	2015		Yes	
Biological Infestation	**Maintain the "City of Bismarck Emerald Ash Borer Response Plan" developed and approved by the Forestry Advisory Board and the City Commission.**		Staff Time Public Works / Forestry Budget	2015		Yes	
Public Education							
Biological Infestation	**Continue programs to monitor for forest damaging pests including Emerald Ash Borer and Dutch Elm Disease.**		Staff Time	2015		Yes	
Biological Infestation	**Continue public education efforts to diversify tree plantings and reduce potential for transporting pests (biological infestations) from other areas of the country.**		Staff Time	2015		Yes	

GIS							
Hazard	**Mitigation Action**	**Support Agencies**	**Potential Funding Source / Est. Cost**	**Timeline Initiate**	**Timeline Complete**	**On-going**	**Status**
Train Derailment	**Inversion - mapping based on hazardous materials releases (risk area) for airborne gases**		Staff Time	2015	2015		
Train Derailment	**Flow analysis from the tracks**		Staff Time	2015	completed		

Human Resources

Hazard	Mitigation Action	Support Agencies	Potential Funding Source / Est. Cost	Timeline Initiate	Timeline Complete	On-going	Status
Winter Storm	**Downed Power Line Safety Training**	WSI	HR City-Wide Training Budget	2015		Yes	

Police

Hazard	Mitigation Action	Support Agencies	Potential Funding Source / Est. Cost	Timeline Initiate	Timeline Complete	On-going	Status
Active Shooter	Conduct on-going public education regarding Active Shooter hazard.		Department Budget	2015		Yes	

Public Health

Hazard	Mitigation Action	Support Agencies	Potential Funding Source / Est. Cost	Timeline Initiate	Timeline Complete	On-going	Status
Communicable Disease	**Identify appropriate locations for isolation or quarantine.**		Staff Time	2015	2015	Yes	Annual review necessary
Communicable Disease	**Assess willingness among local health care providers to work collaboratively to address bacterial resistance and anti-biotic stewardship.**		Planning Function No cost	2015	2015	Yes	On-going public education and assessment
Communicable Disease	**Sterilization of foot care equipment with an autoclave to decrease spread of communicable disease.**		On-going annual maintenance costs	2014	2014	Yes	On-going staff time to complete sterilization process and maintain autoclave
Communicable Disease	**Continue Existing Mitigation Efforts (BBPH)**		Staff Time Dept Budget	2015		Yes	
Communicable Disease	**Standard Awareness Training: Course covering bio-terrorism and terrorism information including agents with signs and symptoms.**	Medical Providers, EMS, Fire, PD	Funded by NDDES or NDDoH	2015		Yes	

Public Works

Hazard	Mitigation Action	Support Agencies	Potential Funding Source / Est. Cost	Timeline Initiate	Timeline Complete	On-going	Status
Flood	**Develop an Emergency Action Plan for Jackman Coulee Dam #2. (Tom O'Leary Golf Course)**		Staff Time	2015	2016		
Flood	**Maintain existing flood protective measures to minimize vulnerability as a result of ice jams as well as 100-year and 500-year flood events. Note: Refers to maps (Figures 1 thru 5) within "existing mitigation"**	PW Service Ops and PW Utilities	PW Utility Funding and Staff Time	2012		Yes	
Flood	**Apex Engineering has been contracted to conduct a preliminary investigation into solutions to reduce urban flooding in south Bismarck in the Expressway and South 12th Street areas. (current mitigation activity)**		Already funded	2014	2015		Being presented to commission April 2015
Flood	**Continue Watershed master planning and updating as an on-going mitigation activity conducted jointly by Engineering, Public Works, and Community Development.**	Community Development, Engineering	Staff Time	2015		Yes	
Flood	**Conduct maintenance activities at Jackman Coulee Dam #2 (Tom O'Leary Golf Course) as recommended by the State Water Commission and/or annual inspections conducted by Bismarck Public Works.**	PW Utilities	PW Utilities Funding	2015		Yes	
Shortage or Outage of Critical Materials	**Identify critical facilities and infrastructure having or needing back-up generators (ie: critical facilities and shelter locations). Gap Analysis**		Staff Time	2015	2015		
Shortage or Outage of Critical Materials	**Ensure back-up generators are in place at all city-owned Critical Facilities. Ensure the back-up generators allow for continued operations of critical and essential functions.**		TBD based on generator needs	2015	2017		
Shortage or Outage of Critical Materials	**Develop an Emergency Agreement with private vendors for delivery of fuel for generators.**		Planning Function No Cost	2015	2016		

Public Works							
Hazard	**Mitigation Action**	**Support Agencies**	**Potential Funding Source / Est. Cost**	**Timeline Initiate**	**Timeline Complete**	**On-going**	**Status**
Shortage or Outage of Critical Materials	**Explore use of Natural Gas based on generator size needed - natural gas is a more reliable source of fuel**		Staff Time	2015	2017		
Shortage or Outage of Critical Materials	**Conduct an assessment of back-up power capabilities for traffic lights.**	PW Service Ops: Streetlights & Traffic Signals	Staff Time	2015	2016		Map available showing existing signals with back-up power capabilities
Tornado	**Include a Tornado Safe Room to EF4 standards within any new construction of city owned critical facilities where applicable based on occupancy.**	Public Works Facility Mgmnt	Project Specific	2015		Yes	
Tornado	**NOAA All Hazards Weather Radios in all city owned buildings**	Facilities Mgmt.	Individual City Departments $50 per radio	2015	2015		
Winter Storm	**Ensure Back-up generators exist for critical facilities, infrastructure, and shelter locations.**	Emergency Management	Funding Source TBD based on facility owner (ie: shelters)	2015	2020		
Winter Storm	**Evaluate need and opportunity for snow fences.**	PW Service Ops: Forestry	Staff Time	2015		Yes	
Public Education							
Geologic	**Do NOT stockpile snow within any geological sensitive areas.**	PW Service Ops, Roads & Streets, Engineering	Staff Time Dept Budget	2015		Yes	

Mitigation Actions – Prioritizing

Mitigation Actions were scored and prioritized during the hazard specific mitigation planning team meetings and reviewed by the Community Emergency Response Committee (CERC) represented by City Administration, Fire Department, Police Department, Public Health, and Public Works. In ranking mitigation action items as "high," "moderate," or "low," the hazard specific planning teams and CERC reviewed the considerations outlined on the next page as well as the score made up of "STAPLEE" criteria (see below), expected benefit/cost, and benefit to life safety and/or property protection.

Public Education mitigation actions are integrated into position job descriptions within various departments and are generally on-going or routine activities. These mitigation actions are grouped as "Public Education" rather than ranked as high, moderate, or low. However, they are listed based on the hazard ranking.

STAPLEE Criteria	
Criteria	**Considerations**
Social	Community Acceptance Effects on Segment of Population
Technical	Technical Feasibility Long-Term Solution Secondary Impacts
Administrative	Staffing Funding Allocated Maintenance/Operations
Political	Political Support Local Champion or Proponent Public Support
Legal	Local Authority Subjectivity to Legal Challenges
Economic	Benefit of Action Cost of Action Contribution to Economic Goals Outside Funding Requirement
Environmental	Effects on Land/Water Bodies Effects on Endangered Species Effects on Hazardous Material and Waste Sites Consistency with Community Environmental Goals Consistency with Federal Laws
Source (STAPLEE): Federal Emergency Management Agency	
STAPLEE Scoring Criteria: 1= highly effective, feasible 0= Neutral -1 = Ineffective or not feasible	

Mitigation Action Item Prioritizing			
The STAPLEE score in conjunction with additional considerations below were applied to determine the ranking for each mitigation action item.			
High	**Moderate**	**Low**	**Deny**
• Needs attention or participation from department heads, authorities, officials • Requires Funding support (ie: grants) • Required to address significant vulnerability • Needs urgent attention (not necessarily short term completion) • Higher hazard rank	• Other entities have lead role – Bismarck is supporting role in mitigation • Not fully within city authority – but city voice may be effective	• Routine or part of city position job description • Can be completed by one individual – minimal coordination • Minimal funding challenges • On-going / routine mitigation	• Not effective (ie: not likely to meet cost/benefit ratio of 1:1) • Not feasible, or practical – or may have other more effective solutions

Note: All Mitigation Action items are important, regardless of ranking of high, moderate or low. "Low" priority mitigation action items are important mitigation action items. Also, the rank does not imply a sequence or priority order for initiating or completing mitigation action items.

Mitigation Action "STAPLEE" Evaluation and Priority Level

Hazard	Hazard Ranking	Mitigation Action	Life Safety	Property Protection	Benefit vs. Cost	Social	Technical	Administrative	Political	Legal	Economic	Environmental	Score	Lead Agency	Priority
Winter Storm	High	**Develop City Office closure policy based on imminent or current conditions.**	1	1	1	1	1	1	-1	1	0	1	**7**	Administration	**High**
Winter Storm	High	**Coordinate school/city/business closure communications/decisions.**	1	1	1	1	1	1	1	1	-1	1	**8**	Administration	**High**
Winter Storm	High	**Downed Power Line Safety Training**	1	1	1	1	1	1	1	1	1	1	**10**	Human Resources	**High**
Winter Storm	High	**Ensure Back-up generators exist for critical facilities, infrastructure, and shelter locations.**	1	1	1	1	1	1	1	1	1	1	**10**	Public Works	**High**
Winter Storm	High	**Evaluate need and opportunity for snow fences.**	1	0	1	1	1	1	0	0	1	1	**7**	Public Works	**High**
Tornado	High	**Include a Tornado Safe Room to EF4 standards within any new construction of city owned critical facilities where applicable based on occupancy.**	1	1	0	1	1	1	1	1	0	1	**8**	Public Works Facility Mgmnt	**High**
Hazmat	Moderate	**Consider permitting occupancies in accordance with codes.**	1	1	1	1	1	0	-1	1	1	1	**7**	Fire	**High**
Hazmat	Moderate	**Identify Hazmat Routes within Bismarck**	1	1	1	1	1	1	1	0	1	1	**9**	Fire	**High**
Flood	Moderate	**Develop an Emergency Action Plan for Jackman Coulee Dam #2. (Tom O'Leary Golf Course)**	1	1	1	1	1	1	1	1	1	1	**10**	Public Works	**High**

Hazard	Hazard Ranking	Mitigation Action	Life Safety	Property Protection	Benefit vs. Cost	Social	Technical	Administrative	Political	Legal	Economic	Environmental	Score	Lead Agency	Priority
Flood	Moderate	**Maintain existing flood protective measures to minimize vulnerability as a result of ice jams as well as 100-year and 500-year flood events. Note: Refers to maps (Figures 1 thru 5) within "existing mitigation"**	1	1	1	1	1	1	1	1	1	1	**10**	Public Works	**High**
Shortage or Outage of Critical Materials	Moderate	**Identify critical facilities and infrastructure having or needing back-up generators (ie: critical facilities and shelter locations). Gap Analysis**	1	1	1	1	1	1	1	1	1	1	**10**	Public Works	**High**
Shortage or Outage of Critical Materials	Moderate	**Ensure back-up generators are in place at all city-owned Critical Facilities. Ensure the back-up generators allow for continued operations of critical and essential functions.**	1	1	1	1	1	1	1	1	1	1	**10**	Public Works	**High**
Shortage or Outage of Critical Materials	Moderate	**Develop an Emergency Agreement with private vendors for delivery of fuel for generators.**	1	1	1	1	1	1	1	1	1	1	**10**	Public Works	**High**
Train Derailment	Moderate	**Locate new critical facilities at least ¼ mile away from railroad lines: a. When building new or relocating critical facilities, the City of Bismarck should provide additional consideration or preference for location options at least ¼ mile from either railroad line. Assuming there are viable location options at least ¼ mile from the railroad lines of equal value and functionality, locating critical facilities at least ¼ mile away would reduce the loss potential.**	1	1	1	1	1	1	1	1	1	1	**10**	Administration	**High**
Communicable Disease	Moderate	**Provide education when conducting food service inspections.**	1	0	1	1	1	1	1	1	1	1	**9**	Environmental Health	**High**
Communicable Disease	Moderate	**Provide mosquito control & surveillance services.**	1	0	1	1	1	0	1	1	0	0	**6**	Environmental Health	**High**
Fire	Low	**Promote (not require) residential fire sprinkler systems to minimize fire risk and vulnerability.**	1	1	1	0	1	1	0	1	1	1	**8**	Fire	**High**

Hazard	Hazard Ranking	Mitigation Action	Life Safety	Property Protection	Benefit vs. Cost	Social	Technical	Administrative	Political	Legal	Economic	Environmental	Score	Lead Agency	Priority
Aircraft Accident	Low	**Recommend Burleigh County and city of Lincoln adopt city of Bismarck aeronautical zoning where applicable based on the city of Lincoln growing nearer to the Airport.**	1	1	1	1	1	1	1	1	1	1	**10**	Airport	**High**
Geologic	Low	**Finalize and approve the Ash and Ward Coulee Stormwater Master Plan.**	0	1	0	1	1	1	0	0	0	1	**5**	Engineering	**High**
Geologic	Low	**Continue to include recommendations regarding development control lines in geological sensitive areas as future planning is done.**	0	1	1	1	1	1	0	1	1	1	**8**	Engineering	**High**
Tornado	High	**Install Outdoor Warning Sirens as city grows per identified need.**	1	0	1	1	1	1	1	1	0	0	**7**	Emergency Management	**Moderate**
Tornado	High	**Increase frequency of Outdoor Warning Siren Test - 2 per month (May thru August)**	1	0	1	1	1	1	1	1	1	1	**9**	Emergency Management	**Moderate**
Tornado	High	**Identify Community Planning Group to study/identify Community Tornado Shelter(s) Location - existing facilities**	1	0	1	1	1	-1	1	-1	1	1	**5**	Emergency Management	**Moderate**
Tornado	High	**NOAA All Hazards Weather Radios in all city owned buildings**	1	0	1	1	1	1	1	1	1	0	**8**	Public Works	**Moderate**
Hazmat	Moderate	**Identify "higher risk" inspections to be designated to Fire Marshals for in-depth code enforcement and increased inspection frequency.**	1	1	1	1	1	1	1	1	1	1	**10**	Fire	**Moderate**
Flood	Moderate	**Apply to participate in the National Flood Insurance Program (NFIP) Community Rating System (CRS).**	0	1	1	1	1	1	1	1	1	1	**9**	Community Development Building & Inspections	**Moderate**

Hazard	Hazard Ranking	Mitigation Action	Life Safety	Property Protection	Benefit vs. Cost	Social	Technical	Administrative	Political	Legal	Economic	Environmental	Score	Lead Agency	Priority
Flood	Moderate	**Apex Engineering has been contracted to conduct a preliminary investigation into solutions to reduce urban flooding in south Bismarck in the Expressway and South 12th Street areas. (current mitigation activity)**	0	1	0	1	1	1	1	1	0	1	**7**	Public Works	**Moderate**
Flood	Moderate	**Continue Watershed master planning and updating as an on-going mitigation activity conducted jointly by Engineering, Public Works, and Community Development.**	1	1	1	1	1	1	1	1	1	1	**10**	Public Works	**Moderate**
Flood	Moderate	**Conduct maintenance activities at Jackman Coulee Dam #2 (Tom O'Leary Golf Course) as recommended by the State Water Commission and/or annual inspections conducted by Bismarck Public Works.**	1	1	1	1	1	1	1	1	1	1	**10**	Public Works	**Moderate**
Shortage or Outage of Critical Materials	Moderate	**Explore use of Natural Gas based on generator size needed - natural gas is a more reliable source of fuel**	1	1	1	1	1	1	1	1	1	1	**10**	Public Works	**Moderate**
Shortage or Outage of Critical Materials	Moderate	**Encourage the state to enhance the "Energy Assurance Plan" to acknowledge and address the EMP threat.**	1	1	1	1	1	1	1	1	1	1	**10**	Administration	**Moderate**
Shortage or Outage of Critical Materials	Moderate	**Encourage state involvement in electric utility hardening against EMP attack.**	1	1	1	1	1	1	1	1	1	1	**10**	Administration	**Moderate**
Train Derailment	Moderate	**Clarify bridge ownership and responsibilities for maintenance and inspections.**	1	1	1	1	1	1	1	1	1	1	**10**	Administration	**Moderate**
Train Derailment	Moderate	**Determine if there are reporting requirements regarding track/bridge inspections.**	1	1	1	1	1	1	1	1	1	1	**10**	Administration	**Moderate**

Hazard	Hazard Ranking	Mitigation Action	Life Safety	Property Protection	Benefit vs. Cost	Social	Technical	Administrative	Political	Legal	Economic	Environmental	Score	Lead Agency	Priority
Communicable Disease	Moderate	**Implement risk-based inspection frequency for food establishments.**	1	0	1	1	1	1	1	1	1	1	**9**	Environmental Health	**Moderate**
Communicable Disease	Moderate	**Identify appropriate locations for isolation or quarantine.**	1	0	0	1	1	1	0	0	1	1	**6**	Public Health	**Moderate**
Fire	Low	**Continue to update and enforce zoning, building and fire code regulations.**	1	1	1	1	1	1	0	1	1	1	**9**	Fire	**Moderate**
Winter Storm	High	**Public Information and Warnings (NWS) - continue**	1	1	1	1	1	1	1	1	1	1	**10**	National Weather Service	**Low**
Tornado	High	**Mobile Home Skirting Mitigation / Landscaping - Eliminate wind access (uplift). Research question for NWS and/or FEMA.**	1	1	1	1	0	0	0	0	0	0	**4**	Emergency Management	**Low**
Tornado	High	**Recommend via Local NWS that NOAA ensure multiple language / language selection option is available for the NOAA All Hazards WX Radio**	1	0	1	1	0	1	1	0	1	1	**7**	Emergency Management	**Low**
Hazmat	Moderate	**Develop preplans specific to hazardous materials fixed facilities.**	1	1	1	1	1	1	1	1	1	1	**10**	Fire	**Low**
Shortage or Outage of Critical Materials	Moderate	**Conduct an assessment of back-up power capabilities for traffic lights.**	1	1	1	1	1	1	1	1	1	1	**10**	Public Works	**Low**
Train Derailment	Moderate	**Inversion - mapping based on hazardous materials releases (risk area) for airborne gases**	1	0	1	1	1	1	1	1	1	1	**9**	GIS	**Low**
Train Derailment	Moderate	**Flow analysis from the tracks**	1	1	1	1	1	1	1	1	1	1	**10**	GIS	**Low**

Hazard	Hazard Ranking	Mitigation Action	Life Safety	Property Protection	Benefit vs. Cost	Social	Technical	Administrative	Political	Legal	Economic	Environmental	Score	Lead Agency	Priority
Communicable Disease	Moderate	**Require bi-monthly water analysis for pools and recommend superchlorination if chlorine levels are observed to be low when collecting water samples.**	1	0	1	1	1	1	0	1	1	1	**8**	Environmental Health	**Low**
Communicable Disease	Moderate	**Sterilization of foot care equipment with an autoclave to decrease spread of communicable disease.**	1	0	1	1	1	1	1	1	1	1	**9**	Public Health	**Low**
Communicable Disease	Moderate	**Standard Awareness Training: Course covering bio-terrorism and terrorism information including agents with signs and symptoms.**	1	0	1	1	1	1	1	1	1	1	**9**	Public Health	**Low**
Communicable Disease	Moderate	**Continue Existing Mitigation Efforts (BBPH)**	1	0	1	1	1	1	1	1	1	1	**9**	Public Health	**Low**
Communicable Disease	Moderate	**Assess willingness among local health care providers to work collaboratively to address bacterial resistance and anti-biotic stewardship.**	1	0	1	1	1	1	1	1	1	1	**9**	Public Health	**Low**
Biological Infestation	Low	**Continue programs to monitor for forest damaging pests including Emerald Ash Borer and Dutch Elm Disease.**	0	1	1	1	1	1	1	1	1	1	**9**	Forestry	**Low**
Biological Infestation	Low	**Continue existing mitigation efforts including the systematic approach to removing ash trees in decline.**	0	1	1	1	1	1	1	1	1	1	**9**	Forestry	**Low**
Biological Infestation	Low	**Maintain the "City of Bismarck Emerald Ash Borer Response Plan" developed and approved by the Forestry Advisory Board and the City Commission.**	0	1	1	1	1	1	1	1	1	1	**9**	Forestry	**Low**

Hazard	Hazard Ranking	Mitigation Action	Life Safety	Property Protection	Benefit vs. Cost	Social	Technical	Administrative	Political	Legal	Economic	Environmental	Score	Lead Agency	Priority
Dam Failure	Low	**Locate new critical facilities outside inundation area when possible: When building, remodeling, or relocating critical facilities, the City of Bismarck should provide additional consideration or preference for location options outside of the dam failure inundation area. Because the probability of a catastrophic dam failure is very low, locating critical facilities outside the inundation area is NOT a requirement. However, assuming there are viable location options outside of the inundation area of equal value and functionality, locating outside the inundation area would reduce the loss potential.**	1	1	1	1	1	1	1	1	1	1	**10**	Administration	**Low**
Aircraft Accident	Low	**Complete the current Wildlife Hazard Assessment. This plan is a yearlong study on the wildlife around the airport. The final assessment will provide recommendation on how to reduce the wildlife present on and around the airport.**	1	1	1	1	1	1	1	1	1	1	**10**	Airport	**Low**
Aircraft Accident	Low	**Maintain the current airport hazard mitigation and emergency response plans and planning efforts identified as "existing mitigation."**	1	1	1	1	1	1	1	1	1	1	**10**	Airport	**Low**
Wildland Fire	Low	**Maintain Wildland Fire-Break Trail in Southwest Bismarck.**	1	1	1	1	1	1	1	1	1	1	**10**	Fire	**Low**

Public Education – Mitigation Activities

Hazard	Hazard Ranking	Mitigation Action	Life Safety	Property Protection	Benefit vs. Cost	Social	Technical	Administrative	Political	Legal	Economic	Environmental	Score	Lead Agency	Priority
Winter Storm	High	**Public Education (on-going) - emphasis on dangers of downed power lines and utilizing alternate work start/stop times to minimize rush hour traffic.**	1	1	1	1	1	1	1	1	1	1	**10**	Emergency Management	**Public Education**
Winter Storm	High	**Participate in the Severe Winter Weather Awareness Campaign (on-going).**	1	1	1	1	1	1	1	1	1	1	**10**	Emergency Management	**Public Education**
Tornado	High	**Public Information - NWS Warnings (existing mitigation)**	1	0	1	1	1	1	1	1	1	1	**9**	NWS	**Public Education**
Tornado	High	**Electric Infrastructure Protection (utility industry)**	1	1	1	1	1	1	1	1	1	1	**10**	Utility Industry	**Public Education**
Tornado	High	**Encourage Wind-Resistant Building Techniques**	1	1	1	1	1	1	1	1	1	1	**10**	Building & Inspections	**Public Education**
Tornado	High	**MH owners / Park Owner - joint shelter planning**	1	1	1	1	1	1	0	1	1	1	**9**	Emergency Management	**Public Education**
Tornado	High	**MH owners /area facilities shelter agreements (pre-planning)**	1	0	1	1	1	1	0	1	1	1	**8**	Emergency Management	**Public Education**
Tornado	High	**Promote NOAA All Hazards WX Radio (existing mitigation)**	1	1	1	1	1	1	1	1	1	1	**10**	Emergency Management	**Public Education**
Tornado	High	**Protect property from high winds (FEMA website)** http://www.fema.gov/media-library/assets/documents/13270?id=3263	1	1	1	1	1	1	1	1	1	1	**10**	Emergency Management	**Public Education**
Tornado	High	**Safe Rooms** http://www.fema.gov/media-library/assets/documents/2009?fromSearch=fromsearch&id=1536	1	0	1	1	1	1	0	1	0	0	**6**	Emergency Management	**Public Education**

Hazard	Hazard Ranking	Mitigation Action	Life Safety	Property Protection	Benefit vs. Cost	Social	Technical	Administrative	Political	Legal	Economic	Environmental	Score	Lead Agency	Priority
Tornado	High	**Severe Summer Weather Awareness (existing mitigation)**	1	1	1	1	1	1	1	1	1	1	**10**	Emergency Management	**Public Education**
Severe Summer Weather	Moderate	**Public Education regarding Extreme Heat: Do not leave children or pets in the unattended vehicle.**	1	1	1	1	1	1	1	1	1	1	**10**	Emergency Management	**Public Education**
Severe Summer Weather	Moderate	**Continue participating in the Severe Summer Weather Awareness campaign.**	1	1	1	1	1	1	1	1	1	1	**10**	Emergency Management	**Public Education**
Flood	Moderate	**Coordinate and/or support NFIP flood insurance promotional efforts including the availability of flood insurance for community residents and businesses.**	1	1	1	1	1	1	1	1	1	1	**10**	Community Development	**Public Education**
Flood	Moderate	**Conduct Flood Mitigation and Preparedness Public Education efforts for local citizens and businesses.**	1	1	1	1	1	1	1	1	1	1	**10**	Emergency Management	**Public Education**
Hazmat	Moderate	**Continue Public Education regarding Shelter In Place and Evacuation procedures**	1	1	1	1	1	1	1	1	1	1	**10**	Emergency Management	**Public Education**
Shortage or Outage of Critical Materials	Moderate	**Public Education (minimum of 3 day supplies – recommend enhancing preparedness to 1 or 2 weeks)**	1	1	1	1	1	1	1	1	1	1	**10**	Emergency Management	**Public Education**
Train Derailment	Moderate	**Evacuation and Shelter-In-Place Emergency Preparedness**	1	0	1	1	1	1	1	1	1	1	**9**	Emergency Management	**Public Education**
Active Shooter	Moderate	**Conduct on-going public education regarding Active Shooter hazard.**	1	0	1	1	1	1	1	1	1	1	**9**	Police	**Public Education**
Fire	Low	**Provide Fire Safety public education to the community at large.**	1	1	1	1	1	1	1	1	1	1	**10**	Fire	**Public Education**

Hazard	Hazard Ranking	Mitigation Action	Life Safety	Property Protection	Benefit vs. Cost	Social	Technical	Administrative	Political	Legal	Economic	Environmental	Score	Lead Agency	Priority
Geologic	Low	**Identify opportunities to inform or remind property owners of property related information regarding potential geologic conditions that may impact them or their property.**	0	1	1	1	1	1	1	1	1	1	**9**	Engineering	**Public Education**
Wildland Fire	Low	**Continue to provide for public education efforts, including media releases, interviews, website updates, and public outreach. Public outreach shall include specific mailings to property owners within the wildland fire risk areas every three years or as applicable based on drought conditions. Public education efforts utilize Firewise program guidance.**	1	1	1	1	1	1	1	1	1	1	**10**	Fire	**Public Education**
Wildland Fire	Low	**Share Firewise landscaping concepts with developers and Community Development.**	1	1	1	1	1	1	1	1	1	1	**10**	Fire	**Public Education**
Biological Infestation	Low	**Continue public education efforts to diversify tree plantings and reduce potential for transporting pests (biological infestations) from other areas of the country.**	0	1	1	1	1	1	1	1	1	1	**9**	Forestry	**Public Education**
Geologic	Low	**Do Not stockpile snow within any geological sensitive areas.**	0	1	1	1	1	1	1	1	1	1	**9**	Public Works	**Public Education**
All Hazards		**Promote mitigation and emergency preparedness for all hazards.**	1	1	1	1	1	1	1	1	1	1	**10**	Emergency Management	**Public Education**

Integration of Plans and Programs & Mitigation Capabilities Inventory

This section provides a summary of community mitigation capabilities and identifies the plans, programs, and other capabilities integrated throughout the development of this mitigation plan. Additional capabilities specific to each hazard are identified as "pre-existing" mitigation within Section 3 where applicable.

City Administration will coordinate with the applicable city department to integrate the requirements of the mitigation plan into other plans and funding mechanisms (ie: annual budgeting process, capital improvement program, growth management plan, future land use plan, plat review process, site plan review process) when appropriate.

Plans and Programs Plans and programs reviewed and incorporated into the mitigation plan or mitigation planning process are noted below.	
City of Bismarck Strategic Plan	The City of Bismarck developed a Strategic Plan dated March 21, 2012 identifies public safety and emergency preparedness as a priority (see pages 13, 20 of strategic plan). The plan also emphasizes building partnerships and collaboration within the community. (See page 16 of strategic plan). More Information: http://www.bismarcknd.gov/index.aspx?NID=1360
Bismarck Emergency Operations Plan	The hazard profiles (ie: risk and vulnerability assessment components) contained with this mitigation plan may be referenced to enhance the Emergency Operations Plan and department specific standard operating guides/procedures. The Emergency Operations Plan informs the mitigation planning development through reviews of the Emergency Operations Plan which may identify response capability gaps and opportunities for mitigation.
Bismarck Continuity of Operations Plan	Through the development of this mitigation plan, vulnerabilities are identified and mitigation projects to enhance continuity of operations capabilities may be introduced. Reviews of the Continuity of Operations Plan may identify additional mitigation opportunities to enhance capability to sustain city operations.
Bismarck Rapid Damage Assessment Plan	The Rapid Damage Assessment Plan includes mapping of critical infrastructure, critical facilities, vulnerable populations, schools, and hazardous materials sites including Tier II sites. This community information is integrated into the mitigation planning process and the mitigation plan itself.
2014 Growth Management Plan	The purpose of the 2014 Growth Management Plan is to provide a policy and planning guide that helps the City to: • Manage growth through a collaborative process with landowners and developers to achieve attractive and sustainable land and infrastructure development.

Plans and Programs Plans and programs reviewed and incorporated into the mitigation plan or mitigation planning process are noted below.	
	• Encourage orderly development of unique new neighborhoods, commercial and industrial areas, and redevelopment of existing neighborhoods. • Preserve unique environmental features. • Develop and support an efficient transportation system to serve future circulation and access needs. • Provide attractive and accessible recreation resources to residents and visitors. • Encourage a variety of housing types and support reinvestment in the existing housing stock. • Maintain existing infrastructure, schools, and police and fire services, and expand in growth areas in a cost effective and efficient manner that supports land use, transportation and growth management goals of this plan. More Information: http://www.bismarckgrowthplan.com/p/study-memos-and-reports.html
Stormwater Management Program	Bismarck has a Stormwater Management Program implemented jointly by Community Development, Engineering, and Public Works and a Stormwater Program Coordinator within the Public Works Department. Mitigation capabilities of the Stormwater Management program are identified through Community Development via City Ordinance Title 14.1 (Zoning Ordinance). The city has authority to regulate and enforce stormwater management requirements to promote health, safety, and welfare of the people and property within Bismarck and its extraterritorial jurisdiction. The requirements, permitting and detailed review process are in place to mitigate the impacts of development and land disturbance, protect natural resources, maintain water quality, and minimize stormwater runoff, erosion, and urban flooding issues. More Information: http://www.bismarcknd.gov/index.aspx?nid=190
Bismarck Airport Master Plan **and** **Airport Mitigation and Response Plans**	The Bismarck Airport through its various plans and manuals has specific guidelines and procedures for mitigating hazards. The plans include but are not limited to: Airport Certification Manual, Airport Emergency Plan, Airport Security Program, Spill Prevention Control and Countermeasure Plan (SPCC), Wildlife Hazard Management Plan, Wetland Mitigation and Environmental Assessments. The airport in on-going operations strives to ensure safety and security and mitigate any hazards that could arise. By following procedures set forth, continuous retraining and improvements the airport mitigates hazards.
Public Health Programs	Public Health programs include Emergency Preparedness and Response, Home Health Services, Immunizations and other health services. Bismarck also provides public health services to Burleigh County (via contract).
Board of Health	The board of city commissioners constitutes the City Board of Health. *Reference: N.D.C.C. 23-35-03. (Ord. 5660, 05-13-08)*
Transportation Improvement Program (TIP)	The annually developed Transportation Improvement Program (TIP), produced by the Bismarck-Mandan Metropolitan Planning Organization (MPO), identifies federally funded transportation improvements in the area

Plans and Programs Plans and programs reviewed and incorporated into the mitigation plan or mitigation planning process are noted below.	
	over a four year time frame. The TIP is developed on an annual basis in cooperation with the MPO area member jurisdictions, transit provider, and the North Dakota Department of Transportation. The MPO utilizes its Public Participation Plan and coordinates the TIP with its Long Range Transportation Plan (LRTP). http://www.bismarcknd.gov/index.aspx?NID=1109
Long Range Transportation Plan (LRTP)	The 2009-2035 Long Range Transportation Plan (LRTP), is a guide for the development of the area's transportation system over the next 20+ years. Maintaining a relevant LRTP allows the Bismarck-Mandan area to be eligible for federal transportation dollars for transportation improvements. The LRTP was developed by the MPO with stakeholder input including a "Community Committee" made up of area residents, business groups, bike groups, transit users/representatives, and community agency representatives. http://www.bismarcknd.gov/index.aspx?nid=1226
Fringe Area Road Master Plan	In 2014, the MPO adopted a new Fringe Area Road Master Plan to address the growing Bismarck-Mandan Metropolitan Fringe Areas. The plan serves as a framework for a suitable future roadway network and will also help guide land use planning for the future. http://www.bismarcknd.gov/index.aspx?NID=134
Capital Improvement Program	The Capital Improvement Program is managed by the Finance Department. A department may place capital improvement projects over $50,000 (for non-special assessment district projects) on the Capital Improvement Plan which are evaluated by the Budget Committee. The Budget Committee makes recommendations to the City Commission regarding approvals/adjustments to the Capital Improvement 5-year and annual plans. The City Commission adopts the 5 year plan and approves the annual plan. Projects under $50,000.00 follow the purchasing ordinance. The Engineering Department may submit a request to the City Commission to create a special assessment district to assess benefiting properties. The city commission calls for a public hearing regarding those projects.
State and County Mitigation Plans	The 2014 State of North Dakota Multi-Hazard Mitigation Plan and the Burleigh and Morton County Multi-Hazard Mitigation Plans were reviewed by Bismarck Emergency Management and integrated into this plan and planning process.
Missouri River 2014 Flood Response and Action Plan (updated from 2012 and 2013)	The Apex Engineering Missouri River 2014 Flood Response and Action Plan was reviewed and integrated into the Bismarck Multi-Hazard Mitigation Plan. The plan addresses both Ice Jam and Flood protection.

Codes, Permitting and Inspections The following mitigation capabilities are reviewed and incorporated into the mitigation plan and planning process.	
Building Ordinance and Codes	The Building Inspections Division of Community Development enforces various building codes per Title-4 Building Ordinance. The building codes ensure construction standards to address life safety and quality construction issues. The ordinance establishes processes for permitting and inspections managed by the Building Inspections Division of Community Development. The jurisdiction of the division includes Bismarck and Burleigh ETA mapped : http://www.bismarcknd.gov/DocumentCenter/Home/View/574 More information: http://www.bismarcknd.gov/index.aspx?nid=113
Fire Codes	The Bismarck Fire Department enforces Fire Codes per Title-4 Building Ordinance in cooperation with the Building Inspections and Planning Divisions of Community Development. The Fire Department issues permits for licensed daycare facilities, exhaust hood system installations, sprinkler systems, fire alarm systems, and professional firework displays. Bismarck Fire conducts annual inspections of all commercial and public facilities to ensure sustained compliance with fire codes and to promote safety and mitigation practices. Within the incorporated limits of the City of Bismarck, the ISO Public Protection Classification is 2. More information: http://www.bismarcknd.gov/index.aspx?nid=479

Land Use Planning and Ordinances The following land use planning capabilities and ordinances are incorporated into the mitigation plan or planning process.	
Zoning	Zoning authorities are established by Bismarck City Ordinance Title 14. The zoning ordinance provides for the concept of a "Master Plan" which is a compilation of adopted street, road, land use, water, sanitary sewer and drainage plans. The Planning Division administers land use regulations and coordinates the development application process for City Planning & Zoning Commission, the County Planning Commission and the Board of Adjustment. 14-02-01. Intent. It is the intent of the board of city commissioners to promote the health, safety and general welfare by guiding the development of the city by means of a comprehensive land use plan which is in part carried out by the provisions of this ordinance. It is the intent of this ordinance to provide regulations, standards and guides for the city's development which will: a) Lessen congestion in the streets; b) Secure safety from fire, panic and other dangers; c) Promote the health and general welfare; d) Prevent the overcrowding of land; e) Provide adequate light and air; f) Avoid undue concentration of population;

Land Use Planning and Ordinances The following land use planning capabilities and ordinances are incorporated into the mitigation plan or planning process.	
	g) Facilitate adequate provision for transportation, water, sewerage, schools, parks and other requirements. More Information: http://www.bismarcknd.gov/index.aspx?nid=138
Floodplain Ordinance	The floodplain ordinance is contained with the Bismarck Zoning Ordinance – Title 14. The purpose of the regulations set forth by the floodplain ordinance (14-04-19) is to promote public health, safety, and general welfare, and to minimize public and private losses due to flood conditions. A "Floodplain Administrator" is designated by the City of Bismarck to administer the City's floodplain regulations. More information: http://nd-bismarck.civicplus.com/DocumentCenter/Home/View/1962
Flood Insurance Study and Flood Insurance Rate Maps	Flood Insurance Study and Flood Insurance Rate Maps: http://www.swc.nd.gov/4dlink9/4dcgi/GetContentRecord/PB-1976
Snow Emergency Ordinance	City Ordinance Title 10 established snow emergency routes and outlines the process to issue a snow emergency declaration. A snow emergency declaration allows for the public works director to take specific actions such as allow for the discontinued use of snow plow "snow gates" to more efficiently remove snow. Title 12 (traffic code) and Title 14 (Zoning) also support snow emergency preparedness, mitigation, and response efforts. Title 12 authorizes the removal of parked vehicles located on a posted snow emergency routes during a declared snow emergency or otherwise impeding efficient snow removal or obstructing normal traffic flow. Title 14 requires available snow storage via islands, medians, and adjacent parking areas. More information (title 10): http://www.bismarcknd.gov/index.aspx?nid=90
Drought – City Ordinance	Title 2 (Chapter 2-08) of the Bismarck City Ordinance provides authority to restrict the use of water and other utilities during a drought or other emergency following a declaration of emergency. More information: http://www.bismarcknd.gov/index.aspx?nid=90 http://www.bismarcknd.gov/index.aspx?nid=213
Neighborhood Parks and Open Space	The Neighborhood Parks and Open Space ordinance and policy were both adopted by the City Commission in October 2013. More Information: http://www.bismarcknd.gov/index.aspx?nid=1474

Administration Administration capabilities integrated within mitigation planning are noted below.	
Planning and Zoning Commission	The Bismarck Planning and Zoning Commission hears requests for major and minor subdivision plats, zoning changes, zoning ordinance text amendments, annexations, special use permits and rural lot splits. The City of Bismarck has zoning and subdivision authority within the corporate limits and the extraterritorial area. The Planning and Zoning Commission meets monthly. More information: http://www.bismarcknd.gov/index.aspx?nid=1037
Metropolitan Planning Organization	The Metropolitan Planning Organization (MPO) provides a forum for public officials, citizens, and other interested groups to establish policies and plans for effectively addressing various metropolitan transportation issues. The MPO is comprised of five jurisdictions including: Bismarck, Lincoln, Mandan, and portions of Burleigh and Morton counties. More information: http://www.bismarcknd.gov/index.aspx?nid=133

Department/Staff Mitigation Capabilities The following department/staff mitigation capabilities are integrated into the mitigation planning process.	
Building Official	Also see "Building Ordinance and Codes." Bismarck has a full-time Building Official and additional full-time Building Inspections staff to enforce ordinances and building codes including building regulations, floodplain administration, addressing, and zoning administration and enforcement. The Building Inspections Division is within Community Development Department. More information: http://www.bismarcknd.gov/index.aspx?NID=111
Floodplain Administrator	The Building Official for Bismarck is designated as the Floodplain Administrator. The Floodplain Administrator (Building Official) administers the city's floodplain regulations. The duties and responsibilities of the Floodplain Administrator are outlined in Title 14 Zoning (14-04-19). More information: http://nd-bismarck.civicplus.com/DocumentCenter/Home/View/1962
Community Planner	The Planning Division within Community Development is responsible for: • Administering land use regulations for the City of Bismarck and portions of Burleigh County • Coordinating the development application process for zoning changes, major and minor subdivision plats, annexations, special use permits, variances, lot modifications, plat modifications (right-of-way vacations, easement releases, street name changes), site plan review and downtown design review • Administering HUD Grant Programs (CDBG and HOME) for the City • Administering Downtown Programs (Renaissance Zone and CORE) for the City • Providing staff support to the City Planning & Zoning Commission, the County Planning Commission, the Board of Adjustment and the Renaissance Zone Authority

Department/Staff Mitigation Capabilities The following department/staff mitigation capabilities are integrated into the mitigation planning process.	
	• Plat Reviews More Information: http://www.bismarcknd.gov/index.aspx?NID=138
Civil Engineer	The Engineering Department monitors contracted construction projects and permits by private contractors in the City of Bismarck streets, rights of way, and public easements. The Engineering Department also provides guidance and information relating to land development, stormwater and floodplain management, traffic matters (including parking, street signs, road closures and pavement markings), property boundaries, water distribution, sanitary sewer collection, transportation network master planning, records of public infrastructure (including water, sewer, road, lighting, and service lines to private buildings). The Engineering Department works in conjunction with the Public Works Department which is responsible for operations and maintenance of water utility services, streets/lights, waste and recycling, and city forestry. More Information: http://www.bismarcknd.gov/index.aspx?nid=17
Geographic Information Systems	The GIS Division is capable of producing maps, graphs, tables, images, and applications using geographic data to support operational and planning functions, including support to mitigation planning efforts.
Forestry	Bismarck has a Forestry Division (within Public Works Department). Mitigation capabilities of the Forestry Division are identified in City Ordinance Title 13 providing the City Forester with authority to regulate/enforce forestry standards which govern planting, maintenance, removal, fertilization, pruning, and bracing of trees to minimize interference with utility lines and support public safety (ie: maintain visibility, public safety access, wildland/urban interface). Through promotion of the urban forestry program, stormwater run-off reduction is achieved as well with an estimated annual benefit of $500,000.00. More information: http://www.bismarcknd.gov/index.aspx?nid=163
Southwest Central Emergency Preparedness Regional Coordinator	The Southwest EPR Coordinator develops plans and capabilities to address public health (and all hazard) emergencies. Public Health Emergency Operations Plans address Points of Distribution, Mass Inoculation, Regional Strategic National Stockpile, Mass Fatality, Mental Health, and Pandemic Influenza.
Emergency Manager	Bismarck established an emergency management program at the city level in 2003 and employs a full-time city emergency manager partially funded by the Emergency Management Performance Grant. Alternate Emergency Managers are identified in the Continuity of Operations Plan. More information: http://www.bismarcknd.gov/index.aspx?NID=495

Technical Mitigation Capabilities	
Warning Systems & Services	There are 22 outdoor warning sirens in Bismarck and surrounding area. Eighteen of them are within city of Bismarck. The sirens are activated via the Combined Communications Center (CCC). CCC also has emergency notification system technology to activate personnel and to notify a select area of the community of an impending or current situation. Notification/alerts may be sent out via land-line phone, cell phone, text, etc.
Grant Writing	All Departments have grant writing capability. Bismarck also has a Grants Coordinator position to assist with grants management including grant compliance.

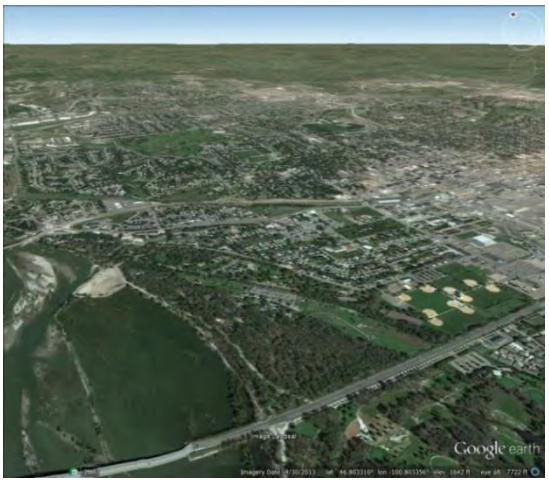
Financial Mitigation Capabilities	
Financial capabilities - various	-Capital Improvement project funding is approved annually via the city commission. See *Capital Improvement Program* under *Plans and Programs* above. -Bismarck has the authority to levy taxes. -Bismarck may incur debt through general obligation bonds. However, funds are more typically raised via taxes such as hotel/motel, liquor, sales tax, and car rental taxes. -Community Development Block Grant funds are utilized by Bismarck annually.

Education and Outreach Mitigation Capabilities and Plan Integration	
Public Education: Mitigation and Emergency Preparedness	Various departments have capability and do conduct safety, mitigation, and emergency preparedness public education and outreach activities. City departments include Public Works, Public Health, Fire, Police, as well as Emergency Management. Other community partners also have this capability and conduct public education activities for the benefit of local citizenry including the business community. Other community partners include the American Red Cross, National Weather Service, Burleigh County, and ND Department of Emergency Services.

Community Profile

Geography

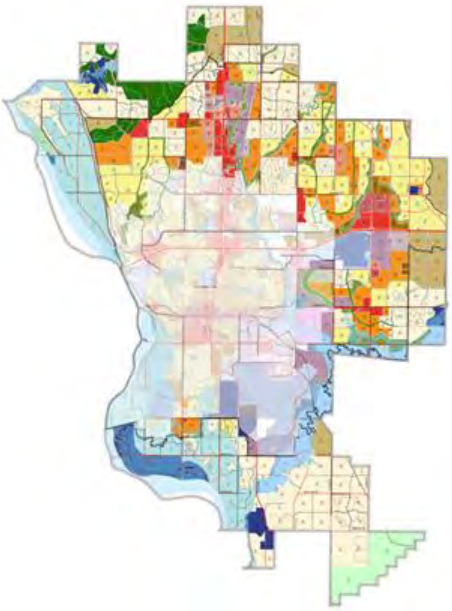
Bismarck, the county seat and State capital, is in the southwestern part of Burleigh County. Bismarck measures 32.86 square miles (Jan 2015), about 2% of the 1,648 square miles of Burleigh County. The Missouri River, flowing in a southerly to southeasterly direction, forms the western boundary of Bismarck. Bismarck lies within the eastern margin of the Great Plains, which is defined by gently rolling hills and wide expanses of prairie.



The north side of Bismarck is of higher elevation with a gently rolling terrain. The highest elevation in Bismarck is 1,973 near the Ash Coulee Drive water tower. There are relatively steep slopes adjacent to the Missouri River on the east side of River Road. The south side of Bismarck is of lower elevation and generally flat. The "gage 0" datum level is 1618.28 at the river gage near the water treatment in west Bismarck. 1630 is the typical lower elevation in southwest Bismarck.

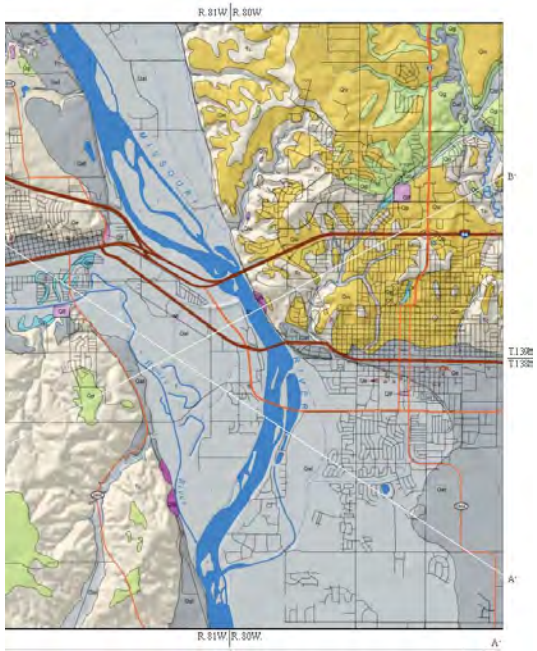
Interstate 94 and US 83 are major transportation routes and both bisect the city of Bismarck.

At Bismarck-Mandan the Missouri River Valley is only about two miles wide where Interstate Highway 94 crosses the river. On the south side of Bismarck the valley broadens to about six miles wide. The reason for this widening is that, prior to glaciation, the Heart and Little Heart rivers, which today flow into the Missouri River (the Heart River enters the Missouri River at Mandan; the Little Heart enters about ten miles south of Mandan), joined a few miles east of Bismarck. The old, combined valley of the Heart-Little Heart rivers still exists as the broad lowland south of Bismarck - a wide spot in the Missouri River valley.



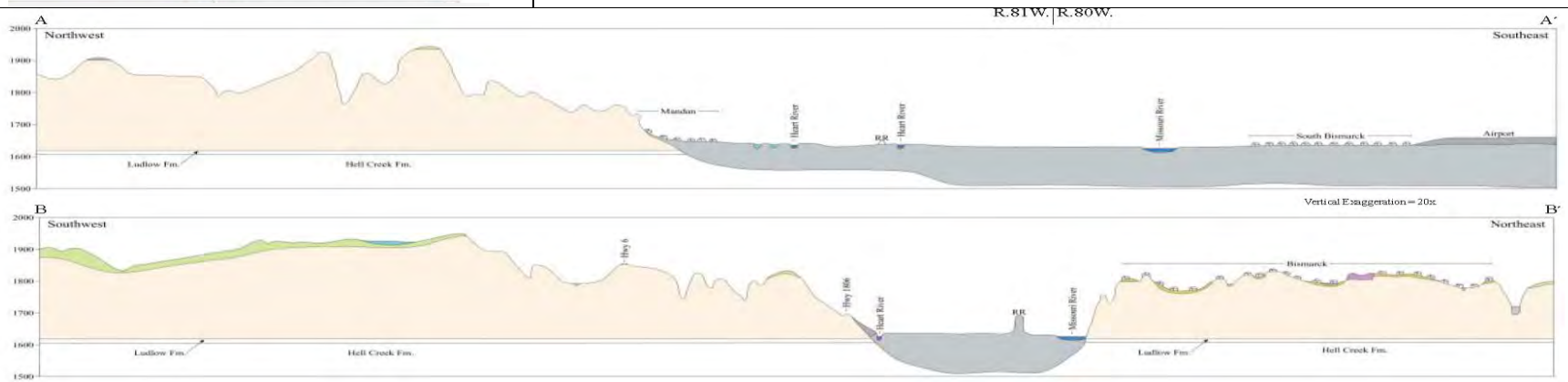
The latitude of Bismarck is 46.808N. The longitude is -100.783W. Elevation is 1,686 feet. Population of Bismarck in 2013 was 67,034, which is latest estimate by the U.S. Census Bureau. The City of Bismarck's form of government is a five-member city commission, elected at-large, of which the president is also the Mayor of the city.

Sources: City of Bismarck, Google Maps, Bismarck Growth Management Plan



The Missouri River forms the western boundary of Bismarck. The elevation of the majority of south Bismarck (shown below at right top) is not significantly higher than the normal or typical river elevations throughout the year. Much of south Bismarck could not be developed until after the completion of the Garrison Dam in 1953. The lower right of the bottom diagram shows a cross section of north Bismarck. The location of each cross section above is based on the geology map at left. Mandan is shown on the west (left) side of the map and diagram.

Source of map and diagram: ND Geologic Survey, Department of Mineral Resources
https://www.dmr.nd.gov/ndgs/documents/Publication_List/pdf/geoinv/GI_3.pdf



Climate

North Dakota's geographic location results in a sub-humid continental climate characterized by marked fluctuations in temperatures and light to moderate precipitation. Average annual precipitation ranges from fewer than 13 inches in the northwest to more than 20 inches in the southeast part of the state. The precipitation tends to be irregular in occurrence, amount, and area of coverage. The inconsistency of the state's weather arises from the interaction of three major air masses that originate in distinct global regions: cold, dry air from the polar region**;** warm, moist air from the Gulf of Mexico**;** and cool, moist air from the northern Pacific. The polar air mass tends to dominate the other two but its influence is considerably lessened during the summer.

Bismarck Normals (1981-2010)			
Month	**Max Temp**	**Min Temp**	**Precipitation**
January	23.4	2.2	0.43
February	28.3	7.9	0.51
March	40.4	19.4	0.87
April	57.0	30.7	1.26
May	68.4	42.6	2.40
June	77.3	52.0	3.17
July	84.7	57.4	2.89
August	83.5	55.5	2.28
September	72.1	45.0	1.59
October	57.5	32.2	1.25
November	39.6	18.8	0.71
December	26.2	6.1	0.49
Annual	55.0	30.9	17.85

Bismarck Record Temperatures				
Month	**Max Temp**	**Year**	**Min Temp**	**Year**
January	63		-45	1916
February	69	2002 1992	-45	1936
March	81	2007*	-36	1897
April	93	1992* 1934*	-12	1975
May	102	2002	13	1907
June	111	1936	30	1969
July	114	1941	32	1884
August	109	1959*	32	1911*
September	105	1963*	10	1876
October	95	1999	-10	1991*
November	79	1939	-30	1985
December	66		-42	1916

***and earlier dates**

Bismarck Climate Data - Monthly Averages (Years 1981-2010)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Mean Temperature (degree F)												
12.8	18.1	29.9	43.8	55.5	64.6	71.1	69.5	58.5	44.8	29.2	16.2	42.8
Average Maximum Temperature (degree F)												
23.4	28.3	40.4	57.0	68.4	77.2	84.7	83.5	72.1	57.5	39.6	26.2	54.9
Average Minimum Temperature												
2.2	7.9	19.4	30.7	42.7	52.0	57.4	55.5	44.9	32.2	18.8	6.1	30.8
Monthly Average Precipitation (inches)												
0.43	0.5	0.86	1.26	2.39	3.16	2.88	2.27	1.59	1.25	0.71	0.48	17.8
Monthly Average Snowfall (inches)												
8.9	8.1	9.1	4.2	.4	0.0	0.0	0.0	.2	2.2	8.8	9.3	51.2

Bismarck Climate Data - Daily Extremes (Years 1981-2010)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Highest Daily Temperature (degree F)											
63	69	81	93	94	111	112	106	103	94	79	61
Lowest Daily Temperature											
-44	-43	-28	-1	17	32	39	33	20	-10	-30	-40
Highest Daily Precipitation											
0.58	1.02	0.95	1.96	1.95	3.19	4.32	4.63	4.31	1.29	0.92	0.72
Highest Daily Snowfall											
13.2	7.0	11.8	15.2	6.5	0.00	0.00	0.00	3.6	8.6	10.8	10.2

Bismarck Climate Data - Monthly Extremes (Years 1875-2012)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Maximum Precipitation (amount/year)											
1.64	1.74	3.27	5.71	7.04	9.9	13.75	9.29	6.93	4.3	3.10	1.71
1877	2000	1916	1878	1927	1914	1993	1998	1977	1982	1896	1884
Minimum Precipitation (amount/year)											
0.00	0.03	0.00	0.00	0.04	0.47	0.10	"T"	0.02	0.00	0.00	0.00
1878	1934 1985	1930	1952	1901	1936	1936	2001	1948	1935	1990	1944
Record Snowfall											
25.0	25.6	31.1	18.7	-	-	-	-	-	23.7	31.0	33.3
-	-	-	-	-	-	-	-	-	-	-	2008
(-) Information not provided via NWS Climatological Reports											

Bismarck Climate Data - Extremes (top 10 from years 1874-2013)

Rank	Value	Date	Rank	Value	Date
Highest Daily Maximum Temperature (degree F)					
1	114	7/16/1936	6-7	109	7/11/1973
2	112	7/30/2006	6-7	109	8/5/1941
3	111	6/29/2002	8-9	108	7/20/1960
4-5	110	7/16/1936	8-9	108	7/9/1921
4-5	110	7/10/1936	10	107	6/27/1988
Lowest Daily Minimum Temperature (degree F)					
1	-45	2/16/1936	6-9	-43	2/9/1994
2	-45	1/13/1916	6-9	-43	12/31/1967
3-5	-44	1/15/2009	6-9	-43	2/19/1929
3-5	-44	1/18/1950	6-9	-43	2/1/1887
3-5	-44	1/2/1887	10	-42	1/12/1974
Highest Daily Precipitation (inches)					
1	4.63	8/21/1998	6	3.36	6/26/1914
2	4.48	8/12/1999	7	3.25	6/3/1947
3	4.32	7/15/1993	8	3.19	6/15/2009
4	4.31	9/15/1994	9	3.12	8/9/1909
5	3.67	9/7/1894	10	3.07	6/15/1953
Highest Daily Snowfall (inches)					
1	15.5	3/3/1966	6	11.9	4/3/1937
2	15.2	4/5/1997	7	11.8	3/30/2009
3	13.2	1/17/1996	8	11.6	3/19/1982
4	11.9	4/27/1984	9	11.0	3/21/1894
5	11.9	3/26/1950	10	10.8	11/24/1993

Source: NOAA - National Weather Service Weather Forecast Office

Economy

Our city consists of agriculture, printing, trucking, farm machinery manufacturing, machine shops, electric power, woodworking, concrete products, railroad, insurance, bakeries, bottlers, and livestock auction markets. We have several shopping malls with 280 stores; 19+ banks, loan and savings associations, nine libraries with 638,037 volumes, and approximately 100 churches representing a variety of faiths. We have one daily newspaper, one weekly newspaper and one monthly newspaper; two movie theater complexes with 20 screens, fourteen radio and four television stations.

Bismarck also has three airlines, which have daily airmail, passenger freight and express mail to several points in the U.S. Several truck lines to provide local, intrastate service. There is one bus terminal. There are two U.S. highways: Highway 83 (north to south) and Interstate 94 (east to west). The city also has several parking ramps accommodating 600 vehicles.

Western North Dakota's energy production is a major economic generator for the state. Bismarck is the corporate headquarters for many of the major energy companies working in North Dakota. Bismarck is within 85 miles of twelve coal-fired electrical generating facilities producing over 4000 megawatts of electricity. In addition, Bismarck is the corporate headquarters for Dakota Gasification, the owners and operators of North America's only commercial lignite coal to synthetic natural gas production facility.

Bismarck's major economic strengths include agriculture, agri-business, energy, development, and health services. Bismarck's medical community provides services in a multi-state area. It currently employs over 4,000 people providing state of the art health care services to residents of western North Dakota, northern South Dakota, and eastern Montana. The hospitals in the Bismarck are St. Alexius Medical Center and Sanford Health with 526 patient beds and 27 satellite clinics supply services to residents in a four-state area with the finest patient care.

Bismarck has a modern water system, obtained from the Missouri River, which is filtered and sterilizing before delivery. The City has approximately 321 miles of water main and close to 2500 fire hydrants. Vast supplies of electricity are available from giant generating plants and the Garrison Dam on the Missouri River, deposits of lignite coal; availability of natural gas and ample supply of water from the Missouri River.

Business Quick Facts

	Bismarck	**North Dakota**
Total number of firms, 2007	6,424	61,546
Black-owned firms, percent, 2007	F	0.3%
American Indian- and Alaska Native-owned firms, percent, 2007	0.7%	1.6%
Asian-owned firms, percent, 2007	S	0.7%
Native Hawaiian and Other Pacific Islander-owned firms, percent, 2007	F	0.0%
Hispanic-owned firms, percent, 2007	F	0.5%
Women-owned firms, percent, 2007	24.3%	24.8%

F: Fewer than 100 firms

S: Suppressed; does not meet publication standards

Sources: City of Bismarck and US Census Bureau - QuickFacts

Economic Characteristics

EMPLOYMENT STATUS	North Dakota				Bismarck			
	Estimate	Margin of Error	Percent	Percent Margin of Error	Estimate	Margin of Error	Percent	Percent Margin of Error
Population 16 years and over	543,270	+/-509	543,270	(X)	50,288	+/-312	50,288	(X)
In labor force	383,089	+/-1,729	70.5%	+/-0.3	35,882	+/-626	71.4%	+/-1.2

Source: US Census Bureau - QuickFacts

Population

PEOPLE	Bismarck	North Dakota
Population, 2013 estimate	67,034	723,393
Population, 2012 estimate	64,777	701,345
Population, 2010 (April 1) estimates base	61,264	672,591
Population, percent change, April 1, 2010 to July 1, 2013	9.4%	7.6%
Population, percent change, April 1, 2010 to July 1, 2012	5.7%	4.3%
Population, 2010	61,272	672,591
Persons under 5 years, percent, 2010	6.4%	6.6%
Persons under 18 years, percent, 2010	20.8%	22.3%
Persons 65 years and over, percent, 2010	15.4%	14.5%
Female persons, percent, 2010	51.4%	49.5%

Sources: ND Department of Commerce and US Census Bureau - QuickFacts

POPULATION BY AGE GROUP

Age	1990		2000		Change	2010		Change	Change
	Number	% of total	Number	% of total	90-00	Number	% of total	00-10	90-10
Under 5	3,643	7.4%	3,356	6.0%	-237	3,896	6.4%	540	253
5-9	4,019	8.2%	3,431	6.2%	-588	3,431	5.6%	-	-588
10-14	3,621	7.4%	3,790	6.8%	169	3,350	5.5%	-440	-271
15-19	3,400	6.9%	4,308	7.8%	908	3,765	6.1%	-543	365
20-24	3,397	6.9%	4,380	7.9%	983	5,035	8.2%	655	1,638
25-34	8,965	18.2%	7,339	13.2%	-1,626	9,110	14.9%	1,771	145
35-44	7,848	15.9%	8,842	15.9%	994	6,886	11.3%	-1,956	-962
45-54	4,709	9.6%	7,815	14.1%	3,106	8,879	14.5%	1,064	4,170
55-64	4,033	8.2%	4,629	8.4%	596	7,509	12.3%	2,880	3,476
65-74	3,069	6.2%	3,888	7.0%	819	4,435	7.3%	547	1,366
75 & over	2,552	5.2%	3,754	6.7%	1,202	4,976	8.1%	1,222	2,424
Total	**49,256**	**100%**	**55,532**	**100%**	**6,276**	**61,272**	**100%**	**5,740**	**12,016**

Source: City of Bismarck

North Dakota Census Estimates Show Statewide Population Growth:
North Dakota Communities, Counties Ranked Among Nation's Fastest Growing

Excerpt from ND Dept. of Commerce News Release March 27, 2014:

The U.S. Census Bureau today released the agency's annual metropolitan/micropolitan area and county population estimates showing population growth across all regions of North Dakota. The state had a number of communities and counties ranked as some of the fastest growing in the nation. A metro area contains a population of 50,000 or more, while a micro area contains at least 10,000, but less than 50,000…….

…… Of the nation's 10 fastest growing metropolitan areas, Fargo and Bismarck ranked fourth and fifth respectively. The Fargo metro area (Cass and Clay Counties) gained 6,075 residents, while the Bismarck metro area gained 3,528 residents. Three of the top five micro areas ranked as the nation's fastest growing are in North Dakota, with Williston taking the top spot. Dickinson ranked second on the list and Minot rounded off the top five as the fifth fastest growing micro area……

……..The population data is a breakdown from the Census Bureau's state and national population estimates released in December 2013. The Census Bureau reported that North Dakota's population has reached 723,393 residents, an all-time high.

Demographics

PEOPLE	**Bismarck**	**North Dakota**
White alone, percent, 2010 (a)	92.4%	90.0%
Black or African American alone, percent, 2010 (a)	0.7%	1.2%
American Indian and Alaska Native alone, percent, 2010 (a)	4.5%	5.4%
Asian alone, percent, 2010 (a)	0.6%	1.0%
Native Hawaiian and Other Pacific Islander alone, percent, 2010 (a)	Z	0.0%
Two or More Races, percent, 2010	1.5%	1.8%
Hispanic or Latino, percent, 2010 (b)	1.3%	2.0%
White alone, not Hispanic or Latino, percent, 2010	91.6%	88.9%
Living in same house 1 year & over, percent, 2008-2012	82.8%	82.9%
Foreign born persons, percent, 2008-2012	1.4%	2.5%
Language other than English spoken at home, pct age 5+, 2008-2012	5.1%	5.2%
High school graduate or higher, percent of persons age 25+, 2008-2012	92.5%	90.5%
Bachelor's degree or higher, percent of persons age 25+, 2008-2012	33.5%	27.1%
Veterans, 2008-2012	4,934	54,782
Mean travel time to work (minutes), workers age 16+, 2008-2012	17.4	16.5
Housing units, 2010	28,648	317,498
Homeownership rate, 2008-2012	66.3%	66.4%
Housing units in multi-unit structures, percent, 2008-2012	36.0%	25.6%
Median value of owner-occupied housing units, 2008-2012	$156,900	$123,900
Households, 2008-2012	27,306	282,667
Persons per household, 2008-2012	2.2	2.3
Per capita money income in past 12 months (2012 dollars), 2008-2012	$30,810	$28,700
Median household income, 2008-2012	$53,186	$51,641
Persons below poverty level, percent, 2008-2012	9.7%	12.1%

(a) Includes persons reporting only one race.
(b) Hispanics may be of any race, so also are included in applicable race categories.
Z: Value greater than zero but less than half unit of measure shown
Source: US Census Bureau - QuickFacts

Income

	North Dakota				Bismarck			
INCOME AND BENEFITS (IN 2012 INFLATION-ADJUSTED DOLLARS)	Estimate	Margin of Error	Percent	Percent Margin of Error	Estimate	Margin of Error	Percent	Percent Margin of Error
Total households	282,667	+/-1,454	282,667	(X)	27,306	+/-345	27,306	(X)
Less than $10,000	20,013	+/-971	7.1%	+/-0.3	1,678	+/-239	6.1%	+/-0.9
$10,000 to $14,999	15,556	+/-756	5.5%	+/-0.3	1,152	+/-208	4.2%	+/-0.8
$15,000 to $24,999	29,174	+/-855	10.3%	+/-0.3	2,821	+/-338	10.3%	+/-1.2
$25,000 to $34,999	31,639	+/-1,137	11.2%	+/-0.4	2,957	+/-310	10.8%	+/-1.1
$35,000 to $49,999	41,052	+/-1,098	14.5%	+/-0.4	4,313	+/-394	15.8%	+/-1.4
$50,000 to $74,999	54,586	+/-1,305	19.3%	+/-0.5	5,300	+/-444	19.4%	+/-1.6
$75,000 to $99,999	37,926	+/-897	13.4%	+/-0.3	3,721	+/-289	13.6%	+/-1.1
$100,000 to $149,999	34,652	+/-1,009	12.3%	+/-0.4	3,894	+/-352	14.3%	+/-1.3
$150,000 to $199,999	8,895	+/-496	3.1%	+/-0.2	858	+/-178	3.1%	+/-0.6
$200,000 or more	9,174	+/-477	3.2%	+/-0.2	612	+/-134	2.2%	+/-0.5
Median household income (dollars)	51,641	+/-609	(X)	(X)	53,186	+/-2,013	(X)	(X)
Mean household income (dollars)	67,426	+/-754	(X)	(X)	68,675	+/-3,171	(X)	(X)

An '-' following a median estimate means the median falls in the lowest interval of an open-ended distribution.
An '+' following a median estimate means the median falls in the upper interval of an open-ended distribution.
An '(X)' means that the estimate is not applicable or not available
Source: US Census Bureau - QuickFacts

Poverty Statistics

PEOPLE	Bismarck	North Dakota
Households, 2008-2012	27,306	282,667
Persons per household, 2008-2012	2.20	2.30
Per capita money income in past 12 months (2012 dollars), 2008-2012	$30,810	$28,700
Median household income, 2008-2012	$53,186	$51,641
Persons below poverty level, percent, 2008-2012	9.7%	12.1%

Source: US Census Bureau - QuickFacts

Housing Statistics

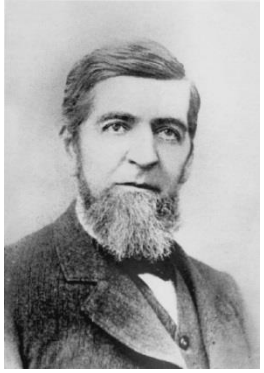
PEOPLE	Bismarck	North Dakota
Living in same house 1 year & over, percent, 2008-2012	82.8%	82.9%
Foreign born persons, percent, 2008-2012	1.4%	2.5%
Language other than English spoken at home, pct age 5+, 2008-2012	5.1%	5.2%
High school graduate or higher, percent of persons age 25+, 2008-2012	92.5%	90.5%
Bachelor's degree or higher, percent of persons age 25+, 2008-2012	33.5%	27.1%
Veterans, 2008-2012	4,934	54,782
Mean travel time to work (minutes), workers age 16+, 2008-2012	17.4	16.5
Housing units, 2010	28,648	317,498
Homeownership rate, 2008-2012	66.3%	66.4%
Housing units in multi-unit structures, percent, 2008-2012	36.0%	25.6%
Median value of owner-occupied housing units, 2008-2012	$156,900	$123,900
Households, 2008-2012	27,306	282,667
Persons per household, 2008-2012	2.2	2.3
Per capita money income in past 12 months (2012 dollars), 2008-2012	$30,810	$28,700
Median household income, 2008-2012	$53,186	$51,641
Persons below poverty level, percent, 2008-2012	9.7%	12.1%

Source: US Census Bureau - QuickFacts

	North Dakota				Bismarck			
HOUSE HEATING FUEL	Estimate	Margin of Error	Percent	Percent Margin of Error	Estimate	Margin of Error	Percent	Percent Margin of Error
Occupied housing units	282,667	+/-1,454	282,667	(X)	27,306	+/-345	27,306	(X)
Utility gas	117,512	+/-1,070	41.6%	+/-0.4	19,999	+/-500	73.2%	+/-1.7
Bottled, tank, or LP gas	38,588	+/-731	13.7%	+/-0.2	439	+/-127	1.6%	+/-0.5
Electricity	104,733	+/-1,221	37.1%	+/-0.4	6,233	+/-462	22.8%	+/-1.6
Fuel oil, kerosene, etc.	12,952	+/-450	4.6%	+/-0.2	111	+/-81	0.4%	+/-0.3
Coal or coke	1,044	+/-174	0.4%	+/-0.1	38	+/-46	0.1%	+/-0.2
Wood	1,696	+/-154	0.6%	+/-0.1	0	+/-20	0.0%	+/-0.1
Solar energy	54	+/-48	0.0%	+/-0.1	0	+/-20	0.0%	+/-0.1
Other fuel	3,896	+/-395	1.4%	+/-0.1	188	+/-85	0.7%	+/-0.3
No fuel used	2,192	+/-266	0.8%	+/-0.1	298	+/-103	1.1%	+/-0.4
SELECTED CHARACTERISTICS								
Occupied housing units	282,667	+/-1,454	282,667	(X)	27,306	+/-345	27,306	(X)
Lacking complete plumbing facilities	754	+/-151	0.3%	+/-0.1	85	+/-57	0.3%	+/-0.2
Lacking complete kitchen facilities	1,839	+/-288	0.7%	+/-0.1	262	+/-101	1.0%	+/-0.4
No telephone service available	5,410	+/-455	1.9%	+/-0.2	663	+/-164	2.4%	+/-0.6

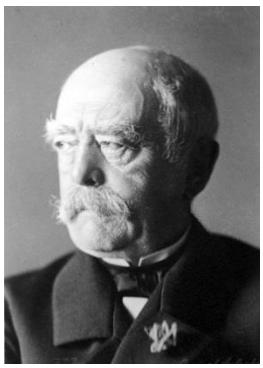
An '-' following a median estimate means the median falls in the lowest interval of an open-ended distribution.
An '+' following a median estimate means the median falls in the upper interval of an open-ended distribution.
An '(X)' means that the estimate is not applicable or not available
Source: U.S. Census Bureau - American FactFinder

History


Dr. Walter Burleigh

Reaching the Missouri River in 1872, the Northern Pacific Railroad decided to locate its terminus at what was then known as "The Crossing on the Missouri." Called Burleigh Town, a small village two miles south of present Bismarck was established by Dr. Walter Burleigh who was a railroad contractor and speculator in charge of surveyors for the Lake Superior and Puget Sound Company (a firm working for Northern Pacific). This company also established Camp Greeley, named after Horace Greeley, a famous newspaper publisher. In 1872, the Ida Stockdale steamed up the Missouri and brought the first troops to this site, chosen as a military supply depot. The camp was later renamed Camp Hancock after General W. S. Hancock arrived to protect the railroad crew.

At the time of its birth in 1872, Bismarck was the only town west of Fargo, in the midst of Indian Territory. On May 14, 1872 a town site was staked out and christened Edwinton in honor of Edwin Ferry Johnson of Vermont, civil engineer for the Northern Pacific Railway. He was the first to urge the building of a transcontinental railroad. It was before the first locomotive reached Edwinton in 1873 that Henry Villard, Secretary of Northern Pacific, drew a large map of the town site – owing to the German immigrants, moving into the territory. It is situated on the east bank of the Missouri River at the point reached in 1873 by the westward construction of the Northern Pacific Railroad.


Price Baron Otto Eduard Leopold von Bismarck-Schoenhausen

By February 16, 1873, the post office of Edwinton was established. On July 17, 1873, Bismarck was named in honor of Germany's "Iron Chancellor" Prince Baron Otto Eduard Leopold von Bismarck-Schoenhausen, a famous German statesman from Prussia, credited with the creation of the German Empire and serving as its first chancellor. At this time the railroad was in a financial bind and having trouble attracting investors. The name was given to encourage German capital in the railroad's transcontinental construction program. The map of Bismarck was shown throughout Europe in hopes that the princely statesman would dig deeply into his wallet to get the small metropolis bearing his name on its feet. Bismarck did acknowledge his fledgling namesake with a heartfelt thank you note, but the fervently hoped for Reichsmarks did not materialize. Bismarck's name stayed that way.

In 1876 the Battle of the Little Big Horn put Bismarck on the world map. In 1877 the Sheridan House was built to house railroaders. Also in March of 1877, Bismarck was hit with its first major fire in the business district.

Following the arrival of the railroad, Bismarck quickly became a center of trade and transportation. Steamboat business developed and flourished for a time on the Missouri and Bismarck became a port as well as a railroad terminus until the railroad bridged the Missouri in 1883. Gold discoveries in the Black Hills made Bismarck a freight-shipping center, and long wagon trains pulled by oxen traversed the 300 mile "Custer Route" to the Black Hills.

In 1883, Bismarck became the Capital of the Dakota Territory. Six years later, when the Territory divided into two states, Bismarck became the capital of North Dakota. Since then Bismarck has developed into a major business, financial and cultural center with its retail trade area reaching over 100 miles and serving upwards of 200,000 people, also our wholesale trade services about 350,000 in western North Dakota as well as South Dakota and eastern Montana.

North Dakota's state historic sites are well developed with interpreters, visitor centers with exhibits, furnished buildings, picnic areas, and other amenities. Others lie obscurely in pastures without a monument or fencepost to mark their existence. A few sites are currently closed to visitors because of lack of accessibility, concerns about preservation, or out of respect for American Indians who hold some of these places sacred. An upsurge in heritage tourism across the country has created renewed interest in the history of the northern plains, and North Dakota has many sites of significance. The 56 historic sites are owned by the state and are preserved, maintained, and interpreted by the State Historical Society of North Dakota. The following sites are located in Bismarck.

Sources: City of Bismarck, State Historical Society of North Dakota, and Bismarck Veterans Memorial Public Library

Former Governors' Mansion

The Former Governor's Mansion is located at 320 E. Ave. B in Bismarck; the site consists of a large two and one-half story, restored Victorian house and a carriage house. Constructed in 1884, it housed 20 chief executives between 1893 and 1960. Unique room exhibits feature the restoration process, architectural style changes, and furniture used by several governors.

This house was the North Dakota governors' residence from 1893 to 1960. It was built in 1884 as a private residence by Asa Fisher. At various times he was a wholesale liquor dealer, register of the Bismarck Land Office, and president of the First National Bank. He sold this house to the state for $5,000 in 1893.

Source: State Historical Society of North Dakota

Camp Hancock

This site preserves part of a military installation established as Camp Greeley in 1872 to provide protection for work gangs then building the Northern Pacific Railroad. A log headquarters building still stands on the site; it has been enlarged and remodeled several times, and the logs have been concealed by clapboard siding.

Source: State Historical Society of North Dakota

Steamboat Warehouse

Steamboat Warehouse Historic Marker is located on the east bank of the Missouri River in Bismarck across the street from the water treatment plant on River Road (Hwy 1804). The marker commemorates the Northern Pacific Railroad warehouse built to store goods in transshipment between steamboats and freight trains. It was constructed in 1883 and torn down in 1925.

Source: State Historical Society of North Dakota

North Dakota Heritage Center and State Museum

Heritage Center & State Museum is located on the State Capital grounds off Exit 159 on I-94 in
Bismarck, the North Dakota Heritage Center is the headquarters of the State Historical Society of North Dakota and the largest museum in the state. The North Dakota Heritage Center, an enduring monument to North Dakota's past, has been constructed on the Capitol Grounds, including a main gallery with approximately 22,000 feet of exhibit space. It is much more than a museum; it houses collections of the historical society and is an educational center as well. Opened in 1981, it features temporary and permanent exhibits that explore the story of life on the northern plains from prehistory to the present.

Sources: City of Bismarck and State Historical Society of North Dakota

Education

School facilities in Bismarck include a four-year college, a four-year university, a junior college with a vocational technical center, 17 grade schools, 3 middle schools, 4 senior high schools, an alternative high school, a Career Academy and Technical Center, and an early childhood program, parochial grade schools, learning centers, special educational, two commercial colleges, school of medicine, beauty shops, dance studios, school for the handicapped. A non-denominational academy operated by the 7th Day Adventist Church, a Priory and a Conservatory of Music.

The colleges located in Bismarck are the University of Mary, Bismarck State College, Rasmussen College and United Tribes Technical College:

• University of Mary serves the needs of adult learners, providing four-year degrees for both teachers and nurses.

• Bismarck State College, a comprehensive community college, is the fourth largest college in North Dakota. BSC offers a wide range of educational services through its threefold mission – to provide academic transfer programs, vocational-technical programs, and community services.

• Rasmussen College, offers Bachelor's and Associate's degrees in fields expected to have exceptional growth.

• Located on a 105-acre campus, three miles south of Bismarck, is the United Tribes Technical College. UTTC provides educational services to families. A grade school is located on the campus for the students' children.

Source: City of Bismarck

Recreation

Bismarck has approximately 50 parks administered by the Bismarck Park District, comprising 2000 acres of scenic and historic lands. Lighted baseball parks, 23 softball and baseball diamonds; soccer fields; 7 lighted tennis courts, with 17 additional concrete and 8 asphalt tennis courts; racquetball courts, outdoor hockey rinks, skating rinks, indoor ice arena, lighted horseshoe courts, horse club, gun club, 4 golf courses, indoor and outdoor archery ranges, rifle range and athletic field. Bismarck provides more than 30 miles of recreational trails to the public. The Missouri Valley Trail connects the people of Bismarck and Mandan to several historical, recreational, and cultural places along the Missouri River. The trail begins at the Bismarck-Mandan Convention and Visitors Bureau, proceeds along Pioneer and Sertoma parks, and concludes at Fort Abraham Lincoln State Park.

Source: City of Bismarck

Missouri River

Dotted with sandbars and lined by gentle river bluffs, this broad, swift waterway commands respect from numerous standpoints. Its historical, recreational, and natural values within the state are unparalleled. The Missouri River ranks as North Dakota's most prominent river. The famed Lewis and Clark expedition, commissioned by President Thomas Jefferson, came through what is now North Dakota in the fall and winter of 1804-05 and the spring of 1806. The Missouri River corridor eventually became a hub for the state's development and growth. Fur trading, steam-boating, and military relics can still be found on the river's banks. Unique and rare flora and fauna inhabit the river and surrounding land. Four federally threatened or endangered species make the river their home: bald eagle, least tern, piping plover and pallid sturgeon. The river bottom forests provide one of the biggest expanses of woodland in the state. Many wildlife species use this corridor for food, shelter, water and as a migration route.

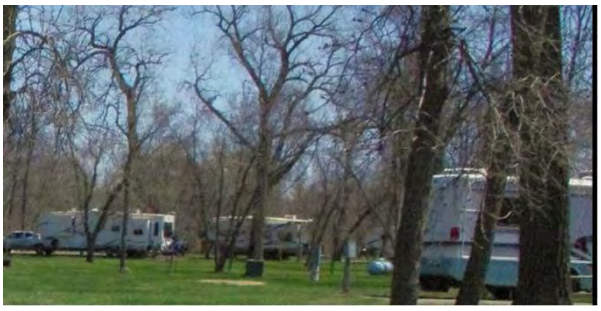
Source: North Dakota Parks and Recreation Department

Sertoma Park

Sertoma Park offers picnic shelters, walking trails, playgrounds, an amusement park and a miniature golf course. The Dakota Zoo is located inside the park.

Source: City of Bismarck

Sibley Park



General Sibley Park is located on South Washington Street four miles south of the Bismarck Expressway.

The park includes camping sites for tents and campers with electrical hook-ups. There are also full service restrooms, picnic shelters, playgrounds, 24-hole disc golf course and a boat ramp.

Source: Bismarck Parks and Recreation District

McDowell Dam Recreation

McDowell Dam Recreation Area is a 271 acre park located five miles east of Bismarck on Old Highway 10 and one mile north. The park is owned by the Burleigh County Water Resource District and managed by the Bismarck Parks and Recreation District. Available activities include swimming, boating, fishing and paddle boating. There is a public beach, picnic shelters that are available (and can be reserved for special occasions), horseshoe pits, a small concessions area, a playground and modern restrooms. There is a paved recreational trail on the grounds, as well as a wooded area for nature walks or runs. There is also a Nature Trail encircling the banks of McDowell Dam.

Source: Bismarck Parks and Recreation District

Dakota Zoo

On June 3, 1961, the Dakota Zoo opened its gates to the public with 75 mammals and 23 birds on some 15 acres of developed land. Forty thousand visitors paid a ten cent admission fee that first year to visit the zoo. Today an average of over 100,000 people walk through the gates each year and view 125 species of birds, reptiles, insects and mammals. Memberships today total approximately 3400.

In 1987, the Dakota Zoo was challenged by the Bismarck Tribune to develop a master plan which would outline the orderly and organized development of the zoo. This challenge was accepted by the zoo board and a plan was developed. The master plan is reviewed and update on an ongoing basis, with the last major revision taking place in 2005. The master plan serves as a “roadmap” of where the Dakota Zoo is going in the future.

In 1988, the Beyond the Bear Necessities capital campaign began. This campaign, Dakota Zoo's first ever attempt to raise large sums of money, raised $1.2 million. Exhibits such as the bear habitat, river otter exhibit and canine and small animal exhibits are some of the fruits of this campaign.

In late 1996, the second major capital campaign, Discovery 2000 - Turning Dollars Into Senses was launched. The goal of this campaign was to raise at least $1.5 million for continued major improvements. Exhibits constructed to date that are the results of this endeavor include moose, mountain goat, mountain lion, bobcat, lynx and the Discovery Zoo.

In 2005, the third major capital campaign, Make the Big Cats Roar, was launched. The celebration goal of just over $1.9 million was reached by the fall of 2005. An extended challenge goal of $2.3 million is currently in the works, with over $2.1 million pledged by March 2007.

Source: Dakota Zoo

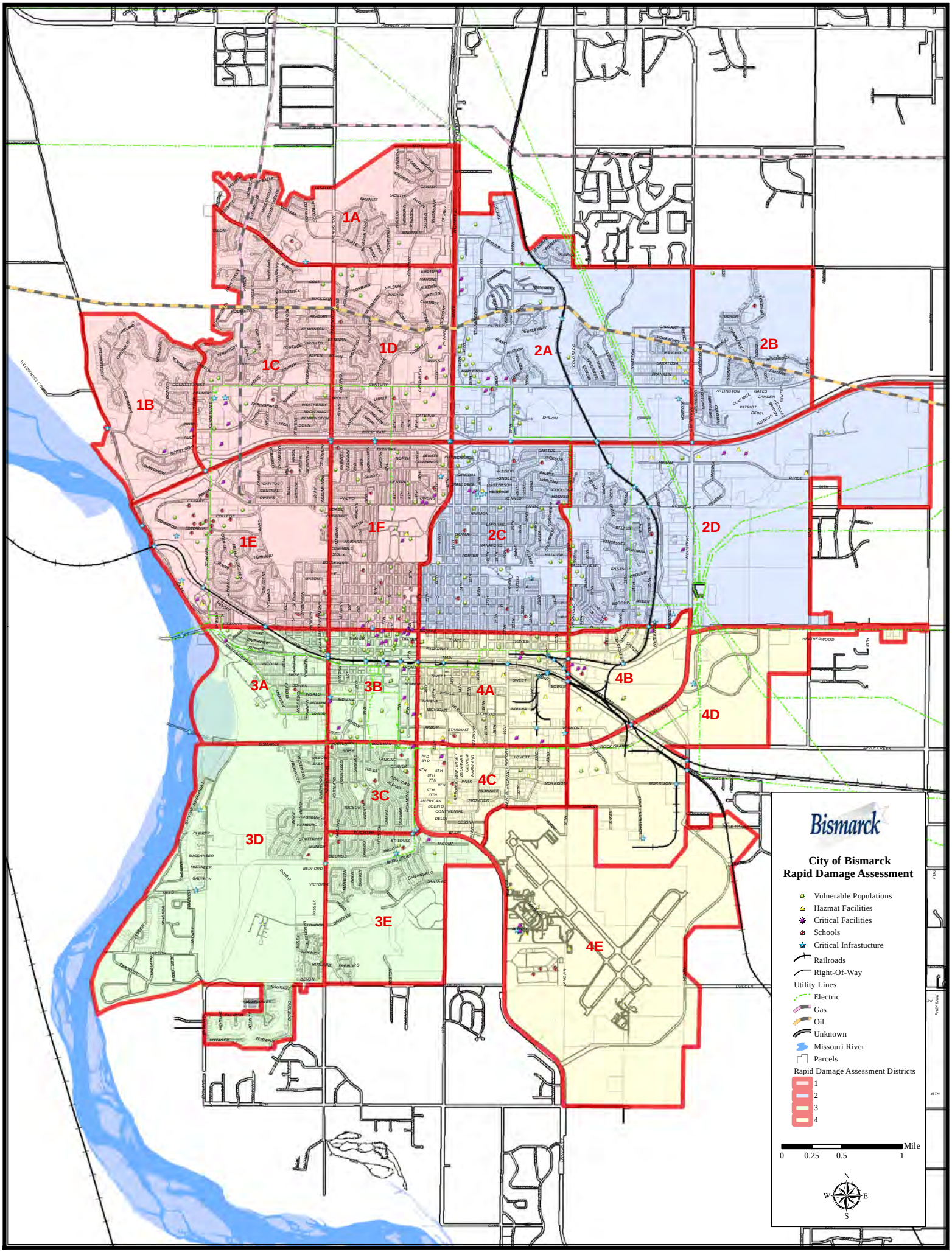
Community Assets

Community Assets are identified for planning purposes, to assist in the identification of potential impacts and vulnerabilities within the various hazard profiles. Community Assets are also identified within the various hazard profiles where applicable. This section provides an overview of community assets to aid in hazard profile development and updating.

Community Asset Categories and category descriptions:

- Critical Facility
  - A facility that provides a critical service or product that is vital to the community for continuity of emergency services, critical government services, medical services, and critical supplies.
- Critical Infrastructure
  - Transportation infrastructure and utility infrastructure: gas, electricity, communications, sewer and water.
- Schools
  - All schools: from licensed daycare to college and private schools.
- Hazardous Materials Sites
  - Hazards Materials Sites contain chemical, biological, or other substances. If a hazardous materials facility is impacted, there may be an additional threat to the community because of the potential for a release.
- Vulnerable / Special Populations
  - Includes areas of "assembly" where a facility or site is likely to have a "high density" population within a relatively small area. Schools are not included, as they are a separate category.
  - Includes populations that may require special assistance during response and recovery efforts. Examples are jail/prison populations, nursing homes, assisted living, etc.

The map on the following page identifies the various community assets as noted above. The map is maintained by Bismarck Emergency Management and Bismarck GIS.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Rapid Damage Assessment
Vulnerable Populations
Hazmat Facilities
Critical Facilities
Schools
Critical Infrastucture
Railroads
Right-Of-Way
Utility Lines
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Risk Assessment Overview

Risk: the potential for damage, loss, or other impacts created by the interaction of hazards with community assets.

Risk Assessment: product or process that collects information and assigns values to risks for the purpose of informing priorities, developing or comparing courses of action, and informing decision making.

Hazard Identification

Many hazards have the potential to affect Bismarck, from regional or global events to isolated, localized events. To provide a framework for the risk assessment, hazards were identified for inclusion in this plan based on previous occurrences as well as inclusion in the 2014 State of North Dakota Multi-Hazard Mitigation plan and Bismarck Emergency Operations Plan. Participants in the Mitigation Plan Development Coordination Meeting (Bismarck "Kick-Off meeting") and subsequent Stakeholder meeting in January 2014 determined which hazards were to be addressed in the plan. As new hazards are identified, they can be added to the hazard list, profiled, and mitigated. Hazards excluded from the plan are noted on page 8.

This plan section provides an overview of the risk assessment. Additional detail regarding risk (ie: historical occurrences) and vulnerability are noted in Section 10 Hazard Profiles.

Hazards were ranked as **"High," "Moderate," or "Low"** on a preliminary basis during the hazard specific mitigation planning team meetings utilizing the hazard profile data (ie: understanding of the hazard, risks, and vulnerabilities). Additional considerations for hazard ranking include the status of existing hazard mitigation, opportunities and capability to mitigate, as well as emergency response capabilities related to each hazard.

The results of the hazard specific mitigation planning teams were then reviewed by the Community Emergency Response Committee (CERC) represented by City Administration, Fire Department, Police Department, Public Health, and Public Works for evaluation and consensus.

Integration of Threat/Hazard Identification and Risk Assessment (THIRA) process:

Included within each hazard profile (section 10) is a risk assessment tool in the process of being implemented statewide: Threat and Hazard Identification and Risk Assessment (THIRA). THIRA ratings are based on consensus of each hazard specific planning team. THIRA was applied to various scenarios within each hazard to better illustrate the full range of likelihood and impact per hazard.

The THIRA ratings support the decision making process, but do NOT dictate the hazard ranking of "High, Moderate, or Low."

Hazard Ranking

	Natural Hazards	Technological or Human Caused
High	Winter Storm Tornado	
Moderate	Severe Summer Weather Flood Communicable Disease	Shortage or Outage of Critical Materials or Infrastructure Hazardous Materials Release Train Derailment Active Shooter
Low	Biological Infestation: *Urban Forest* Drought Geologic Hazard Wildland Fire	Fire Dam Failure Aircraft Accident

<u>The following factors were considered while ranking hazards:</u>

- Likelihood of Occurrence (Risk/Probability)
- Potential Impact
  - to Life, Property, Environment, Economy, Psychological, Continuity of Essential Functions
- Mitigation Status: Existing Mitigation in place
  - if already mitigated, hazard may be of lower priority
- New Mitigation Actions
  - hazard may rank higher if it's NOT mitigated, and there's high need and/or good opportunity to mitigate
- Response Capabilities
  - mitigating a hazard may be more important if response capabilities are lower compared to other hazards

Threat/Hazard Identification and Risk Assessment (THIRA)

Each hazard profile (section 10) includes Threat and Hazard Identification and Risk Assessment (THIRA) ratings which are summarized here. The THIRA ratings for each hazard are based on consensus of each hazard specific planning team. The THIRA ratings/scores facilitate the decision making process regarding the hazard ranking, but do not dictate the hazard ranking of "High, Moderate, or Low." Additional considerations for hazard ranking include the status of existing hazard mitigation as well as response capabilities related to each hazard.

		Very Likely	Likely	Possible	Unlikely	Improbable
	Score	5	4	3	2	1
Catastrophic	5			Communicable Disease *(Pandemic)*	*SCMI (EMP) Dam Failure *(Garrison Dam)* Tornado *(EF4-EF5)*	
Significant	4			Train Derailment *(involving hazmat/fire)* Aircraft as Weapon Aircraft Accident		
Moderate	3	Winter Storm	Hazmat Release: *Transportation*	Tornado (EF2-EF3) Hazmat Release: *Pipeline or Fixed Facility*	Fire: Conflagration Flood: 500-Year	
Minor	2	Severe Summer WX Fire: Residential Flood: Urban Flooding	*SCMI *3-day power outage* Biological Infestation *(ie: DED or EAB)* Communicable Disease *(Foodborne Illness)*	*SCMI *1-week Power Outage* Tornado (EF0-EF1) Drought (D4 rating) Flood: Ice Jam Active Shooter Geologic Hazard		
None / Negligible	1	Wildland Fire *(WUI)*				

*SCMI = Shortage or Outage of Critical Materials or Infrastructure. SCMI includes power outages as well as power outages caused by an Electromagnetic Pulse (EMP) event.

Threat and Hazard Identification and Risk Assessment (THIRA) Terminology and Definitions

Frequency				
Very Likely (5)	Likely (4)	Possible (3)	Unlikely (2)	Improbable (1)
The potential for impact is very probable (near 100%) in the next year.	The potential for impact is between 10% and 100% within the next year, or there is at least one chance of occurrence within the next 10 years.	The potential for impact is between 1% and 10% within the next year, or there is at least one chance of occurrence within the next 100 years.	The potential for impact is less than 1% in the next 100 years.	The potential for impact can safely be ruled out because it either does not exist (e.g. hurricane) and/or the potential for it to occur in the next 100 years is so low it can safely be called 0%.
Human Consequence				
None/Negligible (1)	Minor (2)	Moderate (3)	Significant (4)	Catastrophic (5)
0 fatalities < 10 injuries is most likely	< 10 fatalities and/or < 50 injuries is most likely	10-25 fatalities and/or < 100 injuries is most likely	25-100 fatalities and/or 100 – 500 injuries is most likely	> 100 fatalities and/or > 500 injuries is most likely
Economic Consequence				
None/Negligible (1)	Minor (2)	Moderate (3)	Significant (4)	Catastrophic (5)
< $500K losses or damages is most likely	> $500K to <$1 Million losses or damages is most likely	>$1 Million to $50 Million losses or damages is most likely	>$50 Million to <$100 Million losses or damages is most likely	>$100 Million losses or damages is most likely
Psychological Consequence				
None/Negligible (1)	Minor (2)	Moderate (3)	Significant (4)	Catastrophic (5)
Event most likely creates minimal population behavior change or effects on social functioning	Event most likely creates occasional or minor loss of nonessential social functions	Event most likely creates a loss of many nonessential social functions	Event most likely creates dysfunctional behavior and disruption of important social functions	Event most likely creates a loss in belief of government and some institutions
Government Consequence				
None/Negligible (1)	Minor (2)	Moderate (3)	Significant (4)	Catastrophic (5)
Event most likely creates no measureable change in the accomplishment of government functions/missions	Event most likely creates only minor changes in the accomplishment of government functions/missions	Event most likely creates a moderate interruption or change in the ability to sustain government functions/missions	Event most likely creates a widespread and significant change in ability to sustain government functions/missions	Event most likely creates a widespread and sustained loss of ability to sustain government functions/missions

Threat and Hazard Risk Assessment

Hazard Name and Scenario	Frequency	IMPACT				*THIRA Score
		Human	Economic	Psychological	Government	
Winter Storm	Very Likely 5	Minor 2	Moderate 3	Significant 4	Minor 2	**7.75**
Communicable Disease: Pandemic	Possible 3	Catastrophic 5	Catastrophic 5	Significant 4	Significant 4	**7.50**
Aircraft as Weapon	Possible 3	Catastrophic 5	Catastrophic 5	Significant 4	Moderate 3	**7.25**
Severe Summer Weather	Very Likely 5	Minor 2	Moderate 3	Minor 2	Minor 2	**7.25**
SCMI - EMP event	Unlikely 2	Catastrophic 5	Catastrophic 5	Catastrophic 5	Catastrophic 5	**7.00**
Fire: Residential	Very Likely 5	Minor 2	Moderate 3	Minor 2	None/Negligible 1	**7.00**
Dam Failure – Catastrophic (Adversarial)	Unlikely 2	Catastrophic 5	Catastrophic 5	Significant 4	Catastrophic 5	**6.75**
Train Derailment (ie: hazmat/fire)	Possible 3	Significant 4	Significant 4	Significant 4	Moderate 3	**6.75**
Hazmat Release: Transportation	Likely 4	Moderate 3	Moderate 3	Minor 2	Moderate 3	**6.75**
Aircraft Accident	Possible 3	Catastrophic 5	Catastrophic 5	Moderate 3	Minor 2	**6.75**
Flood: Urban Flooding	Very Likely 5	None/Negligible 1	Minor 2	Minor 2	Minor 2	**6.75**
Tornado EF4/5	Unlikely 2	Catastrophic 5	Catastrophic 5	Significant 4	Significant 4	**6.50**
Wildland Fire	Very Likely 5	Minor 2	None/Negligible 1	None/Negligible 1	None/Negligible 1	**6.25**
Hazmat Release: Pipeline	Possible 3	Significant 4	Significant 4	Minor 2	Minor 2	**6.00**
Tornado EF2/3	Possible 3	Significant 4	Moderate 3	Minor 2	Moderate 3	**6.00**
Communicable Disease: Foodborne Illness	Likely 4	Minor 2	Minor 2	Minor 2	None/Negligible 1	**5.75**
SCMI - 3 day power outage	Likely 4	Minor 2	None/Negligible 1	None/Negligible 1	Minor 2	**5.50**
Hazmat Release - Fixed Facility	Possible 3	Moderate 3	Moderate 3	Minor 2	Minor 2	**5.50**
Biological Infestation (Urban Forest)	Likely 4	None/Negligible 1	Moderate 3	None/Negligible 1	None/Negligible 1	**5.50**
SCMI - 1 week power outage	Possible 3	Minor 2	Minor 2	Minor 2	Moderate 3	**5.25**
Fire: Conflagration	Unlikely 2	Moderate 3	Catastrophic 5	Moderate 3	Minor 2	**5.25**
Flood: Ice Jam	Possible 3	Minor 2	Minor 2	Minor 2	Moderate 3	**5.25**
Flood: 500-Year	Unlikely 2	Moderate 3	Moderate 3	Moderate 3	Moderate 3	**5.00**
Active Shooter	Possible 3	Minor 2	None/Negligible 1	Moderate 3	Minor 2	**5.00**
Drought - D4	Possible 3	None/Negligible 1	Moderate 3	Minor 2	None/Negligible 1	**4.75**
Tornado EF0/1	Possible 3	Minor 2	Minor 2	None/Negligible 1	Minor 2	**4.75**
Geologic Hazard	Possible 3	None/Negligible 1	Minor 2	Minor 2	Minor 2	**4.75**

*THIRA Score = Frequency + Average of Impact Ratings

Hazards Excluded from this Plan Natural Hazards Excluded from this Bismarck Multi-Hazard Mitigation Plan are consistent with natural hazards excluded from the ND Department of Emergency Services Multi-Hazard Mitigation Plan.	
Hazard	**Why Excluded/Where Addressed**
Avalanche	Avalanches generally require long stretches of slopes of 25-55 degrees; North Dakota has few areas that meet this criteria. North Dakota is not covered by a National Avalanche Center. North Dakota does not have a history of any declared state or federal avalanche disasters.
Coastal Erosion	North Dakota does not have an ocean coastline.
Coastal Storm	North Dakota does not have an ocean coastline.
Hurricane	North Dakota does not have an ocean coastline, nor is it located in a potential hurricane impact area.
Tsunami	North Dakota does not have an ocean coastline.
Volcano	Volcanic ashfall can occur over North Dakota, but the frequency is relatively rare and the potential impacts are not expected to exceed local capabilities. North Dakota does not have a history of any declared state or federal volcano disasters.

Hazard Profiles – Section 10

Table of Contents

Hazard Profiles are included Alphabetically by Hazard Name.

- Active Shooter
- Aircraft Accident
- Biological Infestation
- Communicable Disease
- Dam Failure
- Drought
- Fire
- Flood
- Geologic Hazards
- Hazardous Materials Release
- Severe Summer Weather
- Shortage or Outage of Critical Materials or Infrastructure
- Tornado
- Train Derailment
- Wildland Fire
- Winter Storm

Nine of the hazards are addressed primarily as **Natural Hazards**: Biological Infestation, Communicable Disease, Drought, Flood, Geologic Hazards, Severe Summer Weather, Tornado, Wildland Fire, and Winter Storm.

Seven of the Hazards are addressed primarily as **Technological or Human-Caused Hazards**: Active Shooter, Aircraft Accident, Dam Failure, Fire, Hazardous Materials Release, Shortage or Outage of Critical Materials or Infrastructure, and Train Derailment.

In some cases, hazards may be the result of natural, technological, and/or human caused. Each hazard is categorized based on the more likely cause of significant impact.

Methodology

Each hazard or group of related hazards has its own profile. A stand-alone hazard profile allows for the comprehensive analysis of each hazard from many different aspects. The Tornado hazard was addressed separately from Severe Summer Weather because of the significant differences in terms of probability as well as impact compared to other summer storms and because local citizens tend to identify it as its own unique hazard. Each hazard contains a hazard *Description, Risk Assessment, and Vulnerability Assessment.* Hazard descriptions are based on reliable sources including area expertise. Risk Assessment methodology is explained in Section 9. The hazard profiles contain a vulnerability assessment table which is used as a tool to identify vulnerabilities from different perspectives – such as potential vulnerability to Continuum of Government/Continuity of Operations (COG/COOP). Vulnerability summary statements are based on vulnerability assessments within each hazard profile, and are included in section 3 of this mitigation plan.

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Active Shooter – Hazard Profile

Description

Vulnerabilities and specific mitigation actions will not be included in this plan for the Active Shooter Hazard to avoid compromising safety and security of specific facilities and populations. Regarding the active shooter hazard, the mitigation plan content is limited to profiling the hazard, identifying existing mitigation or prevention measures, and identifying general risk mitigation recommendations. The hazard profile is general in nature since we don't have local history of occurrences for incidents meeting the definition of "active shooter."

Active Threat

The Bismarck Police Department has developed an "Active Threat Response Plan" to provide uniform guidelines and provisions for use in responding and resolving situation involving crimes of violence in progress involving an Active Threat situation with the potential for more victims. Active Threat crimes include, but are not limited to situation such as Active Shooter in schools, businesses, public places, gatherings as well as any other type of ongoing crime of violence where innocent victims are in in continuous imminent danger due to the ongoing act of an Active Threat.

Active Threat definition (within Bismarck PD Active Threat Response Plan): Subject or subjects that are utilizing deadly force and without intervention would continue to do so while, having unrestricted access to additional victims. The means of deadly force by the subject does not necessarily need to be that of a firearm.

Active Shooter - Hazard Profile

The subsequent "active shooter" hazard profile information within this plan document are excerpts derived from the following study: *Blair, J. Pete, and Schweit, Katherine W. (2014). A Study of Active Shooter Incidents, 2000 - 2013. Texas State University and Federal Bureau of Investigation, U.S. Department of Justice, Washington D.C. 2014.*

The full report may be found at http://www.fbi.gov/news/stories/2014/september/fbi-releases-study-on-active-shooter-incidents/pdfs/a-study-of-active-shooter-incidents-in-the-u.s.-between-2000-and-2013

The agreed-upon definition of an active shooter by U.S. government agencies—including the White House, U.S. Department of Justice/FBI, U.S. Department of Education, and U.S. Department of Homeland Security/Federal Emergency Management Agency—is "an individual actively engaged in killing or attempting to kill people in a confined and populated area." Implicit in this definition is that the subject's criminal actions involve the use of firearms.

Incidents identified in the study did not encompass all gun-related situations; therefore caution should be taken when using this information without placing it in context. Specifically, shootings that resulted

from gang or drug violence—pervasive, long-tracked, criminal acts that could also affect the public—were not included in the study.

In the study, the FBI identified 160 active shooter incidents, noting they occurred in small and large towns, in urban and rural areas, and in 40 of 50 states and the District of Columbia. Though incidents occurred primarily in commerce and educational environments (70.0%), they also occurred on city streets, on military and other government properties, and in private residences, health care facilities, and houses of worship. The shooters victimized young and old, male and female, family members, and people of all races, cultures, and religions.

The study findings establish an increasing frequency of incidents annually. During the first 7 years included in the study, an average of 6.4 incidents occurred annually. In the last 7 years of the study, that average increased to 16.4 incidents annually. This trend reinforces the need to remain vigilant regarding prevention efforts and for law enforcement to aggressively train to better respond to—and help communities recover from—active shooter incidents.

> *… The study results support the importance of training and exercises—not only for law enforcement but also for citizens. It is important, too, that training and exercises include not only an understanding of the threats faced but also the risks and options available in active shooter incidents….*

The findings also reflect the damage that can occur in a matter of minutes. In 64 incidents where the duration of the incident could be ascertained, 44 (69.0%) of 64 incidents ended in 5 minutes or less, with 23 ending in 2 minutes or less. Even when law enforcement was present or able to respond within minutes, civilians often had to make life and death decisions, and, therefore, should be engaged in training and discussions on decisions they may face.

> *21 incidents (13.1%), ended after unarmed citizens safely and successfully restrained the shooter.…*
>
> *… In 11 of those 21 incidents, unarmed principals, teachers, other school staff and students confronted the shooters to end the threat…*
>
> *… In 10 incidents, citizens, working or shopping when the shootings began, successfully restrained shooters until police could arrive. And in 6 other incidents, armed off-duty police officers, citizens, and security guards risked their lives to successfully end the threat…*

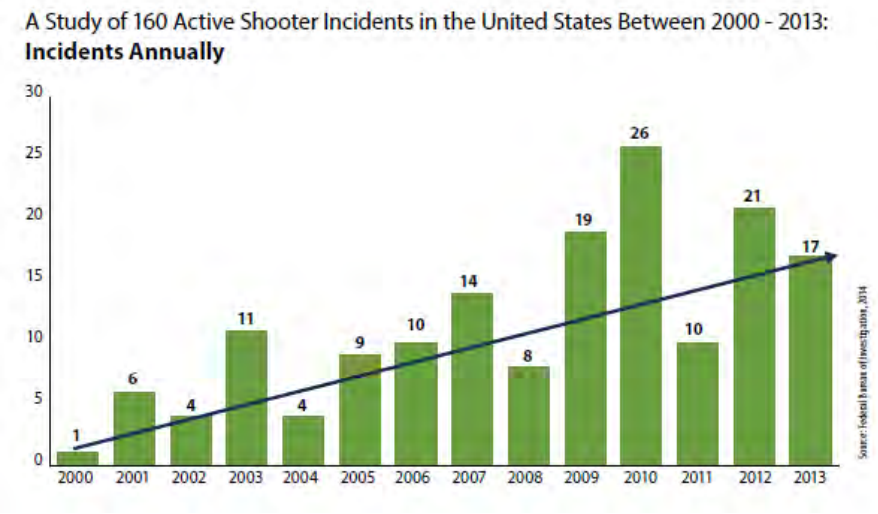
As expected, therefore, many incidents ended before police arrived. Of the 160 incidents, at least 107 (66.9%) ended before police arrived and could engage the shooter, either because a citizen intervened, the shooter fled, or the shooter committed suicide or was killed by someone at the scene.

The majority of the 160 incidents (90 [56.3%]) ended on the shooter's initiative— sometimes when the shooter committed suicide or stopped shooting, and other times when the shooter fled the scene.

Incidents

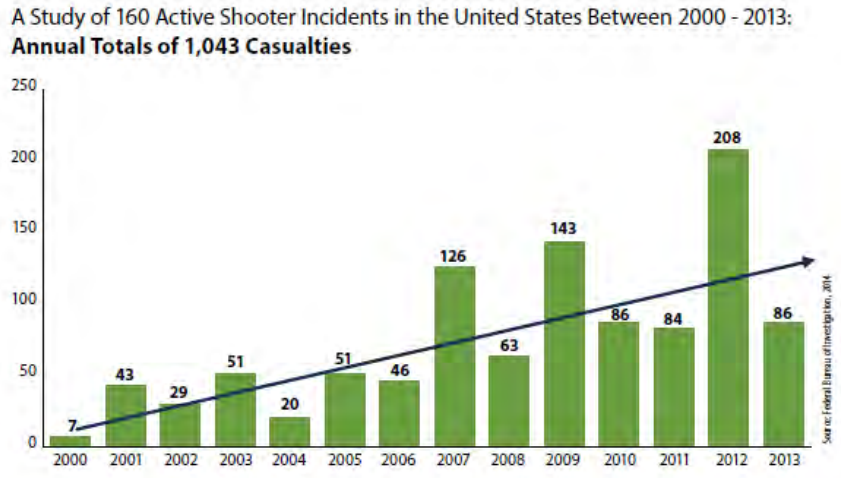
An average of 11.4 incidents occurred annually.

- An average of 6.4 incidents occurred in the first 7 years studied, and an average of 16.4 occurred in the last 7 years.
- 70.0% of the incidents occurred in either a commerce/business or educational environment.
- Shootings occurred in 40 of 50 states and the District of Columbia.
- 60.0% of the incidents ended before police arrived.



Casualties

- Casualties (victims killed and wounded) totaled 1,043. The individual shooters are not included in this total.
- A total of 486 individuals were killed.
- A total of 557 individuals were wounded.
- In 64 incidents (40.0%), the crime would have fallen within the federal definition of "mass killing"—defined as "three or more" killed—under the new federal statute.



Incidents with the Highest Casualty Counts:

- Cinemark Century 16 Theater in Aurora, Colorado: 70 (12 killed, 58 wounded), July 20, 2012.
- Virginia Polytechnic Institute and State University in Blacksburg, Virginia: 49 (32 killed, 17 wounded), April 16, 2007.
- Ft. Hood Soldier Readiness Processing Center in Ft. Hood, Texas: 45 (13 killed, 32 wounded), November 5, 2009.
- Sandy Hook Elementary School and a residence in Newtown, Connecticut: 29 (27 killed, 2 wounded), December 14, 2012.

…. no law enforcement officers were killed or wounded when responding to a school incident. However, in 45 of the 160 incidents where law enforcement did engage a shooter, law enforcement suffered casualties in 21 (46.7%) of the incidents, resulting in 9 officers killed and 28 wounded.

Shooters:

- All but 2 incidents involved a single shooter.
- In at least 9 incidents, the shooter first shot and killed a family member(s) in a residence before moving to a more public location to continue shooting.
- In at least 6 incidents, the shooters were female.
- In 64 incidents (40.0%), the shooters committed suicide; 54 shooters did so at the scene of the crime.

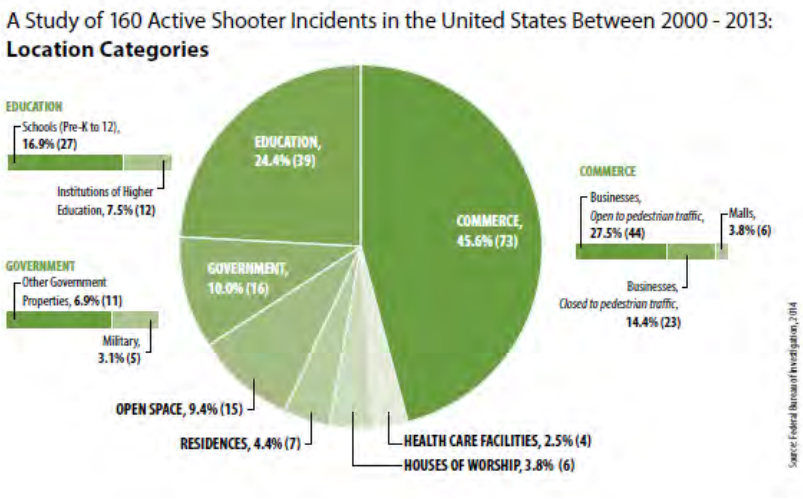
…12 of 14 shooters in high school shootings were students at the schools, and 5 of the 6 shooters at middle schools were students at the schools…
… in businesses generally closed to pedestrian traffic, 22 of the 23 shooters were employees or former employees of the involved company…

Incident Locations

The study results identified 73 (45.6%) of 160 incidents that occurred in areas of commerce. These included businesses open to pedestrian traffic (44 [27.5%]), businesses closed to pedestrian traffic (23 [14.3%]), and malls (6 [3.8%]). These distinctions were made in order to determine whether the public was more at risk in areas where pedestrian traffic was likely.

Educational environments were identified as the second-largest location grouping (39 [24.4%]). These were further broken down as those occurring in schools (27 [16.9%], including two school board meetings) and IHEs (12 [7.5%]). Other incidents, in descending order, were located in:

- Open spaces (15 [9.4%]);
- Government properties (16 [10.0%]);
- Other (non-military) government properties (11 [6.9%])
- Military properties (5 [3.1%])
- Residences (7 [4.4%]);
- Houses of worship (6 [3.8%]); and
- Health care facilities (4 [2.5%]).



Education Environments
The 39 incidents that occurred in educational environments (27 schools, 12 IHEs) resulted in 117 individuals killed and 120 wounded. Note that in this study, schools are defined as pre-kindergarten through 12th grade (PreK-12) educational facilities; incidents that occurred at school-related facilities such as school administration buildings are also included in this category.

Incidents in educational facilities account for some of the higher casualty counts. For example, the highest death tolls among the 160 incidents occurred at Virginia Polytechnic Institute and State University in Blacksburg, Virginia (32 killed, 17 wounded) and Sandy Hook Elementary School in Newtown, Connecticut (26 killed, 2 wounded [1 additional death at a residence]). Other high casualty counts occurred during the shootings at Northern Illinois University in DeKalb, Illinois (5 killed, 16 wounded) and Santana High School in Santee, California (2 killed, 13 wounded).

Risk

Risk: the potential for damage, loss, or other impacts created by the interaction of hazards with community assets.

Risk Assessment: product or process that collects information and assigns values to risks for the purpose of informing priorities, developing or comparing courses of action, and informing decision making.

Active Threat: Active Shooter

Frequency	Consequence			
	Human	Economic	Psychological	Government
Possible	Minor	None/Negligible	Moderate	Minor

Building Security Risk Mitigation Recommendations (ie: Active Shooter Hazard)

Procedures:

- Conduct a realistic security assessment to determine the facility's vulnerability to an active shooter attack.
- Identify multiple evacuation routes and practice evacuations under varying conditions; post evacuation routes in conspicuous locations throughout the facility; ensure that evacuation routes account for individuals with special needs and disabilities.
- Designate shelter locations with thick walls, solid doors with locks, minimal interior windows, first-aid emergency kits, communication devices, and duress alarms.
- Designate a point-of-contact with knowledge of the facility's security procedures and floor plan to liaise with police and other emergency agencies in the event of an attack.
- Incorporate an active shooter drill into the organization's emergency preparedness procedures.
- Vary security guards' patrols and patterns of operation.
- Limit access to blueprints, floor plans, and other documents containing sensitive security information, but make sure these documents are available to law enforcement responding to an incident.
- Establish a central command station for building security.

Systems:

- Put in place credential-based access control systems that provide accurate attendance reporting, limit unauthorized entry, and do not impede emergency egress.
- Put in place closed-circuit television systems that provide domain awareness of the entire facility and its perimeter; ensure that video feeds are viewable from a central command station.
- Put in place communications infrastructure that allows for facility-wide, real-time messaging.
- Put in place elevator systems that may be controlled or locked down from a central command station.

Training:

- Train building occupants on response options outlined by the Department of Homeland Security in "Active Shooter: How to Respond" when an active shooter is in the vicinity.

    - **Evacuate**: Building occupants should evacuate the facility if safe to do so; evacuees should leave behind their belongings, visualize their entire escape route before beginning to move, and avoid using elevators or escalators.
    - **Hide**: If evacuating the facility is not possible, building occupants should hide in a secure area (preferably a designated shelter location), lock the door, blockade the door with heavy furniture, cover all windows, turn off all lights, silence any electronic devices, lie on the floor, and remain silent.
    - **Take Action**: If neither evacuating the facility nor seeking shelter is possible, building occupants should attempt to disrupt and/or incapacitate the active shooter by throwing objects, using aggressive force, and yelling.
- Train building occupants to call 911 as soon as it is safe to do so.
- Train building occupants on how to respond when law enforcement arrives on scene: follow all official instructions, remain calm, keep hands empty and visible at all times, and avoid making sudden or alarming movements.

Aircraft Accident – Hazard Profile

Description

The property of Bismarck Airport, located in south Bismarck, consists of 2,400 acres which includes two runways, a control tower, and a 70,000 square foot terminal building completed in 2005.

In part because of the economic growth in Bismarck and in the state, as well as being a destination location for hunters and other tourists, the airport continues to expand its commercial flight options and is actively used by those using or owning privately owned smaller aircraft. Throughout much of the airports history, there have typically been two commercial airlines providing service. As of 2014, there are five commercial airlines with 114 based airplanes. The airport now has more flights, more destinations, and more use of the airport by the local, regional, and wider community.

Total annual passenger boardings continue to increase:

Total Annual Passenger Boardings				
2010	**2011**	**2012**	**2013**	**2014**
194,043	196,414	236,172	237,683	245,205

Additional information regarding the Bismarck Airport: www.bismarckairport.com

In most disasters, death and injury represent one of the effects of the hazard, while in aircraft accidents (ie: incidents involving major airlines), mass casualties are often the primary impact and focus of the event. An aircraft accident may be intentional as well. Terrorists have used transportation, particularly mass transportation, as a method of delivering their attacks throughout the world.

A mass casualty event from an airline crashing on or near the airport would stress the city's hospitals, clinics and emergency response capabilities. Mass casualties can be defined as an incident resulting in a large number of deaths and/or injuries that reaches a magnitude that overwhelms local resources. In this case, mutual aid as well as state, federal, and private resource assistance would be requested.

Risk

Risk: the potential for damage, loss, or other impacts created by the interaction of hazards with community assets.

Risk Assessment: product or process that collects information and assigns values to risks for the purpose of informing priorities, developing or comparing courses of action, and informing decision making.

THIRA Ratings

(1) Commercial Aircraft Accident (accidental with >50 passengers)
(2) Aircraft as Weapon

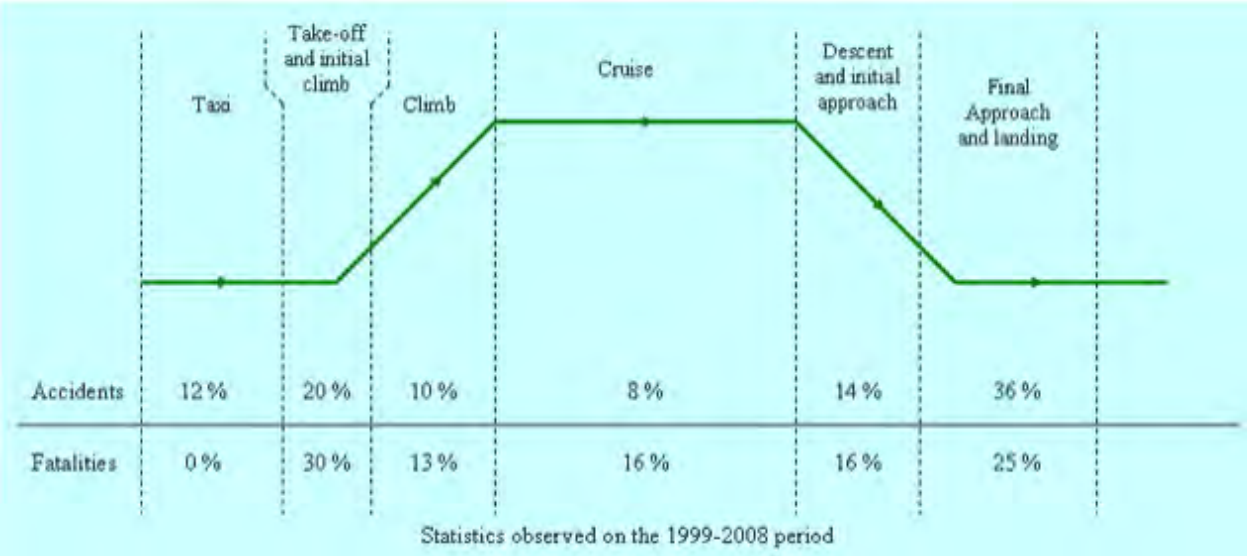
Frequency	Consequence			
	Human	Economic	Psychological	Government
(1) Possible	Catastrophic	Catastrophic	Moderate	Minor
(2) Possible	Catastrophic	Catastrophic	Significant	Moderate

As of 2014, there have been no large commercial line aircraft accidents at the Bismarck Airport or within Burleigh County. However, there have been accidents and even fatalities involving smaller aircraft. The largest number of fatalities for any one incident within Burleigh County is one fatality. Most aircraft accidents involve smaller aircraft.

Bismarck Airport may also be the receiver of redirected flights for aircraft requiring emergency landing. In these cases, the aircraft is not landing at its destination location. Airline incidents and incident related information can be found at the National Transportation Safety Board website: http://www.ntsb.gov/

Airplane Accident Statistics

http://www.1001crash.com/index-page-statistique-lg-2-numpage-3.html

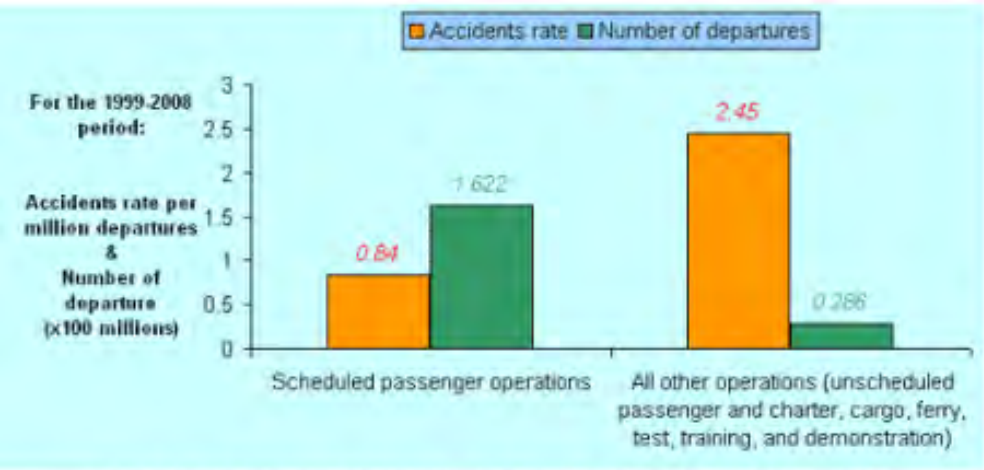


Eighty percent (80%) of all aircraft accidents take place during the departure (take-off/climb) and arrival (approach/landing stages). During these phases aircraft are close to the ground and in a more vulnerable configuration than during flight phases.

Over half of all accidents occur during the final approach and landing stages. These aren't the most devastating accidents, however. A runway overrun may result in only a few injuries, for example.

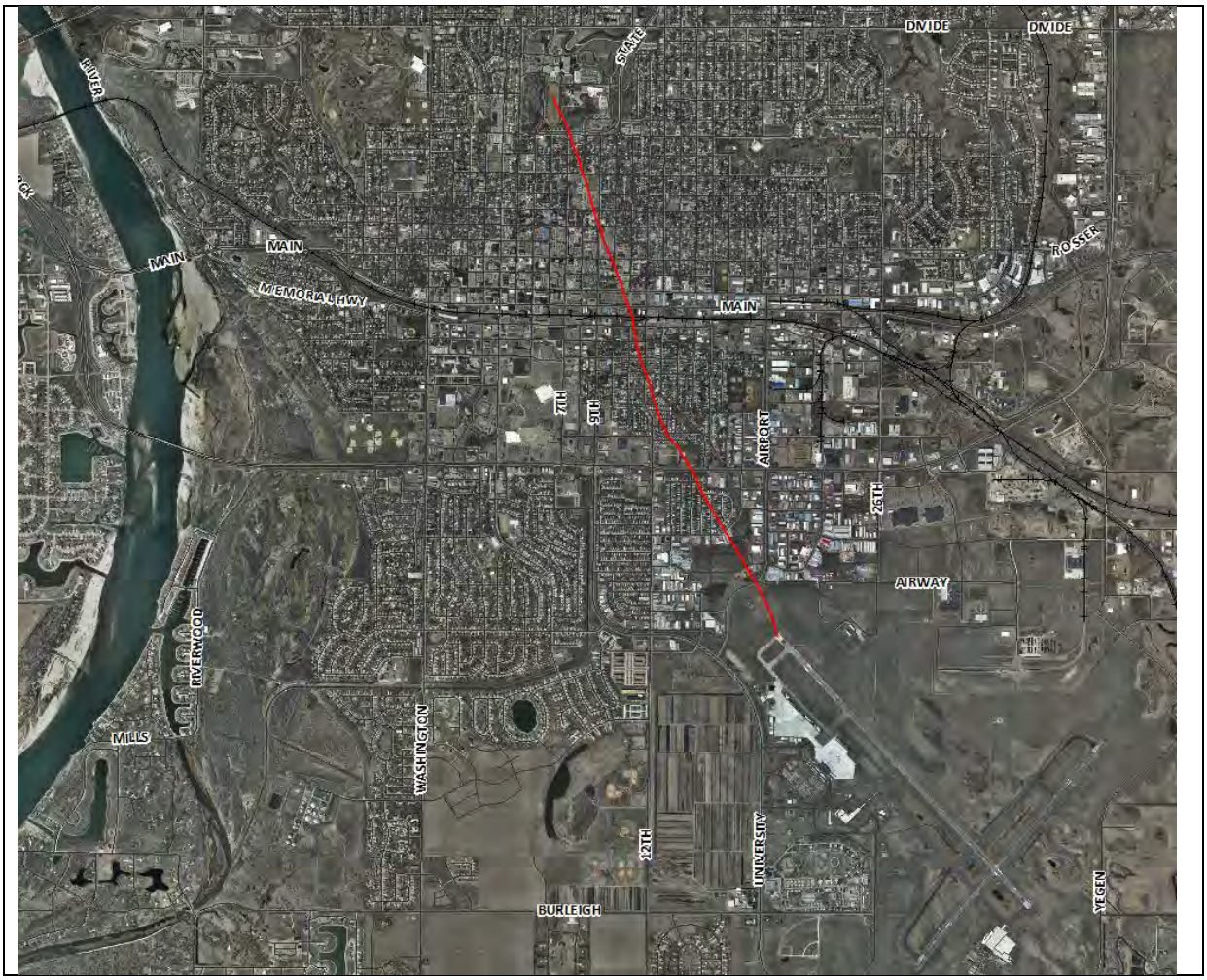
Fatal accidents are more likely to occur during the climbing stage. If the aircraft left the gate with undetected faults, these may become apparent during the climb, as the first stage taking place off the ground, and could prove dangerous. If the crew believe the failure requires the aircraft to land as soon as possible, they will decide to perform an IFTB (In-Flight Turn Back). This could turn out to be difficult, however, as the aircraft may have already lost some of its capabilities.

Reference: http://www.1001crash.com/index-page-statistique-lg-2-numpage-3.html

Scheduled passenger operations are the most common operations, yet, they result in fewer accidents than all other operations combined (unscheduled passenger and charter, cargo, ferry, test, training, and demonstration).	 Scheduled passenger operations and other kind of operations
http://www.1001crash.com/index-page-statistique-lg-2-numpage-3.html	

Vulnerability

The **Accident Potential Zone (APZ)** encompasses an area that extends 15,000 feet beyond the ends of the runway. Reference: Aircraft Rescue and Fire Fighting IFSTA Manual 5th Addition. The width of the zone would vary depending on the type of aircraft as well as any turns made shortly after take-off or turns made prior to landing. The red line within the map is an example and does NOT represent a complete Accident Potential Zone.
Approximate distance from the end of the runway to the State Capitol is 14,500 feet (noted by red line). Approximate distance to the two major hospitals is 9,000 to 10,000 feet.



The highest population and number of properties within 15,000 feet (within the APZ) of the Bismarck Airport are northwest of the airport based on the alignment of the runway running NW/SE. Properties and populations within that distance include CHI St. Alexius Health, Sanford Health, the State Capitol, five mobile home parks, twelve schools, and Bismarck critical facilities including Bismarck Police Department, the City/County Building and Bismarck Burleigh Public Health.

The most vulnerable populations are the crew members and frequent travelers based on extensive use of aircraft (higher use equals higher risk or probability).

The city of Lincoln, as it continues to grow, will be within the air traffic pattern of the Bismarck Airport (within the Accident Potential Zone).

Vulnerability Assessment

Vulnerability: Characteristics of community assets that make them susceptible to damage from a given hazard.

	Aircraft Accident– Commercial Airline
Probability	Possible
Speed of Onset	No notice event or may have some notice based on identified issues creating risk (prior to landing)
Geographic Area	Not specific, however, areas of concern include the geographic area within the Accident Potential Zone (APZ)
Death / Injury 1. Primary Causes A. Highest vulnerability	 1. Crash impact and/or Fire A. Crew and Passengers B. Those within the APZ (higher risk)
Mass Casualty Incident	1. Yes. Mass casualty is the primary concern for aircraft accidents.
Property Losses	1. Properties within the Accident Potential Zone.
Environmental	1. An aircraft accident could involve the Missouri River, Hay Creek, or Apple Creek. Environmental impact would be primarily fuel and debris entering the waterways.
COG/COOP	Critical Facilities within the APZ: 1. City County Building 2. Bismarck Police Department 3. Bismarck Burleigh Public Health 4. State Capitol 5. Burleigh County Courthouse Combined Communications and the Emergency Operations Center are on airport property, however, are not within the flight path based on the direction of each of runway. United Tribes Technical College, also in close proximity, is NOT within the flight path.
Critical Facilities	1. See COG/COOP above. 2. Bismarck Civic Center 3. CHI St. Alexius Health 4. Sanford Health

	Aircraft Accident– Commercial Airline
Critical Infrastructure	1. Railroad (BNSF) is within APZ 2. DMVW Railroad within APZ
Schools	Schools within the APZ: 1. Jeanette Myhre Elementary School 2. Bismarck High School 3. St. Mary's Central High School 4. Willmore Elementary 5. BECEP 6. St. Anne's Grade School 7. Pioneer Elementary 8. Saxvik Elementary 9. Simle Middle School 10. South Central Middle School 11. Roosevelt Elementary 12. Cathedral Elementary
High Risk Facilities (chemical)	1. Airport Fuel Farm
Specific Populations: Public Assembly, Vulnerable / Special Populations	1. Crescent Manor 2. Mobile Home Parks: Holiday Park, Airport Village, Skyway Park Village, Stardust Terrace, Colonial Estates
Economy (community wide)	Catastrophic (THIRA Rating)
OTHER:	

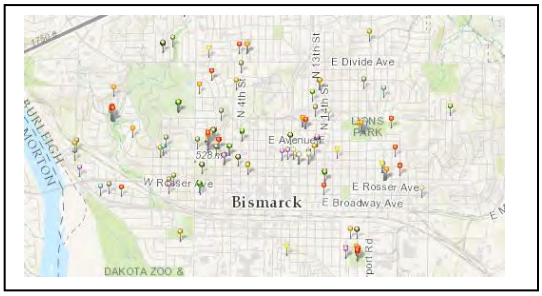
Biological Infestation – Hazard Profile

Urban Forest Damaging Pests

Description

There are several pests and diseases, some more harmful than others, that are prevalent in Bismarck.

Dutch Elm Disease (DED): The most common disease in Bismarck every year is Dutch Elm Disease (DED). Approximately twenty Elm trees are removed in Bismarck each year due to DED. Click here to view the map showing the history of DED.



Dutch elm disease (DED) was first detected in North Dakota in 1969, and has since been recorded in all North Dakota counties. Dutch elm disease is a wilt disease caused by the fungus *Ophiostoma novo-ulmi* and only affects trees in the elm family (*Ulmaceae*). Dutch elm disease (DED) is spread (vectored) by native elm bark beetles, European elm bark beetles and the banded elm bark beetle in North Dakota. DED is also spread by moving elm firewood from infected trees into new areas.

First detected in Mandan, North Dakota in 1969, Dutch Elm Disease (DED) is a fungus that is spread by elm bark beetles. When an elm tree is infected with DED, branches in the upper crown will yellow, curl and wilt, commonly referred to as *flagging*. If a healthy elm tree is next to a tree infected with DED it is possible for the fungus to spread through the root systems. This happens when trees are planted close together and as they mature their roots fuse together, also known as root grafting.

Tree mortality can occur within one year of infection, though DED generally takes three years or more to kill a tree.

Why is Dutch elm disease a problem?

- Dutch elm disease kills trees rapidly and spreads readily if not properly managed.
- There is no 'cure' for DED and the disease is widespread in urban and rural areas throughout North Dakota.
- Dutch elm disease kills American elm trees, the North Dakota State Tree, which is well-adapted to environmental conditions in our state.
- Management of Dutch elm disease in North Dakota communities is costly.

What are the current impacts of Dutch elm disease in North Dakota?

- Continual need to spend considerable amounts of money to manage Dutch elm disease in North Dakota communities.
- Continual loss of a prominent, well-adapted tree species in natural settings.
- Continual incremental loss of a prominent and excellent tree for urban settings.

The Forestry Division is also on watch for Emerald Ash Borer (EAB). EAB attacks Ash (*Fraxinus*) trees. It has not been found in the State of North Dakota; however, EAB has been found in other Midwest States, including Minnesota.

Emerald Ash Borer (EAB) is an invasive pest from China that first appeared in Detroit, MI from there it has spread out to Colorado, Kansas, Arkansas, Georgia, New York, MN WI and all states in-between. The world has become a Global Market, meaning North America and other countries are receiving material from other parts of the world. Along with these products invasive pest are also being shipped. Looking back at the major pest problems all are an invasive pest or disease; Gypsy Moth, Dutch Elm Disease (DED), Chestnut Blight, and now EAB. It is difficult to tell what future pest will be introduced to the North America and North Dakota. In the case of EAB, the City of Bismarck has close to 30% of the boulevard trees are composed of an ash species. Bismarck has been successful in its efforts with DED. As the City report states when City staff has to address EAB this will detract from our DED program. This will then put the 20% elm street tree population at risk of finally succumbing to DED. With those two efforts the City of Bismarck has the potential of losing 50% of its street population. This does not account for the Bismarck Park District and private trees.

Risk

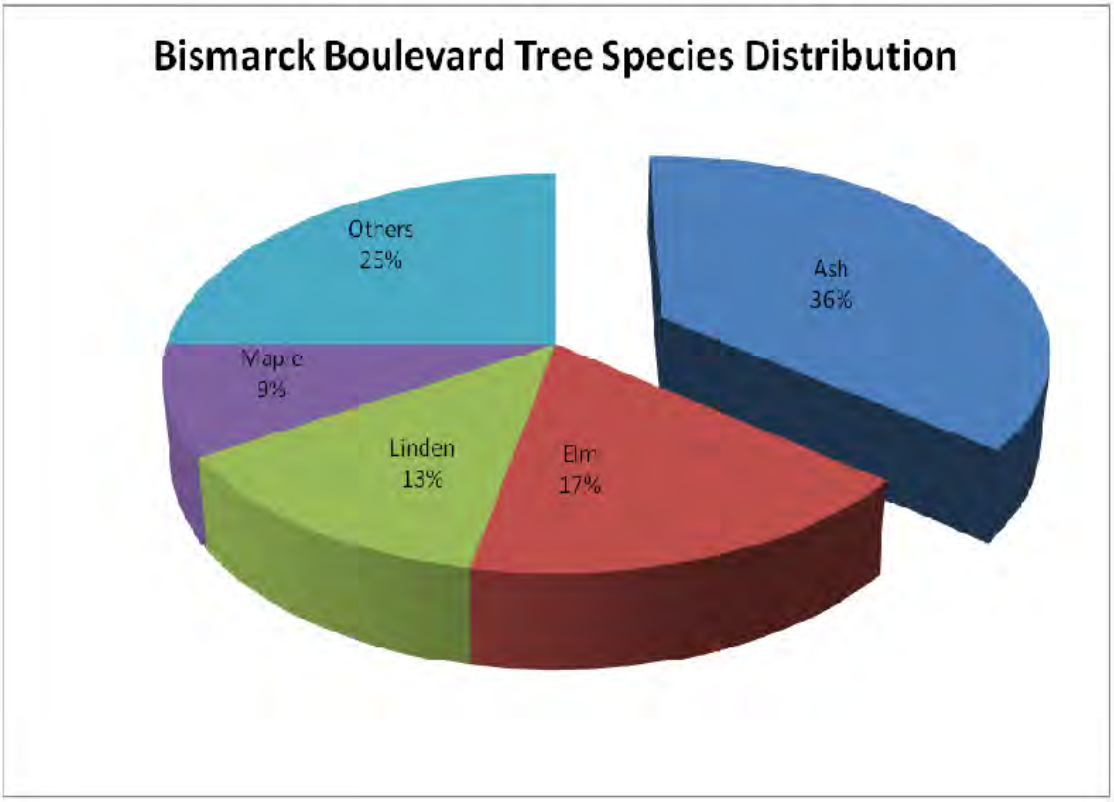
Risk: the potential for damage, loss, or other impacts created by the interaction of hazards with community assets.

Risk Assessment: product or process that collects information and assigns values to risks for the purpose of informing priorities, developing or comparing courses of action, and informing decision making.

THIRA Ratings – Biological Infestation – EAB or DED

Frequency	Consequence			
	Human	Economic	Psychological	Government
Likely	None/Negligible	Moderate	None/Negligible	None/Negligible

History: EAB is an exotic wood boring beetle that attacks all ash species and its cultivated varieties. Since its discovery in the United States in 2002, the insect has emerged in the states of Michigan, Ohio, Indiana, Illinois, Kentucky, Maryland, Pennsylvania, West Virginia, Wisconsin, Minnesota, New York, Quebec, Canada and Ontario, Canada. This pest has killed millions of ash trees along the way.



Vulnerability Assessment

Vulnerability: Characteristics of community assets that make them susceptible to damage from a given hazard.

	Biological Infestation – Emerald Ash Borer and Dutch Elm Disease
Probability	Likely
Speed of Onset	Slow
Geographic Area	City, County, Statewide
Death / Injury 1. Primary Causes A. Highest vulnerability	1. Trimming or removing trees. A. Those without adequate training or experience in tree removal, if attempting to trim or remove their own trees. B. City Forestry staff due to a potentially high number of impacted trees should EAB impact Bismarck.
Mass Casualty Incident	No.
Property Losses	1. Potentially ALL Ash Trees (Emerald Ash Borer) 2. Elm Trees (Dutch Elm Disease)
Environmental	1. Loss of shading and protection increases heating and cooling requirements (and costs) of surrounding facilities. 2. Aesthetics. 3. Storm water system impacted due to rainwater not being intercepted by mature trees.
COG/COOP	1. No impact on continuity of government or continuity of operations.
Critical Facilities	1. None.
Critical Infrastructure	1. None.
Schools	1. None.
High Risk Facilities (chemical)	1. None.
Specific Populations: Public Assembly, Vulnerable / Special Populations	1. None.
Economy (community wide)	Moderate impact. See "Scope of Emerald Ash Borer Impact on Bismarck" below.
OTHER:	Transporting of infested firewood.

Scope of Emerald Ash Borer Impact on Bismarck:
Ash is one of the most important and abundant species in the City of Bismarck and the surrounding area. Ash composes nearly 36% of all street trees (7,393 street trees, all of these ash trees will be impacted by EAB) in Bismarck. This does not take into account park property and private trees in Bismarck. Once introduced to Bismarck and the surrounding area, it is likely that every ash tree will be impacted by EAB.

In 2009, the Forestry Division surveyed a few local tree services and nurseries to develop cost estimates. The estimates presented here represent 2009 dollars:
Removal and stump grinding of a medium sized tree could cost $400-500 per tree. Replanting a 2" caliper tree would cost anywhere from $250-350 per tree. Taking a conservative approach, the City would be spending 2.9 million dollars for removals and citizens could spend 1.8 million dollars replanting lost ash trees. This does not account for the lost economic benefits that these trees provide to the City and the residents such as; more rainwater would work its way into the storm water systems without the trees to intercept the rainwater, household cooling cost would increase due to the lost shade provided by the trees, winter heating cost would increase without these trees blocking the harsh winter winds.

This impact would have an enormous economic, social and ecological impact to the City.
To review the entire City of Bismarck Emerald Ash Borer Response Plan, visit the following website:
http://www.bismarck.org/DocumentCenter/Home/View/2124

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Communicable Disease - Hazard Profile

Includes Pandemic Influenza, Bio-Terrorism, and specific infectious diseases

Description

Communicable diseases are naturally occurring biological diseases in humans as well as those biological agents found in the environment, or diagnosed in animals, that have the potential for transmission to humans. An infectious disease is a clinically evident illness resulting from the presence of pathogenic biological agents, including pathogenic viruses, pathogenic bacteria, fungi, protozoa, multicellular parasites, and aberrant proteins known as prions. These pathogens are able to cause disease in animals and/or plants. Infectious pathologies are also called communicable diseases or transmissible diseases due to their potential of transmission from one person or species to another by a replicating agent (as opposed to a toxin).

Transmission of an infectious disease may occur through one or more of diverse pathways including physical contact with infected individuals. These infecting agents may also be transmitted through liquids, food, body fluids, contaminated objects, airborne inhalation, or through vector-borne spread. Transmissible diseases which occur through contact with an ill person or their secretions, or objects touched by them, are especially infective, and are sometimes referred to as contagious diseases. Infectious (communicable) diseases which usually require a more specialized route of infection, such as vector transmission, blood or needle transmission, or sexual transmission, are usually not regarded as contagious, and thus are not as amenable to medical quarantine of victims.

Human epidemics may lead to quarantines, large-scale use of the medical care system, and mass fatalities. Typically, the elderly, young children, and those with suppressed immune systems at greatest risk from communicable diseases. The following biologic agents are considered the highest bioterrorism threats (Category A) due to their ease of dissemination or person-to-person transmission, high mortality rate with potential for major public health impacts, and potential for public panic and social disruption: Anthrax, Botulism, Plague, Smallpox, Tularemia, and Viral Hemorrhagic Fevers. (Centers for Disease Control and Prevention, 2010)

In addition to global disease and bioterrorism concerns, naturally occurring diseases can threaten communities. Natural illnesses of particular concern include Influenza, Meningitis, Pertussis (Whooping Cough), Measles, Norwalk Virus, Severe Acute Respiratory Syndrome (SARS), and food-borne illnesses such as E. coli and Salmonella outbreaks, among others. These diseases can infect populations rapidly, particularly through groups of people in close proximity such as schools, assisted living facilities, and workplaces. Source: 2014 DES Mitigation Plan

Although Bismarck hasn't experienced any major pandemics in recent years, the charts on the following pages list mandatory reportable conditions for communicable diseases which are required should they appear. http://www.ndhealth.gov/disease/disease%20reporting/diseasecall.htm

North Dakota Department of Health

Mandatory Reportable Conditions

~Report within 7 days unless otherwise specified~

- AIDS
- Anthrax ☎ ◈
- Arboviral Infection (specify etiology)
- Botulism ☎ ◈
- Brucellosis ☎ ◈
- Campylobacteriosis ◈
- Carbapenem-resistant *Enterobacteriaceae* (CRE) ◈◆
- Cancer ◆+
- CD4 Test Results (any CD4 value)
- Chickenpox (varicella)
- Chlamydial infection
- Cholera ☎ ◈
- *Clostridium perfringens* intoxication ☎ ◈
- Coccidiomycosis ◈
- Creutzfeldt-Jakob disease
- Cryptosporidiosis
- Diphtheria ☎ ◈
- *E. coli* (shiga-toxin producing strains) ◈
- Enterococcus, Vancomycin-resistant (VRE) ◈
- Foodborne/waterborne outbreaks ☎
- Giardiasis
- Glanders ☎ ◈
- Gonorrhea
- *Haemophilus influenza* (invasive) ◈
- Hantavirus ☎ ◈
- Hemolytic uremic syndrome ☎
- Hepatitis A ☎
- Hepatitis B
- Hepatitis C
- HIV infection (confirmed and all HIV positive rapid screens) ◈
- Influenza
- *Klebsiella pneumoniae* Carbapenemase (KPC) - producers ◈◆
- Laboratory incidences with possible release of category A agents or novel influenza virus ☎
- Lead level ≥10µg/dL
- Legionellosis
- Listeriosis ◈
- Lyme disease
- Malaria ◈
- Measles (rubeola) ☎ ◈
- Melioidosis ☎ ◈
- Meningitis (bacterial – specify etiology) ◈
- Meningococcal disease (invasive) ☎ ◈
- Mumps ☎
- Nipah virus infections ☎ ◈
- Nosocomial outbreaks in institutions
- Pertussis ☎ ◈
- Plague ☎ ◈
- Poliomyelitis ☎ ◈
- Pregnancy in person infected with perinatally transmissible disease (such as hepatitis B and HIV)
- Psittacosis
- Q fever ◈
- Rabies
  - Animal
  - Human ☎ ◈
- Rocky Mountain spotted fever
- Rubella ☎ ◈
- Salmonellosis ◈
- Scabies outbreaks in institutions
- Severe Acute Respiratory Syndrome (SARS) ☎ ◈
- Shigellosis ◈
- Smallpox ☎ ◈
- *Staphylococcus aureus*
  - Methicillin-resistant (MRSA) – exclude urine; invasive sites only ◈
  - Vancomycin-resistant and intermediate resistant (VRSA and VISA) – any site ☎ ◈
- Staphylococcus enterotoxin B intoxication ☎ ◈
- Streptococcal infection (invasive) ◈
- Syphilis
- Tetanus
- Tickborne diseases (any tickborne encephalitis or tickborne hemorrhagic fevers ☎ ◈)
- Toxic Shock Syndrome ◈
- Trichinosis
- Tuberculosis ☎ ◈
- Tularemia ☎ ◈
- Tumors of the central nervous system +
- Typhoid fever ☎ ◈
- Unexplained critical illness/death in otherwise healthy person ☎
- Unusual disease clusters ☎
- Vibriosis ◈
- Viral hemorrhagic fevers ☎
- Weapons of Mass Destruction suspected event ☎
- Yellow fever ☎ ◈

☎ Report Immediately: 1.800.472.2180 or 701.328.2378

◈ Send isolate or sample to NDPHL. This is a Select Agent when confirmed. Notify NDPHL 701-328-6272. Report any possible laboratory exposures.

◆See website for complete definition www.ndhealth.gov/Disease/Rules +Submit report to the North Dakota Cancer Registry. Call 800-280-6512 for assistance.

North Dakota Administrative Code 33-06-01 Statutory authority NDCC 23-07-01 Updated 01-01-2011

North Dakota Department of Health

Mandatory Reportable Conditions

~Report within 7 days unless otherwise specified~

Antibiotic Resistant Infections

- Enterococcus, Vancomycin-resistant (VRE) ◈
- *Staphylococcus aureus*:
  - Methicillin-resistant (MRSA) – exclude urine; invasive sites only ◈
  - Vancomycin-resistant and intermediate resistant (VRSA and VISA) – any site ☎ ◈
- Carbapenem-resistant *Enterobacteriaceae* (CRE) ◈◆
- *Klebsiella pneumoniae* Carbapenemase (KPC) - producers ◈◆

Bloodborne/STD Infections

- AIDS
- Chlamydial infection
- Gonorrhea
- Hepatitis B
- Hepatitis C
- HIV infection(confirmed and all HIV positive rapid screens) ◈
- Syphilis

Enteric Illnesses

- Campylobacteriosis ◈
- Cholera ☎ ◈
- *E. coli* (shiga-toxin producing strains) ◈
- Hepatitis A ☎
- Listeriosis ◈
- Salmonellosis ◈
- Shigellosis ◈
- Typhoid fever ☎ ◈
- Vibriosis ◈

Vaccine Preventable Diseases

- Chickenpox (varicella)
- Diphtheria ☎ ◈
- *Haemophilus influenza* (invasive) ◈
- Influenza
- Measles (rubeola) ☎ ◈
- Mumps ☎
- Pertussis ☎ ◈
- Poliomyelitis ☎ ◈
- Rubella ☎ ◈
- Smallpox ☎ ◈
- Tetanus

Vectorborne Diseases

- Arboviral Infection (specify etiology)
- Lyme disease
- Malaria ◈
- Rocky Mountain spotted fever
- Tickborne diseases (any tickborne encephalitis or tickborne hemorrhagic fevers ☎ ◈)

Parasitic Infections

- Cryptosporidiosis
- Giardiasis
- Trichinosis

Zoonotic Diseases

- Anthrax ☎ ◈
- Brucellosis ☎ ◈
- Glanders ☎ ◈
- Hantavirus ☎ ◈
- Nipah virus infections ☎ ◈
- Plague ☎ ◈
- Psittacosis
- Q fever ◈
- Rabies
  - Animal
  - Human ☎ ◈
- Tularemia ☎ ◈

Other Bacterial/Viral Infections

- Botulism ☎ ◈
- Legionellosis
- Melioidosis ☎ ◈
- Meningitis (bacterial – specify etiology) ◈
- Meningococcal disease (invasive) ☎ ◈
- Severe Acute Respiratory Syndrome (SARS) ☎ ◈
- Streptococcal infection (invasive) ◈
- Toxic Shock Syndrome ◈
- Tuberculosis ☎ ◈
- Viral hemorrhagic fevers ☎

Other Reportable Conditions

- Cancer ◆+
- CD4 Test Results (any CD4 value)
- *Clostridium perfringens* intoxication ☎ ◈
- Coccidiomycosis ◈
- Creutzfeldt-Jakob disease
- Foodborne/waterborne outbreaks ☎
- Hemolytic uremic syndrome ☎
- Laboratory incidences with possible release of category A agents or novel influenza virus ☎
- Lead level ≥10µg/dL
- Nosocomial outbreaks in institutions
- Pregnancy in person infected with perinatally transmissible disease (such as hepatitis B and HIV)
- Scabies outbreaks in institutions
- Staphylococcus enterotoxin B intoxication ☎ ◈
- Tumors of the central nervous system +
- Unexplained critical illness/death in otherwise healthy person ☎
- Unusual disease clusters ☎
- Weapons of Mass Destruction suspected event ☎

☎ Report Immediately: 1.800.472.2180 or 701.328.2378

◈ Send isolate or sample to NDPHL ☣ This is a Select Agent when confirmed. Notify NDPHL 701-328-6272. Report any possible laboratory exposures.

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North Dakota Administrative Code 33-06-01 Statutory authority NDCC 23-07-01 Updated 01-01-2011

Foodborne Illness:

Foodborne illness (sometimes called "foodborne disease," "foodborne infection," or "food poisoning) is a common, costly—yet preventable—public health problem. The Centers for Disease Control and Prevention (CDC) define a foodborne illness outbreak when two or more people get the same illness from the same contaminated food or drink. Many different disease-causing microbes, or pathogens, can contaminate foods, so there are many different foodborne infections. In addition, poisonous chemicals, or other harmful substances can cause foodborne diseases if they are present in food. Foodborne illnesses are a major public health problem. The CDC estimate that each year one in six Americans get sick by consuming contaminated foods or beverages; 128,000 are hospitalized; and 3,000 die of foodborne diseases.

Recreational Water Illness:

Recreational water illnesses (RWIs) are caused by germs spread by swallowing, breathing in mists or aerosols of, or having contact with contaminated water in swimming pools, hot tubs, water parks, water play areas, interactive fountains, lakes, rivers, or oceans. RWIs can also be caused by chemicals in the water or chemicals that evaporate from the water and cause indoor air quality problems. RWIs include a wide variety of infections, such as gastrointestinal, skin, ear, respiratory, eye, neurologic, and wound infections. The most commonly reported RWI is diarrhea. In the past two decades, there has been a substantial increase in the number of RWI outbreaks associated with swimming. Crypto (short for Cryptosporidium) which can stay alive for days even in well-maintained pools, has become the leading cause of swimming pool-related outbreaks of diarrheal illness.

West Nile:

West Nile virus (WNV) is most commonly transmitted to humans by mosquitoes. There are no medications to treat or vaccines to prevent WNV infection. Most people infected with WNV will have no symptoms. About 1 in 5 people who are infected will develop a fever with other symptoms. Less than 1% of infected people develop a serious, sometimes fatal, neurologic illness.

In 2012, an unprecedented outbreak of WNV occurred in Texas; 1,868 cases were reported, including 844 (45%) cases of (WNV neuroinvasive disease [WNND], which included encephalitis, meningoencephalitis, and meningitis) and 89 deaths (case-fatality rate 5%). Male patients, persons >65 years of age, and minorities were at highest risk for neuroinvasive disease. Fifty-three percent of counties reported a case; 48% of case-patients resided in 4 counties around Dallas/Fort Worth. The economic cost was >$47.6 million.

RISK

Risk: the potential for damage, loss, or other impacts created by the interaction of hazards with community assets.

Risk Assessment: product or process that collects information and assigns values to risks for the purpose of informing priorities, developing or comparing courses of action, and informing decision making.

Communicable Disease (Pandemic Influenza Scenario)

Frequency	Consequence			
	Human	Economic	Psychological	Government
Possible	Catastrophic	Catastrophic	Significant	Significant

Foodborne Illness

Frequency	Consequence			
	Human	Economic	Psychological	Government
Likely	Minor	Minor	Minor	None/Negligible

Risk Assessment

Communicable diseases, whether human, animal, or plant are not governed by geographic boundaries. However, those jurisdictions with the highest human and livestock populations and crop exposure are at greatest risk from communicable diseases.

Approximately three human influenza pandemics have occurred over the past 100 years with one, the 1918 pandemic, severely affecting the United States.

Fortunately, North Dakota has not experienced any devastating human disease outbreaks within its population in recent years. Following World War I, the Spanish influenza pandemic of 1918 killed 20-40 million people worldwide, including 675,000 Americans. (Billings, 1997) In North Dakota, about 2,700 people died and around 6,000 people were infected. Schools, churches, and businesses were closed for a time, and public gatherings were banned. Transporting influenza patients by train was a crime. (US Department of Health and Human Services, 2006) Previous to that, in 1837, a smallpox epidemic virtually annihilated the village of Mandan Native Americans near Fort Clark. (State Historical Society of North Dakota, 2007)

The probability of communicable disease in Bismarck presents challenges due to a limited history of outbreaks. Medical advances over the past fifty years prevent many disease outbreaks, yet the potential

remains. International and domestic travel is so common, that, like the Spanish Influenza of 1918, Bismarck would most likely be affected at some point. Burleigh County is a combination of rural and urban communities. Although somewhat isolated from the rapid spread of global diseases, it is not completely immune. Its agricultural communities are most at risk from communicable disease among the plants and animals found on the county's family farms. Its urban center (The City of Bismarck is the state capital and one of the most populous cities within North Dakota), is more prone to communicable diseases affecting the human population. The Universities located in Bismarck are particularly vulnerable as their student populations often live and study in close quarters, thus heightening the probability of transmission.

The magnitude of a communicable disease outbreak varies from every day disease occurrences to widespread infection. During the 1918 Influenza Pandemic, infection rates approached 28 percent in the United States. (Billings, 1997) Other pandemics produced infections rates as high as 35percent of the total population. (World Health Organization, 2010) Such a pandemic affecting North Dakota represents a severe magnitude event. Almost any highly contagious, incapacitating disease that enters the North Dakota population would quickly overwhelm local and state health resources. Similarly, any rapidly spreading bioterrorism event for which little vaccination or containment capability exists is a high magnitude event.

In 1900 nearly all of the leading causes of death were infectious; now only pneumonia and influenza remain among the top 10 causes of death. The number of deaths due to pneumonia and influenza are tracked by the North Dakota Department of Health (NDDoH) by influenza year, which begins in September. The rate is age adjusted to the standard 2000 census. NDDoH's goal is less than 60 deaths per 100,000 people.

Deaths Due to Influenza and Pneumonia per 100,000 People, 2005-2011						
Number of deaths due to influenza and pneumonia among all causes of death per 100,000 population	**2005-2006**	**2006-2007**	**2007-2008**	**2008-2009**	**2009-2010**	**2010-2011**
	60	78	62	76	67	55

Many of the diseases such as diphtheria, tetanus, and polio that have the potential to result in serious outbreaks are preventable through routine vaccination. Vaccination is so effective that each vaccination actually saves substantially more money than it costs. In parts of the world where vaccination rates are low, these diseases continue to take a high toll in death and disability.

Risk Assessment Narrative Source: 2014 ND DES Mitigation Plan

2009 H1N1 Influenza: http://www.ndflu.com/h1n1/

NORTH DAKOTA DEPARTMENT of HEALTH

Division of Disease Control

FOR THE WEEK ENDING
October 10, 2009
WEEK 40

AT A GLANCE

1	ND has 563 reports of laboratory identified influenza.
2	Number of reported influenza deaths: 0
3	Influenza Hospitalizations: 26
4	Novel H1N1 Cases

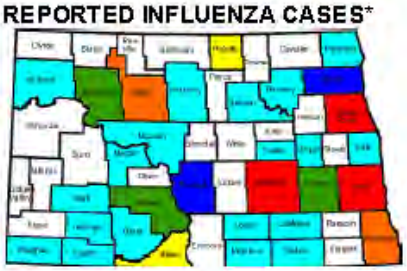
Total Cases: 110

Age-Information	
Range	Cases
<10	33
10-19	35
20-29	28
30-39	7
40-49	4
50-59	2
60-and-over	1

Female	134
Male	126
Hospitalized	35
Deaths	1

North Dakota Department of Health
Influenza Summary 2009-2010

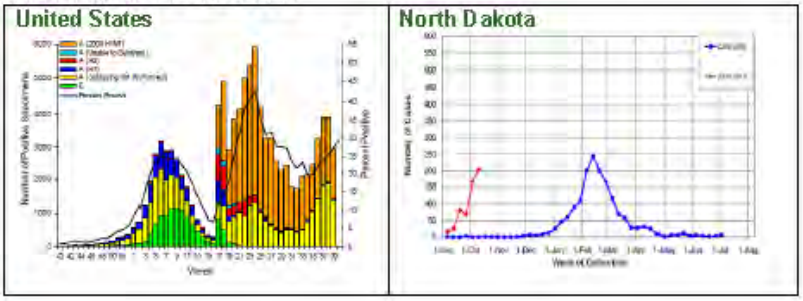
REPORTED INFLUENZA CASES*



Week	Type A Novel H1N1	Type A H1	Type A H3	Type A Unspecified	Type B	Unknown	Total
37	25	0	0	56	0	1	82
38	25	0	0	36	1	7	69
39	32	0	0	129	3	1	165
40	12	0	0	191	1	0	204
YTD	110	0	1	436	7	9	563

*Includes positive rapid tests, DFA, IFA, PCR and culture.

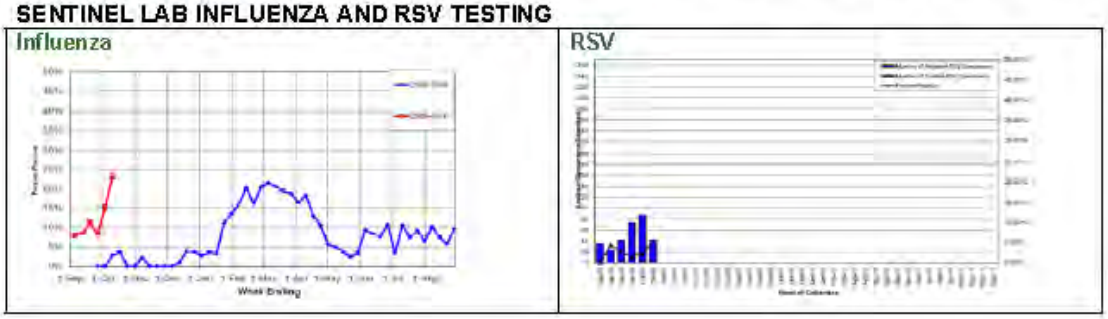
INFLUENZA BY SUBTYPE



INFLUENZA BY AGE GROUP

Week	<1	1-5	6-10	11-19	20-24	25-34	35-44	45-54	55-64	65+
37										
38										
39	0	34	31	56	14	9	9	8	4	0
40	4	23	32	96	19	12	6	9	2	1
YTD	7	77	82	220	71	42	31	24	6	3

SENTINEL LAB INFLUENZA AND RSV TESTING



http://www.ndflu.com/DataStats/Docs/SummaryUpdates/2009-2010/Weekly%20Summary%2010-10-2009%20_40_.pdf

Vulnerability Assessment (1 of 2)

Vulnerability: Characteristics of community assets that make them susceptible to damage from a given hazard.

Scenario:	**Communicable Disease**	**Pandemic Influenza**	**Bio-Terrorism**
Probability	Likely	Possible	Possible
Speed of Onset	May be a "no-notice" event or slow onset depending on location of origin	May be a "no-notice" event or slow onset depending on location of origin	May be a "no-notice" event or slow onset depending on location of origin
Geographic Area	Local, regional…. worldwide	Local, regional…. Worldwide	Local, regional…. worldwide
Death / Injury 1. Primary Causes A. Highest vulnerability	1. Reportable Communicable Diseases. See charts within Description section. A. Those with underlying medical conditions or suppressed immune systems. B. Elderly and young A. Those living or working in close proximity. • Schools, universities, assisted living, nursing homes	1. Reportable Communicable Diseases. See charts within Description section. B. Those with underlying medical conditions or suppressed immune systems. C. Elderly and young D. Those living or working in close proximity. • Schools, universities, assisted living, nursing homes	1. Anthrax, Botulism, Plague, Smallpox, Tularemia, and Viral Hemorrhagic Fevers. A. Those who come in direct contact with the bio-agent (i.e.: targeted victims, first responder community and hospital staff). B. Those in close proximity to location of dispersal C. As bio-agent dissipates, risk and vulnerability are reduced.
Mass Casualty Incident	Yes Possible	Yes Probable	Yes Likely

Scenario:	Communicable Disease	Pandemic Influenza	Bio-Terrorism
Property Losses (points of vulnerability – high priority)	1. Decontamination of a facility may be required before reuse. 2. Use may be discontinued until threat has passed.	1. Decontamination of a facility may be required before reuse. 2. Use may be discontinued until threat has passed.	1. Decontamination of a facility may be required before reuse. 2. Use may be discontinued until threat has passed.
Environmental (points of vulnerability – high priority)	1. Incident Specific • Water, Soil, Air, Food	1. Incident Specific • Water, Soil, Air, Food	2. 1. Incident Specific • Water, Soil, Air, Food
COG/COOP (points of vulnerability – high priority)	1. Employee/Family Illness 2. Orders of Succession all departments. 3. Public Health Department, response capability compromised 4. Emergency Services staffing, services, and capabilities compromised.	1. Employee/Family Illness 2. Order of Succession all departments 3. Public Health Department, response capability compromised 4. Emergency Services staffing, services, and capabilities compromised.	1. First Response Emergency Services • Fire • EMS • Police 2. Public Health
Critical Facilities (points of vulnerability – high priority)	1. Hospitals 2. Clinics 3. Other Emergency Service Providers 4. Airport 5. Civic Center 6. Prison, jail and other institutional facilities	1. Hospitals 2. Clinics 3. Other Emergency Service Providers 4. Airport 5. Civic Center 6. Prison, jail and other institutional facilities	1. Federal/State Agencies 2. Hospitals - may be treating victims with unknown bioterrorism agent 3. HVAC systems of Critical Facilities 4. Emergency Services 5. USPS Warehouse sorting facility
Critical Infrastructure (points of vulnerability – high priority)	1. Availability and capability to restore services may be impacted: such as Water, Food, Medication, Sanitation, Communications. 2. Transportation – Airport	1. Availability and capability to restore services may be impacted: such as Water, Food, Medication, Sanitation, Communications. 2. Transportation - Airport	1. Transportation - Airport

Scenario:	Communicable Disease	Pandemic Influenza	Bio-Terrorism
Schools (points of vulnerability – high priority)	1. Entire school population is of high vulnerability. 2. School facilities may require decontamination, delayed use, or may be needed for alternative purposes.	1. Entire school population is of high vulnerability. 2. School facilities may require decontamination, delayed use, or may be needed for alternative purposes.	
High Risk Facilities (chemical) (points of vulnerability – high priority)	1. Facilities containing hazardous materials may pose a greater risk depending on impact to staffing and on-site safety and security personnel.	1. Facilities containing hazardous materials may pose a greater risk depending on impact to staffing and on-site safety and security personnel.	
Specific Populations: Public Assembly, Vulnerable / Special Populations (points of vulnerability – high priority)	1. Elderly 2. Young 3. School population 4. Universities 5. Day Cares 6. Those living or working in close proximity 7. Senior Citizen Facilities 8. Nursing Home 9. Assisted Living 10. Incarcerated, institutional settings 11. Indoor/Outdoor Events 12. Malls/Stores 13. Churches 14. Social Gathering	1. Elderly 2. Young 3. School population 4. Universities 5. Day Cares 6. Those living or working in close proximity 7. Senior Citizen Facilities 8. Nursing Home 9. Assisted Living 10. Incarcerated, institutional settings 11. Indoor/Outdoor Events 12. Malls/Stores 13. Churches 14. Social Gathering	1. Non-specific, depends on terrorism group and motives. May involve special populations and motives relating to government or religion for example.
Economy (community wide)			
OTHER: (points of vulnerability – high priority)	1. Those NOT vaccinated for vaccine preventable diseases.	1. Those NOT vaccinated for vaccine preventable diseases.	

Vulnerability Assessment (2 of 2)

Scenario:	Food Borne Illness	Rec Water Illness	West Nile Outbreak
Probability	Likely	Likely	Likely
Speed of Onset	No notice	No notice	No notice
Geographic Area	Statewide/nationwide	Statewide/nationwide	Statewide/nationwide
Death / Injury 1. Primary Causes A. Highest Vulnerability	1. Consuming food or drink that contains a pathogen (i.e.: bacteria, virus or parasite) or harmful chemical or substances A. Young, elderly and Immuno-compromised	1. Swallowing, breathing in mists or aerosols of, or having contact with contaminated water A. Young, elderly and Immuno-compromised	1. Getting bit by an infected mosquito A. People with certain medical conditions such as cancer, diabetes, hypertension and kidney disease are also at greater risk for serious illness.
Mass Casualty Incident	Yes, potentially	Most likely not	Yes, potentially
Property Losses	NA	NA	NA
Environmental	NA	NA	NA
COG/COOP	NA	NA	NA
Critical Facilities	NA	NA	NA
Critical Infrastructure	NA	NA	NA
Schools	NA	NA	NA
High Risk Facilities (chemical)	NA	NA	NA
Specific Populations: Public Assembly, Vulnerable / Special Populations	Those affected are likely to have consumed a common meal from a common source (ie: donated or intentional act)	Those recreating in untreated water – lakes, rivers, reservoirs.	Those who work outside or participate in outdoor activities
Economy (community wide)	Medical costs Lost productivity	Medical costs Lost productivity	Medical costs Lost productivity
OTHER:			

Vulnerability Assessment

The most significant impacts of communicable disease are to the population affected and the healthcare organizations involved. Disease can spread rapidly through schools, health facilities, and communities. The entire state population plus visitors are at risk to contracting a communicable disease that surfaces in North Dakota. Although infectious diseases are not subject to geographic boundaries, several populations in North Dakota are specifically at higher risk to infectious diseases. Communicable diseases are most likely to spread quickly in institutional settings such as dormitories, long-term care facilities, day care facilities, schools, correctional institutions, etc. The number of infections and fatalities in the state depends on the transmission and mortality rates. The statewide economy relies heavily on the agriculture, health care, travel, and utility industries, and therefore, human or livestock diseases would negatively affect the economy. With respect to human diseases, an outbreak would most certainly limit travel and impact the service and tourism industries. The trickle-down economic impacts to nearly all industries could be overwhelming. Workers who become ill, need to care for loved ones, or are fearful of contracting the disease may not show up for work. The impact to critical industries and services could be severe. Examples of industries and services that could be significantly impacted in North Dakota include health care, education, utility services, and emergency response.

The North Dakota Department of Health monitors the rate of vaccination among children, specifically the percentage of children completing the 4:3:1:3:3:1:1 vaccination series at age 2 years. Vaccination rates have been rising slowly since 2007. Although better than US rates for this indicator, the coverage rate is below the target of 90 percent. In 2011, the rate of vaccination for North Dakota children was 82.8 percent and 72.7 percent nationally. Achieving high vaccination levels among two year olds is dependent on the cooperation of parents. Different parents have different reasons for not vaccinating their children. For instance, even though the risks associated with vaccination are far below the risk of serious illness if a child is not vaccinated, some parents remain reluctant to vaccinate their children due to anxiety about serious adverse effects. But serious reactions to childhood vaccination are very rare. Other parents don't perceive vaccination to be a high priority, partly because vaccine preventable diseases are relatively uncommon. Consequently, parents who don't vaccinate their children are in essence depending on the vaccination of other children to protect their child from getting vaccine preventable diseases.

The magnitude of an infectious disease outbreak is related to the ability of the public health and medical communities to stop the spread of the disease. Most disease outbreaks that cause catastrophic numbers of deaths are infectious in nature, meaning that they are spread from person to person. The key to reducing the catastrophic nature of the event is to stop the spread of disease. This is generally done in three ways: (1) identification and isolation of the ill, (2) quarantine of those exposed to the illness to prevent further spread, and (3) education of the public about methods to prevent transmission. The public health and health care providers in North Dakota routinely utilize all three methods to reduce morbidity and mortality from infectious disease. However, the capacity of the health care system is limited. For example, local health jurisdictions have specific pandemic influenza response plans, and mass prophylaxis plans, but most jurisdictions have only a few staff members. Many local health jurisdictions would need to rely on volunteers, pre-scripted messages and procedures and the cooperation of the public in order to respond effectively to a large scale pandemic. Similarly, hospitals in North Dakota have emergency response and pandemic influenza plans, but little excess capacity exists to care for and/or isolate hundreds, even thousands of patients. Because of these limitations in personnel, facilities, and equipment, the health care community is planning to utilize social distancing measures. These measures which could include closure of schools, day cares and other public events would have far-reaching economic impacts on communities and might shutdown facilities for 30 days or more. Closure of the day cares or schools would have a serious impact on the economy as parents might not be able to find child care elsewhere.

The entire state is vulnerable to a major disease outbreak. As evidenced by annual infectious disease reports and reports of investigations completed by the North Dakota Department of Health, many counties experience one or multiple disease outbreaks each year. Potential casualty losses are anticipated to be greatest in counties with higher populations, higher pediatric populations and higher elderly populations as well as larger populations living in group quarters.

2010 Census Data for Population, Under Age 5, Over Age 65 and in Group Quarters Burleigh County						
Total Population 2010	Under Age 5	% Under Age 5	Over Age 65	% Over 65	Total Population In group quarters	% Total population In group quarters
81,308	5,389	6.6	10,913	13.4	2,763	3.4

Source: U.S. Census Bureau, 2010 Decennial Census

The percentage of uninsured North Dakotans for 2009 was 11 percent compared to 17 percent nationally according to the North Dakota Department of Human Services.
Source: 2014 ND DES Mitigation Plan.

Bio-Terrorism:
The following biologic agents are considered the highest bioterrorism threats (Category A) due to their ease of dissemination or person-to-person transmission, high mortality rate with potential for major public health impacts, and potential for public panic and social disruption: Anthrax, Botulism, Plague, Smallpox, Tularemia, and Viral Hemorrhagic Fevers. (Centers for Disease Control and Prevention, 2010)

Loss Estimates

According to The annual impact of seasonal influenza in the US: Measuring disease burden and costs by Molinari et al., nationally the economic burden of influenza medical costs, medical costs plus lost earnings, and the total economic burden were $10.4 billion, $26.8 billion and $87.1 billion respectively. The financial burden of healthcare-associated infections nationally has been estimated at $33 billion annually. There is no data currently available on the economic impact of previous influenza pandemic illness in North Dakota. Using pandemic influenza as the worst case scenario for estimating potential losses, the North Dakota Department of Health's Pandemic Influenza Planning includes the following vulnerability estimates. It has been estimated that a medium-level pandemic, using the CDC scenario estimates of a 30% attack rate, a 0.8% hospitalization rate among the ill, and a 0.2% mortality rate among the ill, in North Dakota:

- 192,660 persons would become ill and may require outpatient care
- 1,541 persons may require hospitalization
- 385 individuals may die

The majority of these deaths, hospitalizations, etc. would occur in more highly populated counties. Using these CDC estimates, the potential statewide and local losses are described below.

Medium-level Pandemic Potential Losses in North Dakota, Statewide			
Statewide	**Number**	**Dollar Loss per day/visit**	**Source of Data**
Illness	192,660	$15,798,120 (one visit per ill person)	Estimate of $85 per visit for out of pocket expenses related to co-pays for physician visit, laboratory and prescription drugs
Hospitalization	1,541	$2,219,040 per DAY	Kaiser State Health facts Average cost per inpatient day in 2010. North Dakota private hospitals - $1440/day
Deaths	385	$ 3,272,500 per DEATH	Headstones.usa Average cost of a funeral in North Dakota is $8,500.

Source: North Dakota Department of Health, Pandemic Flu Loss Estimates

Medium-level Pandemic Potential Losses				
	Population	**Ill**	**Hospitalized**	**Deaths**
North Dakota	642,200	192,660	1,541	385
Burleigh	69,416	24,296	680	194

Loss Estimates: Facilities/Critical Facilities

Vulnerabilities from communicable disease are not to the structures themselves but rather to the occupants. In some instances, the accessibility and functionality of a facility can be compromised. Contamination of a building could render the facility unusable until it is decontaminated or the threat has passed. Should a building become contaminated by some disease agent, clean-up costs and the loss of use of the building could result. Such costs could be significant. For example, the cleanup of anthrax in several congressional offices on Capitol Hill in September and October of 2001 cost the Environmental Protection Agency about $27 million. (US General Accounting Office, 2003) For this reason, all state-owned buildings are assumed to be at some risk from communicable disease.

The structural integrities of critical facilities are not threatened by communicable disease. If facilities supporting emergency response lost their functionality because of contamination, delays in emergency services could result. Additionally, with a significant human disease outbreak, resources such as the ambulance services, hospitals, and medical clinics could quickly become overwhelmed. Diseases can spread quickly in special needs facilities such as schools, colleges, universities, and assisted living. Often these facilities, as well as the hospitals and medical clinics, are the first places where diseases are identified and treated.

In most cases, critical infrastructure would not be affected by communicable disease. Scenarios that would affect infrastructure include the contamination of the water supplies and diseases that require special provisions in the treatment of wastewater. Should an epidemic necessitate quarantine or incapacitate a significant portion of the population, support of and physical repairs to infrastructure may be delayed, and services may be disrupted for a time due to limitations in getting affected employees to work.

Development in Identified Hazard Areas

Buildings, infrastructure, and critical facilities are not vulnerable to this hazard. It affects only persons susceptible to the illness. The impacts and potential losses are largely economic and are dependent on the type, extent, and duration of the illness. As the population of North Dakota ages, the vulnerability to this hazard is likely to increase, similarly, as additional people move to the state due to the growing oil and gas industry, exposure to this hazard is likely to increase.

Vulnerability Assessment Narrative Source: 2014 ND DES Mitigation Plan

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Dam Failure – Hazard Profile

Description

A dam is any artificial barrier, including appurtenant works, which impounds or diverts water. Dam failure is defined as a sudden, rapid, and uncontrolled release of impounded water that can create a potentially significant downstream hazard.

The storage capacity of Garrison Dam ranges from the 18-24 million acre-feet (Lake Sakakawea). The purpose of this dam includes storage of water for irrigation, hydroelectric power generation, flood control, water supply, recreation, and wildlife habitat. Should the dam fail, the consequences can be devastating.

Most dams are classified based on the potential hazard to life and property should the dam suddenly fail. Note the hazard rating is not an indicator of the condition of the dam or its probability of failure. The following hazard categories have been established for North Dakota according to the North Dakota Design Handbook (North Dakota State Engineer, June 1985:

Low Hazard: These dams are located where there is little possibility of future development such as rural or agricultural areas. Failure of low hazard dams may result in damage to agricultural land, township and county roads, and non-residential farm buildings. No loss of life is expected if failure occurs.
Medium Hazard: These dams are located in predominately rural or agricultural areas where failure may damage isolated homes, main highways, railroads, or cause interruption of minor public utilities. The potential for the loss of a few lives exists if the dam fails.
High Hazard: These are dams located upstream of developed and urban areas where failure may cause serious damage to homes, industrial and commercial buildings, and major public utilities. There is a potential for the loss of more than a few lives if the dam fails.
(North Dakota State Engineer, 1985)

High Hazard Dams affecting Bismarck

Dam Name	River	Location	Owner
Garrison Dam *Maximum storage:* *23.8 million acre feet*	Missouri River	McLean County	US Army Corps of Engineers
Jackman Coulee Dam 2	Jackman Coulee	Bismarck	Bismarck
Note: Jackman Coulee Dam 2 is addressed in the "Flood" hazard analysis.			
Fort Peck Dam *Maximum storage:* *19.1 million acre feet*	Missouri River	McCone County, Montana	USACE

Currently, dams with a storage capacity greater than 1,000 acre-feet are required to have an Emergency Action Plan, in accordance with the ND Century Code and ND Administrative Code.

Jackman Coulee Dam 2 in Bismarck is not required to have an EAP (Emergency Action Plan).
Source: North Dakota State Water Commission, 2013.

There are many potential causes for dam failure including hydrologic inadequacy, seepage related issues, structural problems, mechanical problems, operational errors, earthquakes, and terrorism. The causes behind a dam failure can be interrelated and complex. The most common causes of dam failure are hydrologic inadequacy and seepage related issues.

Hydrologic Failures

Hydrologic failures are typically associated with flood events. A hydrologic failure may occur due to dam overtopping or excessive spillway erosion. A dam can be overtopped during a flood event due to insufficient reservoir storage and insufficient spillway capacity. Earthen dams are particularly susceptible to failure when overtopped since earthen material may erode relatively easily. Some dams have an earthen auxiliary spillway designed to carry excess flows during a flood event. Since these are earthen spillways, some erosion can be expected, but under the right conditions excessive erosion can occur. (North Dakota State Water Commission, 2007)

Seepage Failures

All dams have some seepage occurring through the structure and foundation. Seepage, if uncontrolled, can erode material from the embankment of an earthen dam and lead to complete failure of the dam. Piping is a special seepage problem where erosion starts at the point where seepage is exiting the downstream slope or foundation, then works backwards toward the upstream slope. Internal erosion, another type of seepage failure, occurs when water flowing through the dam causes erosion along a crack in the embankment or foundation, or along some other discontinuity or preferential flow path in the embankment, such as along a spillway conduit. Tree roots and animal burrows can also provide paths for seepage. Seepage failures can occur during the course of normal operations, but can also occur during flood conditions when reservoir levels are abnormally high. (North Dakota State Water Commission, 2007)

Garrison Dam Profile

(Source Data: US Army Corps of Engineers, Omaha District)

Garrison Dam is the fifth largest earthen dam in the world. It was constructed as part of the Pick-Sloan Plan for development of the upper Missouri River Basin. Construction of the $294 million dam project began in 1947 and closure of the embankment occurred in April 1953.

Project Statistics

The main features of Garrison Dam are the embankment power plant, spillway and outlet works. The embankment is 2-1/2 miles long and stands 210 feet high. The dam is 2,050 feet wide at the base and tapers off to 60 feet wide at the top. It contains 66.5 million cubic yards of earth fill and 1.5 million cubic yards of concrete.

Power Plant

The power plant consists of five generating units with a total capacity of 515,000 kilowatts. These generators produce 1.8 to 2.6 billion kilowatt-hours of electricity a year. Electrical power is transmitted from the project through seven transmission lines to various substations and is marketed by Western Area Power Administration at the Watertown Dispatch Office in South Dakota.

Intake
The purpose of the Intake Structure is to house the necessary hoisting equipment, gates and auxiliary equipment for the eight water tunnels. Five of the tunnels are for power generation and three are for regulating water releases.

- Height 249 Feet
- Length 540 Feet
- Width 170 Feet

The structure is 7 feet, 8 inches higher than the 18 story N.D. State Capitol building; its base slab is 540 feet long compared to the Capitol's 402 foot length. This structure regulates and directs water flow into the eight water tunnels. The water in the reservoir covers most of the structure, rising nearly to the top of the service bridge piers.

Spillway
The purpose of the Spillway is to control the water level during an emergency situation. The Spillway has 28 gates. Each gate is 29 feet high by 40 feet wide. The total length of the Spillway is almost 3200 feet and was designed for a maximum discharge capacity of 827,000 cubic feet per second at an elevation of 1858.5 mean sea level (MSL). Water released through the gates can reach a speed of 75 miles per hour en route to the stilling basin. The spillway chute contains 42 acres of concrete 18 inches thick. The stilling basin at the end of the chute contains 20 acres of concrete up to a thickness of 5 feet.

***2011 Flooding**: During this flood event, the spillway gates at Garrison Dam were opened for the first time since the dam was built in the 1950s. As of June 1, the Spillway was used to release flood waters. The maximum release was 151,000 CFS on June 25, 2011. While the dam was not in any danger of failure, the record water levels were an historic event. Garrison Dam is a high hazard dam on the Missouri River owned by the US Army Corps of Engineers.*

Video: Garrison Dam Historic Spillway Gate Opening:
http://www.dvidshub.net/video/153064/garrison-dam-historic-spillway-gate-opening#.VAhr-fMo6Uk
Shortly before 8 a.m. on June 1, 2011, the U.S. Army Corps of Engineers opened the gates to pass flood waters for the first time from the Garrison Dam spillway. Seven gates were opened to the height of one foot each to release some 7,500 cubic feet per second of floodwaters. By Kevin Wingert, U.S. Army Corps of Engineers, Omaha District.

The Lake
Lake Sakakawea, formed behind Garrison Dam, is one of the largest man-made lakes in the United States, extending 178 miles from the dam northwest to Williston, N.D.

The lake averages between two and three miles in width and is six miles wide at its widest point. The maximum depth of the lake is 180 feet at the face of the dam. At normal operating pool (1850 feet mean sea level), the lake covers 368,000 acres, has 1,300 miles of shoreline, and can store nearly 23 million acre-feet of water. That amount of water would cover the entire state of North Dakota with about six inches of water. The drainage area of the lake is about 181,400 square miles.

Garrison Project Statistics:

http://www.nwo.usace.army.mil/Media/FactSheets/FactSheetArticleView/tabid/2034/Article/487634/garrison-project-statistics.aspx

Risk

Risk: the potential for damage, loss, or other impacts created by the interaction of hazards with community assets.

Risk Assessment: product or process that collects information and assigns values to risks for the purpose of informing priorities, developing or comparing courses of action, and informing decision making.

THIRA Ratings – Catastrophic Dam Failure (Garrison Dam)

Frequency	Consequence			
	Human	Economic	Psychological	Government
Unlikely	Catastrophic	Catastrophic	Significant	Catastrophic

Note: Jackman Coulee Dam 2 is addressed in the "Flood" hazard analysis.

HISTORY:
North Dakota does not have a history of significant dam failures in the state.

The dam failure probability is somewhat low based on a minimal history of significant events and the regular inspection and upkeep of the high hazard dams. Should a high or significant hazard dam fail, that event would be considered a high magnitude event. The loss of property, services, and even life could result.

Vulnerability Assessment

Vulnerability: Characteristics of community assets that make them susceptible to damage from a given hazard.

Note: Jackman Coulee Dam 2 is addressed in the "Flood" hazard analysis. For Partial Failure, see Flood Hazard – refer to 100 and 500 Year flood information.

Scenario	Garrison Dam Catastrophic Failure
Probability	Unlikely (THIRA rating)
Speed of Onset	10-23 Hours See page 12
Geographic Area	See maps: pages 13 - 15
Death / Injury 1. Primary Causes A. Highest vulnerability	 1. Drowning or "stranded" for a long period of time without necessary supplies and ability to communicate the need for help. A. Those who choose not to evacuate – or do not have the means to evacuate – and do not receive assistance. B. Those who do not receive warnings and other emergency public information in a timely manner. C. Prison Population – ND State Penitentiary
Mass Casualty Incident	Yes, potentially Catastrophic due to special populations requiring evacuation
Property Losses (points of vulnerability – high priority)	1. All Structures within affected area. See Dam Failure maps pages 13-15. See pages 6 -7 for loss estimates.

Environmental	1. All Structures within affected area – all contents and building materials contribute to environmental hazards 2. Debris / hazardous materials, contaminated flood waters 3. Septic systems 4. Hazmat facilities 5. Household hazardous materials released
COG/COOP	1. Bismarck PD 2. Combined Communications / EOC 3. Waste Water Treatment Plant 4. Water Treatment Plant 5. Public Works 6. Public Health 7. South Fire Station 8. Employee / Family impact – availability of personnel
Critical Facilities	1. See COG/COOP above. 2. See pages 8-9 for list of critical facilities.
Critical Infrastructure	1. All Critical Infrastructure within the inundated areas would be destroyed or inaccessible. See pages 10-11 for list of critical infrastructure within dam failure impact area.
Schools	1. All Schools south of Rosser. See page 9 for list of schools within dam failure impact area. 2. Schools, if open, may be overwhelmed with additional student population. Many families, however, may have evacuated Bismarck and relocated to other communities.
High Risk Facilities (chemical)	1. There are approximately 145 facilities storing hazardous materials within the dam failure impact area. The majority are NOT Tier II facilities.
Specific Populations: Public Assembly, Vulnerable / Special Populations	1. Dakota Zoo – not likely to be able to relocate. 2. Non-ambulatory population requiring evacuation assistance. 3. State Penitentiary population. 4. Bismarck Transition Center 5. Crescent Manor 6. Hospital (patient) population
Economy (community wide)	Catastrophic – years/decades to recover
OTHER:	Bismarck <u>Population Displaced</u> as a result of catastrophic dam failure: Approximately **20,356** based on 2010 Census Block information.

Bismarck Critical Facilities and Infrastructure Values Note: Values identified in the table below are additional impacts beyond those identified within the previous table entitled "Impact Analysis – Catastrophic Dam Failure." Properties within this table are limited to those within the inundation area as mapped.			
Group	**Building Property**	**Personal Property**	**Outdoor Property**
Airport	$31,374,921.00	$1,247,496.00	$70,186.00
Bis-Man Transit	$6,115,317.00	$152,965.00	$0.00
Bismarck Public Health Center	$6,137,221.00	$749,215.00	$0.00
Civic Center	$96,225,286.00	$2,651,686.00	$307,961.00
Emergency Management	$1,562,806.00	$1,224,435.00	$971,532.00
Fire Department - South	$2,992,131.00	$802,723.00	$0.00
Multi-Tenant Retail Building	$1,657,072.00	$0.00	$0.00
Northern Plains Commerce Centre	$561,762.00	$13,147.00	$0.00
Parking Authority	$23,223,256.00	$17,806.00	$0.00
Police Department	$9,421,669.00	$1,161,392.00	$924,004.00
Public Works	$15,190,932.00	$655,839.00	$23,281.00
Wastewater Treatment Plant	$7,909,929.00	$4,838,887.00	$436,457.00
Water & Sewer	$4,402,943.00	$0.00	$0.00
Water Treatment Plant	$47,112,487.00	$316,050.00	$233,100.00
Totals	**$253,887,732.00**	**$13,831,641.00**	**$2,966,521.00**
GRAND TOTAL			**$270,685,894.00**

Source: 2014-2015 State Fire and Tornado Insurance Data. Values reflect only properties within Dam Failure Spillway.

Impact Analysis – Catastrophic Dam Failure	
Values within this table reflect 6,506 parcels of 7,376. The remaining 870 parcels are tax exempt properties and are not reflected in the totals within this table.	
Land Value	$447,683,000
Building Value Impact	$1,628,219,000
Total Property Impact	**$2,075,902,000**

Source: Bismarck GIS, 2014

Tax Exempt Property Values NOT included in the total above include parcels with the following designations: 5-year remodeling, blind, charitable, county, disabled person, disabled veteran, Federal, fire levy, graveyard, hospital or homes, lodges, municipal, municipal parks, new business, non-profit, paraplegic wheelchair, religious, school district, state assessed, state owned, homestead credit, payment in lieu of taxes, and renaissance zone project.

CRITICAL FACILITIES Within Dam Failure Impact Area	
City of Bismarck	
Facility	**Location**
Bismarck Airport	2301 UNIVERSITY DR UNIT 17
Bismarck Civic Center	315 S 5TH ST
Bismarck Police Department	700 S 9TH ST
City / County Office Building	221 N 5TH ST
Combined Communications	2301 UNIVERSITY DR
Fire Station 2 - South	835 E BISMARCK
Public Health -Bismarck/Burleigh	500 E FRONT AV
Burleigh County	
Burleigh County Courthouse	514 E THAYER AV
Burleigh County Social Services	316 N 5TH ST
Regional Jail (future development)	
State and Federal Government	
Air Guard	3410 AIRWAY AV
Federal Aviation Agency	2000 UNIVERSITY DR
Federal Building (old)	304 E BROADWAY AV
National Guard - Fraine Barracks	432 FRAINE BARRACKS RD
National Weather Service	2301 UNIVERSITY DR
ND Department Of Health Lab	2635 E MAIN AV
ND Department Of Transportation	218 AIRPORT RD
ND Dept of Health Warehouse	1200 INDUSTRIAL DR, 2
ND DES	35 FRAINE BARRACKS RD
ND State Forensics	2637 E MAIN AV
ND State Lab	2641 E MAIN AV
Post Office	220 E ROSSER AV
State Penitentiary	3303 E MAIN AV
US Postal Processing & Distribution	2220 E BISMARCK EX
Medical and Emergency Services	
Family Practice Center UND	701 E ROSSER AV
Medical Arts Building	810 E ROSSER AV
Metro Area Ambulance South	1139 MEMORIAL HY
Mid Dakota Clinic	401 N 9TH ST
MRI Center	720 E ROSSER AV
Q & R Clinic	222 N 7TH ST
Salvation Army	601 S WASHINGTON ST
Sanford Clinic - South	1040 TACOMA AV
Sanford Health Center	300 N 7TH ST
Sanford Health Powerhouse	310 N 8TH ST
Sanford Health Warehouse	1112 S 12TH ST
St. Alexius Hospital	900 E BROADWAY AV
St. Alexius Purchasing / Warehouse	1300 INDUSTRIAL DR
Communications and Utility Facilities	
Century Link	220 N 5TH ST
MDU	909 AIRPORT RD
Public/Private Critical Facilities	
Bismarck Lumber	2200 E MAIN AV
Bismarck Public School Facilities & Transportation	705 S 9TH ST
Bismarck Transition Center	2001 LEE AV
Bismarck Tribune	707 E FRONT AV
Cash Wise Foods	1144 E BISMARCK
Community Access TV	307 N 4TH ST
Dan's Supermarket - South	835 S WASHINGTON ST
United Blood Service	517 S 7TH ST

CRITICAL FACILITIES Within Dam Failure Impact Area	
City of Bismarck	
Railroad Transportation Facility	
DMVW RR	3501 E ROSSER AV
Schools	
Victor Solheim Elementary South Central High School Dorothy Moses Elementary Jeanette Myhre Elementary Wachter Middle School St. Mary's Elementary United Tribes – Daycare United Tribes – Elementary School (2 buildings) United Tribes Technical College Prairie Rose Elementary Ascension Church School Ehrmantraut Academy First Presbyterian Church – Daycare Noah's Ark Daycare Emmanuel Christian School ECLC Sanford College of Nursing Open Door Community Center Shepherd of the Valley School Super Kids Jr. Academy Shepherd of the Valley Preschool Hair Academy Angel Academy Discovery Daycare Preschool Program - House of Prayer	

CRITICAL INFRASTRUCTURE Within Dam Failure Impact Area	
City of Bismarck	
Facility	**Location**
Combined Communications	2301 UNIVERSITY DR
Wastewater Treatment Plant	601 W LONDON AV
Water Treatment Plant	615 RIVER RD
Sanitary Sewer Pump Station	100 E INDIANA AV
Sanitary Sewer Pump Station	2516 RIVER RD
Sanitary Sewer Pump Station	850 E WACHTER AV
Sanitary Sewer Pump Station	810 S 26TH ST
Sanitary Sewer Pump Station	3701 E BISMARCK EX
Sewer Lift Station	511 South Washington
Sewer Lift Station	1203 Memorial Highway
Sewer Lift Station	2200 South Washington
Sewer Lift Station	125 East Reno
Sewer Lift Station	525 West Reno
Sewer Lift Station	1740 South Reno
Sewer Lift Station	3108 Manchester Street
Sewer Lift Station	1700 River Road
Sewer Lift Station	3701 Morrison Avenue
Sewer Lift Station	300 Santa Fe
Sewer Lift Station	4053 Downing Street
Sewer Lift Station	3200 Rutland Drive
Transportation	
Bis-Man Transit	3750 E ROSSER AV
Communications	
Clear Channel Radio - KFYR/Y93	3500 E ROSSER AV
CellularTower	2301 UNIVERSITY DR
CellularTower	WEST OF 2301 UNIVERSITY DR
Utility	
MDU Operations	400 N 4TH ST
Montana-Dakota Utilities Bismarck Service Center	909 Airport Rd
Western Area Power Administration - Bismarck Substation	
Substation – South Washington Street	South of Burleigh Ave, North of Glenwood Dr.
4th and Front Substation	Front Avenue
Kirkwood Substation	South 7th Street and Arbor Avenue
Sweet Avenue Junction Substation	402 East Sweet Avenue
26th & Expressway Substation	26th Street and Expressway
Pipeline at Missouri River	WEST OF 4051 SANDY RIVER RD
Power Line at Missouri River	WEST OF 6948 BURNT CREEK LP
Power Line at Missouri River	WEST OF 5716 MISTY WATERS DR
Boat Ramps	

CRITICAL INFRASTRUCTURE Within Dam Failure Impact Area	
City of Bismarck	
Fox Island Boat Ramp	NORTH OF 2650 MILLS AV
Grant Marsh Bridge Boat Ramp	NORTH OF 1103 RIVER RD
Bridge Locations	
Bridge: 3rd St over drainage ditch	SOUTHEAST OF 1922 S 3RD ST
Bridge: Bismarck Ex over Missouri River	BISMARCK EXPRESSWAY BRIDGE OVER MISSOURI RIVER
Bridge: Bismarck Ex over Railroad	WEST OF 3310 E BISMARCK EX
Bridge: east bound I-94 over Railroad	I-94 OVER RAILROAD
Bridge: Lincoln Rd over Apple Creek	WEST OF 5151 LINCOLN RD
Bridge: Main Av over Missouri River	WEST OF 100 RIVERSIDE PARK RD
Bridge: Main Av over Washington St	WEST OF 311 W MAIN AV
Bridge: Railroad over 7th St	SOUTHWEST OF 705 E MAIN AV
Bridge: Railroad over 9th St	SOUTHWEST OF 901 E MAIN AV
Bridge: Railroad over Apple Creek	SOUTH OF 7301 APPLE CREEK RD
Bridge: Railroad over Main Av	SOUTH OF 906 MISSOURI AV
Bridge: Railroad over River Rd and Missouri River	NORTH OF 1103 RIVER RD
Bridge: Railroad over Washington St	NORTHWEST OF 260 W FRONT AV
Bridge: Riverwood Dr	2300 RIVERWOOD DR
Bridge: Rosser Av Over Hay Creek	NORTH OF 3605 E ROSSER AV
Bridge: Southport Lp	1500 SOUTHPORT LP
Bridge: Tavis Rd	3300 TAVIS RD
Bridge: University Dr Apple Creek	WEST OF 5701 APPLE CREEK DR
Bridge: Wachter over Drainage Ditch	800 WACHTER AV E
Bridge: Washington over Drainage Ditch	2201 WASHINGTON ST
Bridge: West Bound I-94 over Railroad	I-94 OVER RAILROAD
Railroad / Railroad Crossing Locations	
Railroad Crossing at 12th St	SOUTHEAST OF 1131 E MAIN AV
Railroad Crossing at 24th St	WEST OF 2407 RAILROAD AV
Railroad Crossing at 24th St	NW OF 2400 E FRONT AV
Railroad Crossing at 24th St N	SE OF 2321 E BROADWAY AV
Railroad Crossing at 26th St	SOUTHWEST OF 207 S 26TH ST
Railroad Crossing at 26th St	SE OF 210 S 26TH ST
Railroad Crossing at 26th St	EAST OF 114 N 26TH ST
Railroad Crossing at 3rd St	SOUTHWEST OF 1003 S 3RD ST
Railroad Crossing at 5th St	SOUTHWEST OF 113 S 5TH ST
Railroad Crossing at 66th St	NORTHEAST OF 1580 66TH ST SE
Railroad Crossing at 93rd St	NORTH OF 1800 93RD ST SE
Railroad Crossing at Airport Rd	SOUTHEAST OF 1833 E MAIN AV
Railroad Crossing at Divide Av	SE OF 3500 DIVIDE AV E
Railroad Crossing at Eastdale Dr	SW OF 109 EASTDALE DR
Railroad Crossing at Fraine Barracks	EAST OF 600 RIVER RD
Railroad Crossing at Front Av	EAST OF 2201 E FRONT AV
Railroad Crossing at Main Av	NORTH OF 2409 E MAIN AV
Railroad Crossing at Morrison Av	3810 MORRISON AV
Railroad Crossing at Railroad Av	SE OF 2516 RAILROAD AV
Railroad Crossing at Rosser Av	EAST OF 3422 E ROSSER AV
Railroad Crossing at Vermont Av	NW OF 2220 VERMONT AV
Railroad Crossing at Yegen Rd	EAST OF 1200 YEGEN RD
Railroad Crossing at Yegen Rd	SE OF 910 YEGEN RD
Railroad Over Hay Creek	EAST OF 3120 E CAPITOL AV
Railroad Over Hay Creek	SE OF 2920 E CAPITOL AV

Garrison Dam Failure - Inundation Map

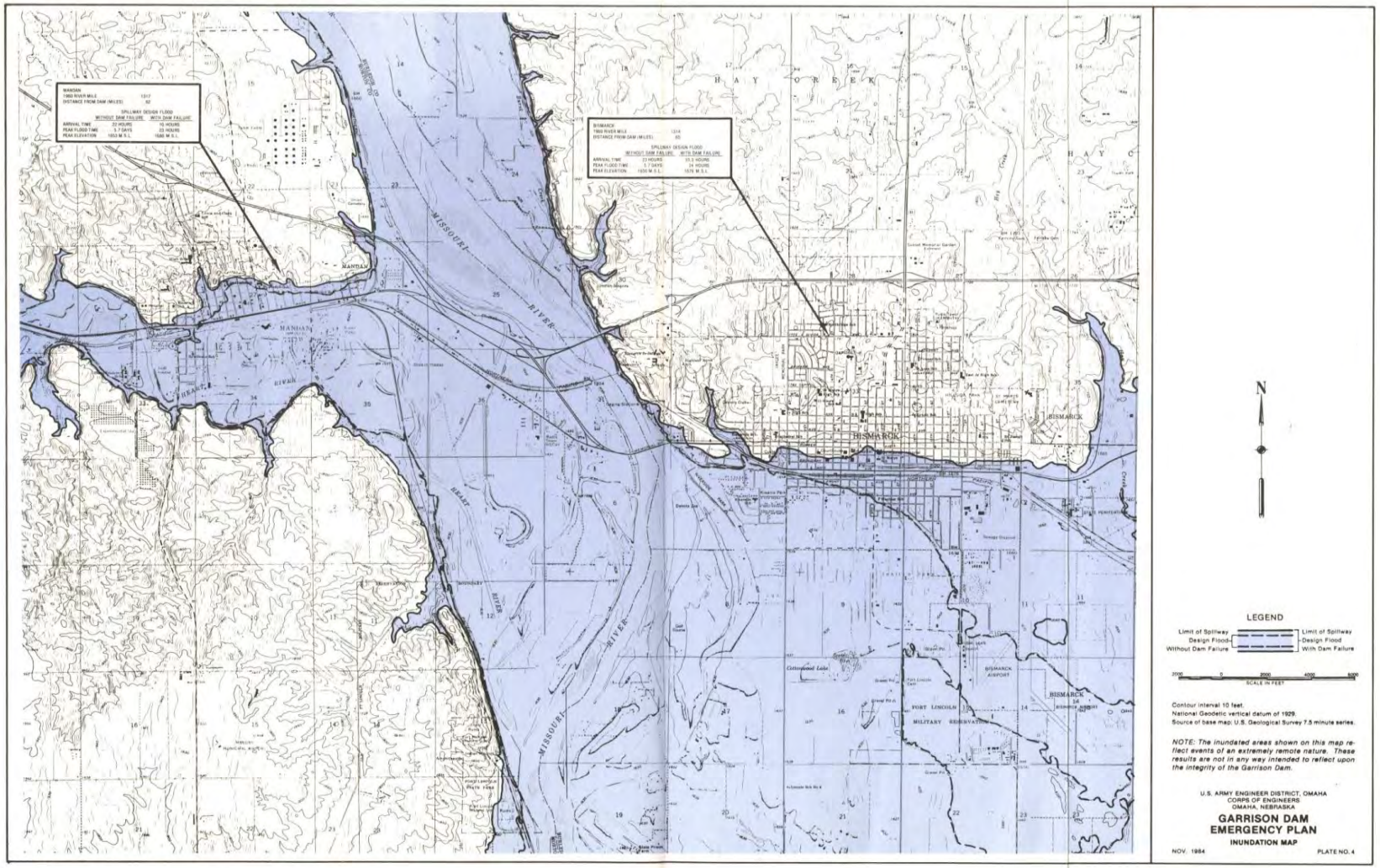
See Garrison Dam Emergency Plan Inundation Map developed by
US Army Corp of Engineers, Omaha District. Publish date: November 1984.
Information regarding Bismarck is enlarged and included below.
(See map - next page)

Bismarck
1960 River Mile: 1314
Distance From Dam: 65

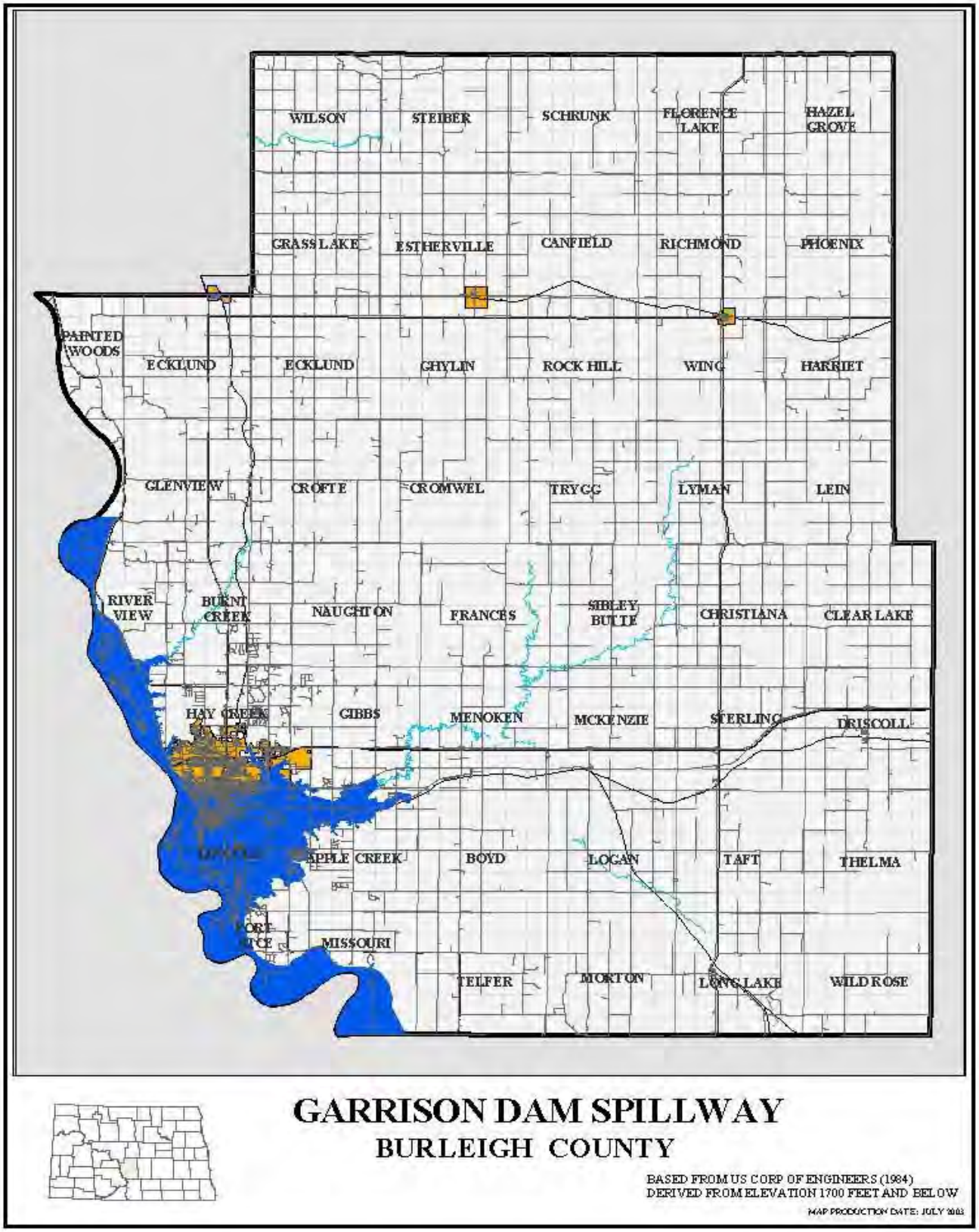
Spillway Design Flood

	Without Dam Failure	With Dam Failure
Arrival Time	23 hours	10.3 hours
Peak Flood Time	5.7 days	24 hours
Peak Elevation	1650 MSL	1675 MSL

Note: The information regarding the Garrison Dam Spillway and inundation maps are intended to be used as a general guideline. The information and mapping regarding the Garrison Dam Spillway contained in this plan was developed by the US Army Corp of Engineers, Omaha District. The information and related maps were published in November of 1984. Changes in topography, new construction, and other various factors may influence or alter the data and inundation maps.


MANDAN
1960 RIVER MILE 1317
DISTANCE FROM DAM (MILES) 82
SPILLWAY DESIGN FLOOD
WITHOUT DAM FAILURE WITH DAM FAILURE
ARRIVAL TIME 22 HOURS 15 HOURS
PEAK FLOOD TIME 3.7 DAYS 23 HOURS
PEAK ELEVATION 1653 M.S.L. 1686 M.S.L.
BISMARCK
1960 RIVER MILE 1314
DISTANCE FROM DAM (MILES) 85
SPILLWAY DESIGN FLOOD
WITHOUT DAM FAILURE WITH DAM FAILURE
ARRIVAL TIME 22 HOURS 15.5 HOURS
PEAK FLOOD TIME 3.7 DAYS 24 HOURS
PEAK ELEVATION 1650 M.S.L. 1676 M.S.L.
HAY CREEK
MISSOURI RIVER
MANDAN
BISMARCK
FORT LINCOLN MILITARY RESERVATION
BISMARCK AIRPORT
N
LEGEND
Limit of Spillway Design Flood Without Dam Failure
Limit of Spillway Design Flood With Dam Failure
SCALE IN FEET
Contour interval 10 feet.
National Geodetic vertical datum of 1929.
Source of base map: U.S. Geological Survey 7.5 minute series.
NOTE: The inundated areas shown on this map reflect events of an extremely remote nature. These results are not in any way intended to reflect upon the integrity of the Garrison Dam.
U.S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA
GARRISON DAM
EMERGENCY PLAN
INUNDATION MAP
NOV. 1984
PLATE NO. 4

Bismarck
Garrison Dam
Inundation Map
Garrison Dam Spillway
Source: US COE - Omaha District - November 1984
Map Production Date: June 5, 2006
ADOBE DR
64TH AV NW
OAKFIELD DR
57TH AV NW
RIVER RD
FERNWOOD DR
HALIFAX ST
RIDGEDALE ST
26TH ST NE
57TH AV NE
62ND ST
MEDORA AV
ASH COULEE DR
SLATE DR
SOURIS ST
83 HY NE
VALHALLA DR
BOUNDARY RD
CENTENNIAL RD
52ND ST NE
15TH ST N
26TH ST N
43RD AV NE
VALLEY DR
BUCKSKIN AV
MONTREAL ST
STATE ST
GLENDALE DR
ROOSEVELT DR
VALLEY DR
CODY DR
ASPEN AV
CHISHOLM TR
CLAIRMONT RD
TYLER PY
CENTURY AV W
CENTURY AV E
NEBRASKA DR
YORKTOWN DR
INTERSTATE 94 HY
INTERSTATE AV E
I-94
WASHINGTON ST N
19TH ST N
DIVIDE AV E
CAPITOL AV E
CANARY AV
DIVIDE AV W
3RD ST N
23RD ST N
LILAC LN
20TH AV NE
17TH AV NE
66TH ST NE
EDWARDS AV
WARD RD
15TH ST N
BOULEVARD AV E
33RD ST N
BISMARCK EX N
52ND ST N
66TH ST N
F AV E
E AV E
D AV E
4TH ST N
26TH ST N
35TH ST N
A AV W
B AV W
1ST ST N
9TH ST N
ROSSER AV E
A AV E
MAIN HY E
MAIN ST E
MEMORIAL HY
MAIN AV E
BROADWAY AV E
SOUTH VIEW LN
BOWEN AV W
3RD ST S
7TH ST S
10TH ST S
15TH ST S
22ND ST S
26TH ST S
BURLINGTON DR
66TH ST S
BISMARCK EX W
BISMARCK EX E
APPLE CREEK RD
PARK AV
LEE AV
FULLER AV
YEGEN RD
UNIVERSITY DR
BILLINGS DR
AIRPORT RD
AIRWAY AV
SYKES ST
MUNICH DR
RENO DR S
12TH ST S
SABER DR
HARBOR DR
RIVERWOOD DR
NAPA LP
66TH ST SE
LARSON RD
WASHINGTON ST S
FAR WEST DR
BURLEIGH AV E
HIGH PLAINS RD
AIRWAY AV
LINCOLN RD
SANTEE RD
ECKLESON RD
ENGLAND ST
LANCASHIRE ST
ASHLEE AV
12TH ST SE
CENTURION DR
CUSTER DR
HUBER DR
48TH AV SW
48TH AV SE
PRESTON LP
GLENWOOD DR
52ND ST SE
S WASHINGTON ST
S 12TH ST
SIBLEY DR
APPLE CREEK DR
62ND AV SE
MCDONALD DR
N RILLING RD
SOUTHRIDGE LN
SCENIC DR


WILSON
STEIBER
SCHRUNK
FLORENCE LAKE
HAZEL GROVE
GRASS LAKE
ESTHERVILLE
CANFIELD
RICHMOND
PHOENIX
PAINTED WOODS
ECKLUND
ECKLUND
GHYLIN
ROCK HILL
WING
HARRIET
GLENVIEW
CROFTE
CROMWEL
TRYGG
LYMAN
LEIN
RIVER VIEW
BURNT CREEK
NAUGHTON
FRANCES
SIBLEY BUTTE
CHRISTIANA
CLEAR LAKE
HAY CREEK
GIBBS
MENOKEN
MCKENZIE
STERLING
DRISCOLL
APPLE CREEK
BOYD
LOGAN
TAFT
THELMA
MISSOURI
TELFER
MORTON
LONG LAKE
WILD ROSE
GARRISON DAM SPILLWAY
BURLEIGH COUNTY
BASED FROM US CORP OF ENGINEERS (1984)
DERIVED FROM ELEVATION 1700 FEET AND BELOW
MAP PRODUCTION DATE: JULY 2003

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Drought – Hazard Profile

Description

Drought is a condition of climatic dryness severe enough to reduce soil moisture below the minimum necessary for sustaining plant, animal, and human life systems. Drought characteristics usually include precipitation levels well below normal and temperatures higher than normal. Under these conditions, topsoil crumbles and is lost due to wind erosion. Streams, ponds, and wells often dry up and water levels in lakes and rivers drastically fall, creating severe strain on vegetation, wildlife, and livestock. Although the agricultural economy may be more negatively impacted, urban economies are also constrained when the amount of domestic and industrial water is in short supply. Prolonged droughts have caused severe economic hardships in North Dakota.

The following is an excerpt from the National Drought Mitigation Center:
Drought is an insidious hazard of nature. Although it has scores of definitions, it originates from a deficiency of precipitation over an extended period of time, usually a season or more. This deficiency results in a water shortage for some activity, group, or environmental sector. Drought should be considered relative to some long-term average condition of balance between precipitation and evapotranspiration (i.e., evaporation + transpiration) in a particular area, a condition often perceived as "normal." It is also related to the timing (i.e., principal season of occurrence, delays in the start of the rainy season, occurrence of rains in relation to principal crop growth stages) and the effectiveness (i.e., rainfall intensity, number of rainfall events) of the rains. Other climatic factors such as high temperature, high wind, and low relative humidity are often associated with it in many regions of the world and can significantly aggravate its severity.
(National Drought Mitigation Center, 2007)

Scientifically, drought can mean many things to many people, depending on the discipline and perspective of the individual. Operational definitions are used to help quantify the beginning, end, and degree of severity of a drought. The following definitions were provided by the National Drought Mitigation Center.

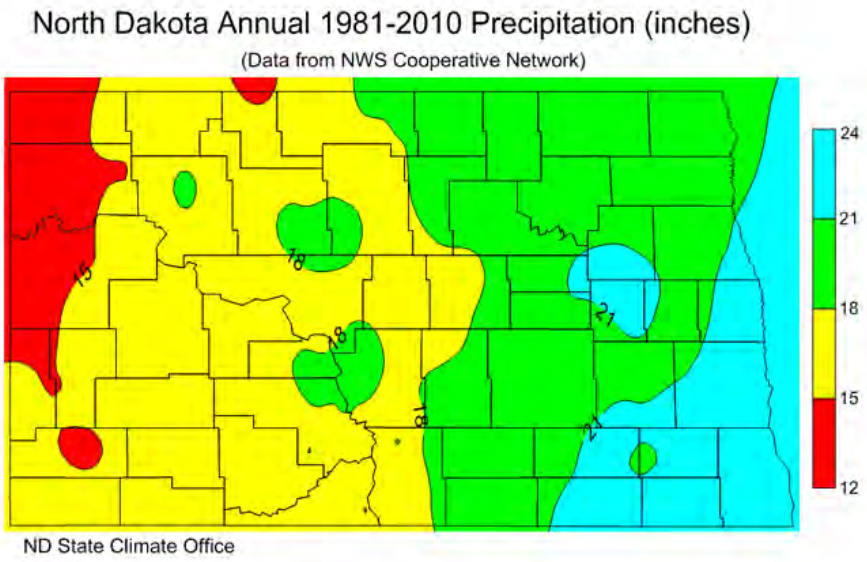
Meteorological drought is usually an expression of precipitation's departure from normal over some period of time. These definitions are usually region-specific, and presumably based on a thorough understanding of regional climatology.

Agricultural drought occurs when there isn't enough soil moisture to meet the needs of a particular crop at a particular time. Agricultural drought happens after meteorological drought but before hydrological drought. Agriculture is usually the first economic sector to be affected by drought.

Hydrological drought refers to deficiencies in surface and subsurface water supplies. It is measured as streamflow and as lake, reservoir, and groundwater levels. There is a time lag between lack of rain and less water in streams, rivers, lakes, and reservoirs, so hydrological measurements are not the earliest indicators of drought. When precipitation is reduced or deficient over an extended period of time, this shortage will be reflected in declining surface and subsurface water levels.

Socioeconomic drought occurs when physical water shortage starts to affect people, individually and collectively. Or, in more abstract terms, most socioeconomic definitions of drought associate it with the supply and demand of an economic good.
(National Drought Mitigation Center, 2007)

Annual precipitation in North Dakota ranges from 12 inches in the west to 24 inches in the southeast. About 75% of the annual precipitation occurs during the crop season from April to September.
(High Plains Regional Climate Center, 2007)



Source: North Dakota State Climate Office, 2014.

Drought effects regarding agriculture depend on time of year, timing of precipitation, amount of stored soil moisture, type of crop, stage of growth, and meteorological variables such as temperature, humidity, and wind. Precipitation deficits as little as four to six inches can cause severe agricultural drought conditions.

A wide range of possible social and economic consequences normally occurs during a prolonged drought. The effects of drought first strike individual farmers and ranchers, who suffer loss of income, increased indebtedness, possible bankruptcy, and dislocation. Regionally, drought can cause increased unemployment, economic disruption, migration intensity, and regional instability. A nation may be affected by increased government payments to the agricultural sector, foreign trade losses, rising prices, food shortages, and health problems. Worldwide effects include severe health problems, disruption of world social systems, international conflict, starvation, and famine.

Hydrological droughts affecting tourism/recreation, energy development, food processing, and other industries are usually related to surface water levels in area lakes and rivers that serve as water sources. Reduced water levels can lower production and threaten the ability to produce energy at an acceptable rate, thus, having significant economic ramifications. Water-related recreation can become less desirable or even impossible with the effects of such extending into the economic well-being of tourism and recreation businesses.

A number of secondary hazards are generally associated with drought. Rural grassland fires increase due to dry vegetation. Reduction in vegetation will expose the soil to wind erosion. Reduced flow characteristics adversely affect chemical quality of lakes and rivers. Sediment transport regimes in streams and rivers are altered. Deterioration of water quality results in injury and death to plants and animals. Stagnant pools along rivers provide favorable habitat for insects, particularly mosquitoes. When normal rain patterns develop, the dry, unstable topsoil becomes vulnerable to gullies and flooding.

Effects of drought accumulate slowly but tend to persist over long periods. Determining whether conditions warrant drought status versus an extended dry spell is difficult and experts often disagree. However, a typical drought in North Dakota would most likely begin with limited winter snowfall, deficient spring precipitation accompanied by warmer than normal temperatures and windy conditions. At this point, normal spring greening does not occur causing a shortage of natural livestock feed. Spring planting plans most likely change. Fire danger to grasslands begins to increase. Growth and production of cash crops and feed grains become questionable. Continued drought negatively affects farm income, ultimately affecting agriculture-related businesses. Besides crop loss, recreational opportunities are reduced and hydroelectric power production is affected. Drought causes serious economic problems for the entire State of North Dakota.

Several drought indices are used to measure a drought's severity and any combination of these indices and others may be used to trigger a wide variety of response activities by governments, individuals, and organizations.

The table below lists the more common indices and their use.

Index	**Use**
Percent of Normal	The percent of normal is a simple calculation well suited to the needs of television weathercasters and general audiences.
Standardized Precipitation Index (SPI)	The SPI is an index based on the probability of precipitation for any time scale.
Palmer Drought Severity Index (PDSI)	The Palmer is a soil moisture algorithm calibrated for relatively homogeneous regions.
Crop Moisture Index (CMI)	A Palmer derivative, the CMI reflects moisture supply in the short term across major crop-producing regions and is not intended to assess long-term droughts.
Surface Water Supply Index (SWSI)	The SWSI was originally designed to complement the Palmer in the State of Colorado, where mountain snowpack is a key element of water supply. The SWSI is calculated by river basin, based on snowpack, streamflow, precipitation, and reservoir storage. Other states have modified the SWSI for their areas.
Reclamation Drought Index (RDI)	Like the SWSI, the RDI is calculated at the river basin level, incorporating temperature as well as precipitation, snowpack, streamflow, and reservoir levels as input.
Deciles	Groups monthly precipitation occurrences into deciles so that, by definition, "much lower than normal" weather cannot occur more often than 20% of the time.

Source: National Drought Mitigation Center, 2013

RISK

Risk: the potential for damage, loss, or other impacts created by the interaction of hazards with community assets.

Risk Assessment: Product or process that collects information and assigns values to risks for the purpose of informing priorities, developing or comparing courses of action, and informing decision making.

THIRA Ratings – Drought (severity = *D4 "exceptional drought" via US Drought Monitor)

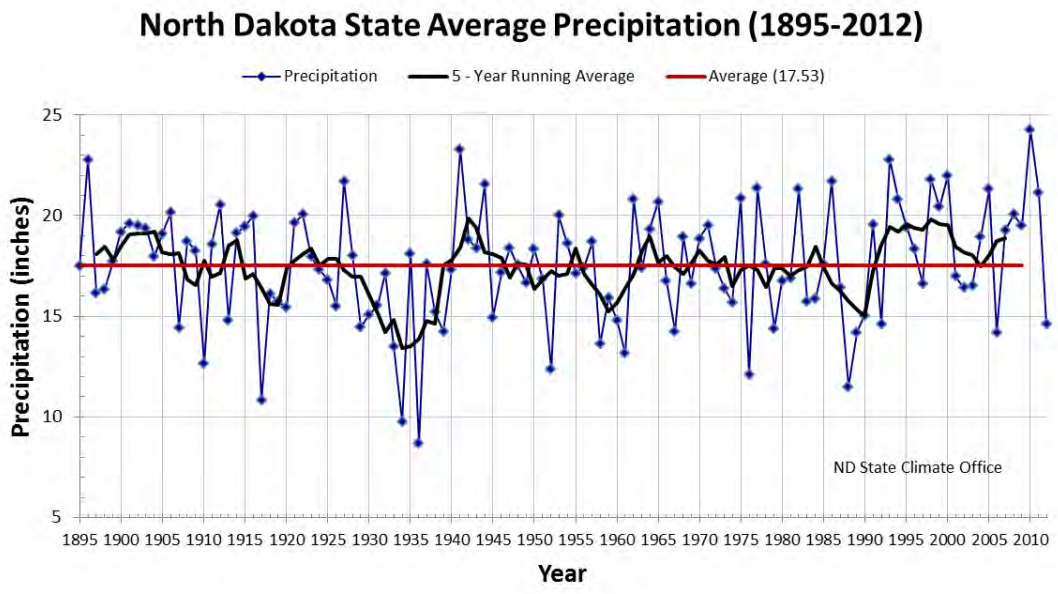
Frequency	Consequence			
	Human	Economic	Psychological	Government
Possible	None/Negligible	Moderate	Minor	None/Negligible

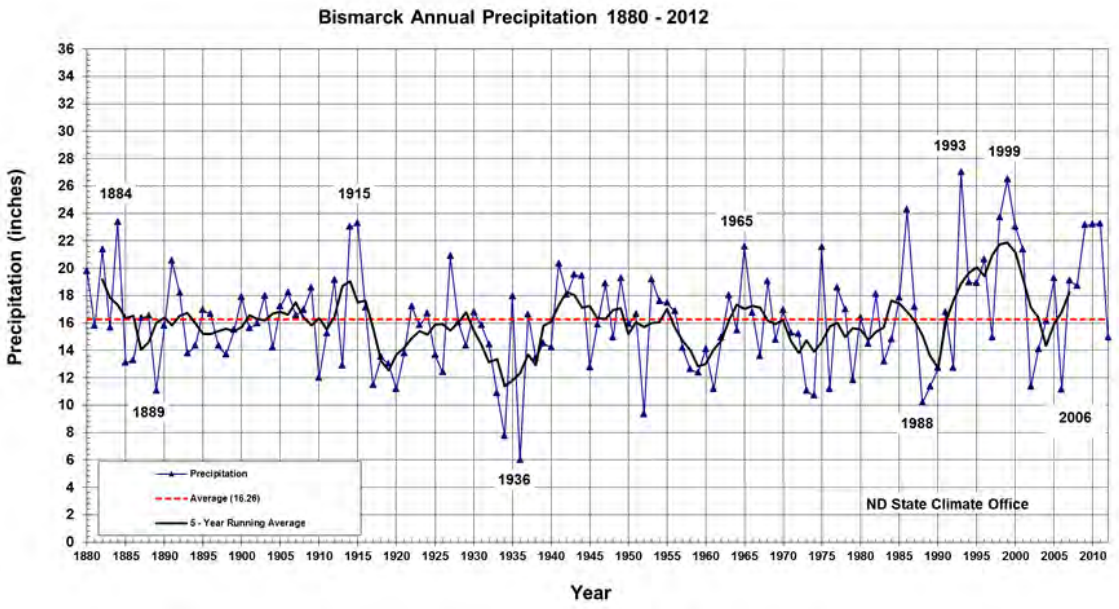
*D4 Exceptional Drought Exceptional and widespread crop or pasture losses; exceptional fire risk; shortages of water in reservoirs, streams, and wells, creating water emergencies.

- Palmer Drought Index -5.5 or less
- Standard Precipitation Index -2.0 or less
- CPC Soil Moisture Model 0-2 percentile
- USGS Weekly Streamflow 0-2 percentile
- Objective Short and Long-term Drought Indicator Blends 0-2 percentile

Droughts cannot be defined with certainty as extremely dry periods often alternate with wetter than normal periods. Since 1930, North Dakota has suffered drought in the 1930s, 1950s, early 1960s, mid 1970s, early 1980s, 1988 through 1991, 2002 through 2004, 2006, and 2012.

See additional historical occurrence information, page 13.





Source: North Dakota State Climate Office, 2014.

Probability and Magnitude

The National Oceanic and Atmospheric Administration Paleoclimatology Program studies drought by analyzing records from tree rings, lake and dune sediments, archaeological remains, historical documents, and other environmental indicators to obtain a broader picture of the frequency of droughts in the United States. According to their research, "The paleoclimatic record of past droughts is a better guide than what is provided by the instrumental record alone of what we should expect in terms of the magnitude and duration of future droughts. For example, paleoclimatic data suggest that droughts as severe at the 1950s drought have occurred in central North America several times a century over the past 300-400 years, and thus we should expect (and plan for) similar droughts in the future. The paleoclimatic record also indicates that droughts of a much greater duration than any in the 20th century have occurred in parts of North America as recently as 500 years ago. These data indicate that we should be aware of the possibility of such droughts occurring in the future as well. The occurrence of such sustained drought conditions today would be a natural disaster of a magnitude unprecedented in the 20th century." Based on this research, the 1950's drought situation could be expected approximately once every 50 years or a 20% chance every ten years. An extreme drought, worse than the 1930's "Dust Bowl," has an approximate probability of occurring once every 500 years or a 2% chance of occurring each decade. (National Oceanic and Atmospheric Administration, 2003)

Drought is usually a regional hazard and any part of the state could be impacted in any given year. Mapping of the current drought status is published by the US Drought Monitor each Thursday at http://drought.unl.edu/dm. North Dakota also has an extensive network of ground monitoring wells and surface water gauges. Ground water information, including hydrographs, recent water levels and chemistry conditions, can be found at http://mapservice.swc.state.nd.us/. Daily streamflow conditions are maintained by the US Geological Survey and can be found at http://waterdata.usgs.gov/nd/nwis/rt.

Vulnerability Assessment

Vulnerability: Characteristics of community assets that make them susceptible to damage from a given hazard.

	Drought	**Extreme Drought**
Probability	Likely	Possible
Drought is a recurring feature of nearly every climate on the planet. In many parts of the world, including North America, we have very little ability to predict exactly when drought will happen next. But if we look at history and climate data, we can be sure that drought will happen again at some point. Source: National Drought Mitigation Center		
Speed of Onset	Slow. Warning time is up to a year	Slow. Warning time is up to a year
Duration	Weeks, Months, Years	Months, Years, Decades
Geographic Area	Multiple counties or States	Multiple counties or states
Death / Injury 1. Primary Causes A. Highest vulnerability	 1. Heat Wave A. Elderly and young – based on lack of cooling (HVAC) indoors or excessive outdoor activity	1. Heat Wave 2. Dust 3. Stress / Depression /Suicide/violence 4. Lack of Food / Nutrition A. Elderly and young B. Those with lung / health issues C. Farmers, agricultural workers, others impacted greatly by economic impact D. Economically disadvantaged E. Increased risk to first responders due to heat stress F. Outdoor workers (construction, etc.)
Mass Casualty Incident	Unlikely	Possible, but not likely to require mass casualty response
In the United States, a well-developed economy and agricultural system generally protect citizens from the most critical effects of drought such as shortages of food and water. However, drought still causes extreme hardship for farm and ranch families, and individual wells may run dry. *Source: National Drought Mitigation Center*		
Property Losses (points of vulnerability – high priority)	Not likely	1. Abandoned property due to economic issues faced by individual families 2. Properties at Wildland/Urban Interface (due to increase in fire)
Environmental	1. Soil Erosion 2. Lower Lake & River levels	1. Soil Erosion 2. Lower Lake/river levels 3. Increase in turbidity and salinity levels 4. Air Quality (dust / pollutants increase) – decreased visibility 5. Loss of wetlands 6. Loss of vegetation 7. Loss of fish and game habitat

	Drought	Extreme Drought
		8. Stressed vegetation and wildlife more vulnerable to disease 9. Insect infestations 10. Plant infestations
COG/COOP		
Critical Facilities		
Critical Infrastructure	1. Water Restrictions may be necessary	1. Diminished food supply and increase in food prices 2. Strain on financial institutions 3. Commercial Food Service Operations
Schools		
High Risk Facilities (chemical)		
Specific Populations: Public Assembly, Vulnerable / Special Populations		1. Farm Families 2. Elderly/Young 3. Increase in Respiratory Ailments 4. Economically disadvantaged (higher food prices) 5. Agribusiness employees
Economy (community wide)	1. Agricultural businesses Impacted 2. Tourism – loss of revenue 3. Recreational facilities / businesses impacted	1. Agricultural businesses impacted 2. Tourism – loss of revenue 3. Recreational facilities / businesses impacted 4. Industrial Users a. Energy production (i.e.: use of water for cooling or hydro-electric power) b. Those that draw directly from the river 5. Financial Institutions 6. Transportation 7. Unemployment 8. Loss of Property Tax revenues 9. Out-migration of affected residents
OTHER:	1. Increased risk of fire 2. Migration of wildlife animals to urban areas seeking food/water (and potential for disease)	Public Safety Concerns: 1. Conflicts over water / water use / water rights 2. Increased risk of fire 3. Firefighting and issues related to requirements for water (quantity / pressure) 4. Migration of wildlife animals to urban areas seeking food/water (and potential for disease)

Nationally, drought losses average about $6-8 billion annually with impacts primarily to agriculture, transportation, recreation, tourism, forestry, and energy sectors. The impacts of drought are so diffuse and far-reaching that financial estimates of loss are often difficult to quantify. The table below shows the types of losses that may occur with drought.

Categories of Potential Drought Losses (Statewide/Regional)

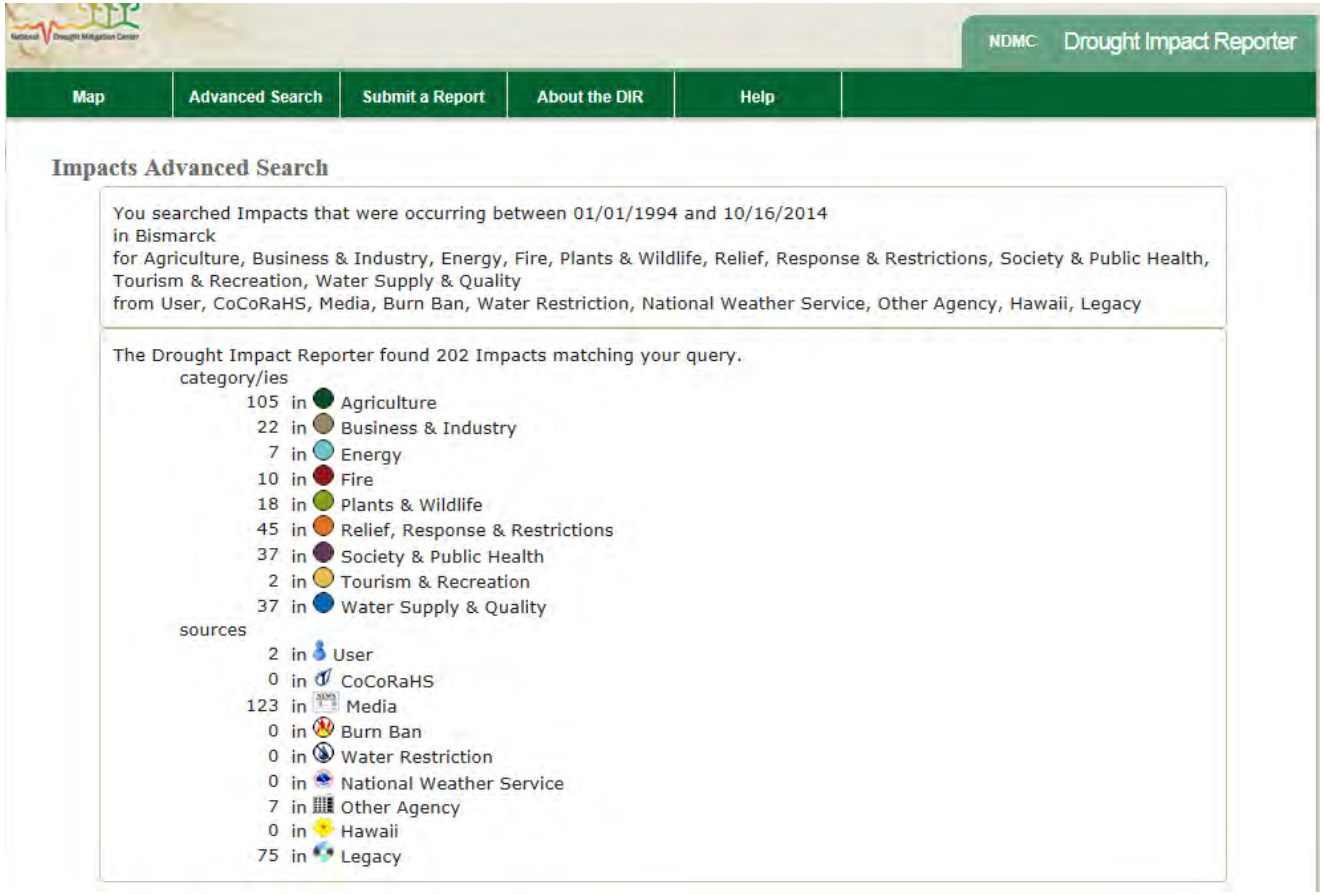
Drought Type	Loss Type	Causes
Agricultural	Costs and losses to agricultural producers	- Annual and perennial crop losses - Damage to crop quality - Reduced crop yields - Reduced productivity (wind erosion, loss of organic matter) - Insect infestation - Plant disease - Wildlife damage to crops - Increased irrigation costs - Water resource development (wells, dams, pipelines)
Agricultural	Costs and losses to livestock producers	- Reduced productivity of rangeland - Reduced milk production - Forced reduction of foundation stock - Closure/limitation of public lands to grazing - High cost/unavailability of water/feed for livestock - Water resource development (wells, dams, pipelines) - Increased feed transportation costs - High livestock mortality rates - Disruption of reproduction cycles - Decreased stock weights - Increased predation - Range fires
Agricultural	Loss from timber production	-Wildland fires - Tree disease - Insect infestation - Impaired productivity of forest land - Direct loss of tress, especially young ones

Drought Type	Loss Type	Causes
Agricultural	General economic effects	Decreased land prices - Loss to industries directly dependent on agricultural production (machinery, fertilizer, food processors, dairies) - Unemployment from declines in production - Strain on financial institutions (foreclosures, more credit risk, capital shortfalls) - Revenue losses to government (reduced tax base) - Reduction of economic development - Fewer agricultural producers (due to bankruptcies, new occupations) - Rural population loss
Hydrological	Loss from fish production	- Damage to fish habitat - Loss of fish and other aquatic organisms due to decreased flows
Hydrological	Loss to recreation and tourism industry	- Loss to manufacturers and sellers of recreational equipment - Losses related to curtailed activities: hunting, fishing, bird watching, boating
Hydrological	Damage to animal species	- Reduction and degradation of fish and wildlife habitat - Lack of feed and drinking water - Greater mortality (increased contact with producers) - Disease - Increased predations - Migration and concentration - Increased stress to endangered species - Loss of biodiversity
Hydrological	Hydrological effects	- Lower water levels in reservoirs, lakes, and ponds - Reduced flow from springs - Reduced streamflow - Loss of wetlands - Increased groundwater depletion, land subsidence, reduced recharge - Water quality effects (salt concentration, increased water temperature, pH, dissolved oxygen, turbidity)

Drought Type	Loss Type	Causes
Socioeconomic	Energy-related effects	- Increased energy demand and reduced supply because of power curtailments - Costs associated with substituting more expensive fuels for hydroelectric power
Socioeconomic	Water suppliers	- Revenue shortfalls and/or windfall profits - Cost of water transport or transfer - Water resource development (wells, dams, pipelines)
Socioeconomic	Decline in food production/disrupted food supply	- Increase in food prices - Increased importation of food (higher costs)
Socioeconomic	Damage to plant communities	- Loss of biodiversity - Loss of trees from urban landscapes, shelterbelts, wooded conservation areas
Socioeconomic	Health and values	- Mental and physical stress - Low-flow problems - Reductions in nutrition - Loss of human life (heat stress, suicides) - Public safety from forest and range fires - Increased respiratory ailments - Increased disease caused by wildlife concentrations - Increased conflicts (water use, political, management) - Increased poverty in general - Population migrations - Loss of aesthetic values - Reduction or modification of recreational activities - Disruption of cultural belief systems - Reevaluation of social values - Dissatisfaction with government response - Perceptions of inequity in relief - Loss of cultural sites - Increased data/informational needs - Recognition of institutional restraints on water use

Source: National Drought Mitigation Center, 2007.

Drought Impacts to Bismarck ND as recorded by the National Drought Mitigation Center 1994-2014



Source: http://droughtreporter.unl.edu/

Data Limitations

The greatest data limitation with drought is the inability to pinpoint the start and end of drought periods and the associated correlation with economic losses.

HISTORY:

1930's Dust Bowl: June 1929 was one of the driest on record in North Dakota, followed by continuing drought conditions throughout the 1930s. In 1936, North Dakota recorded its highest temperature of 121°F at Steele, ND on July 6. (State Historical Society of North Dakota, 2007)

The "Dust Bowl", as it is called, resulted in widespread drought conditions, soil erosion, and grasshopper infestations. This drought was exacerbated by poor farming practices, low market prices, and a depressed economy. Lessons learned during the 1930s drought stimulated the creation of governmental agencies to promote conservation, increased irrigation, and education stressing more flexible and diverse operations using improved management practices. The Federal Crop Insurance Program was established and institutions liberalized credit. The United States Department of Agriculture (USDA), the North Dakota State Agricultural Experiment Station System, and agricultural colleges and universities began an intensified research effort. This resulted in technologies for control of soil erosion, soil moisture conservation, higher yielding grain varieties that could better withstand dry conditions, improved fertilizers, and better farm management techniques.

1950s: The impact of drought in the early 1950s was less severe than the 1930s. The widespread financial distress, interstate migration, and regional disruption characteristic of the Dust Bowl era were largely absent. Strong emphasis was placed on water conservation and augmentation, weather modification research, weather prediction and control, groundwater recharge, irrigation and river basin development, evaporation control, desalination, phreatophyte control, and irrigation canal lining.

1970s and 1980s: 1976 was the driest year in North Dakota since the 1930s. (State Historical Society of

North Dakota, 2007) By 1988, the North Dakota Governor declared a statewide emergency because of the drought. Damages were not limited to agricultural losses. Public water systems and individual wells also began to dry up. (North Dakota State Water Commission, 1994) Disaster damage in 1988 was estimated to be $3.5 billion, not including the cost of indirect impacts. In the 1970s and 1980s, response to drought by state and federal governments was characterized by provisions for livestock feed assistance, crop loss financial aid packages (deficiency and disaster payments), commodity stock adjustments, disaster credit and forbearance programs for agriculture producers and related small businesses, and some water-related assistance.

1976: Presidential Emergency Declaration (DR 3016 declared July 21, 1976) for North Dakota including Burleigh County. Driest year in North Dakota since 1936.

2000-2007: North Dakota soils were under some degree of drought and ruled for 78 consecutive months from December 2000 until mid-June 2007. The most severe drought occurred during July 2006 when 100 percent of the state experienced at least moderate drought status on the drought monitor scale.

2012: Governor Jack Dalrymple declared an agricultural emergency for the state due to drought conditions on August 14, 2012. The declaration included 49 counties (including Burleigh) and the five reservations.

Most locations across western and central North Dakota this year experienced it as one of the top ten warmest years on record, drier than normal conditions, and a snowfall deficit of over 10 inches. Several locations had their warmest March average temperature on record. The average temperatures in March were 12 to 14 degrees Fahrenheit above normal. The drought conditions deteriorated throughout the summer and fall, with below normal precipitation and abnormally dry conditions. In August and September, there were very high and extreme fire dangers in portions of southwest and south central North Dakota. The west to northwest wind gusts were reported between 45 to 51 mph on several days. The drought conditions improved during November and December as the weather pattern transitioned into wetter than normal conditions.

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Fire – Hazard Profile

Description

Fire by definition is a rapid, self-sustaining oxidization process accompanied by the evolution of heat and light of varying intensities. (Essentials of Fire Fighting 4 addition) In other words, fire is a form of oxidation. On the slow end of oxidation you have rusting which can take months to occur and on the fast end of oxidation you have an explosion that happens in micro-seconds, with fire at a rate of just seconds. If fire occurs in a structure it can increase in size very rapidly and be out of control within seconds.

Urban fire departments are one of the oldest continuing institutions in the United States. Professional firefighters are well trained in the latest skills for preserving life and applying their abilities to limit property damages. Fire departments conduct regular inspections to identify and help reduce the fire risk that businesses may have. In addition, public education programs have been implemented within the community to educate businesses and the citizens on the importance of fire safety awareness in the prevention and reduction of fires.

The overall picture of fire safety information reveals that, per capita, the United States has one of the highest death rates in the industrialized world. Bismarck, North Dakota averages approximately 124 fires per year. Records show that Bismarck has less than one fire-related death per year and less than 2 fire-related injuries per year on average. Cooking related fires account for approximately 20% of all fires within the community.

Although structure fires are usually individual disasters and not community wide ones, the potential exists for widespread urban fires that can displace several businesses or families and exceed local resources. Urban blocks, commercial structures, and apartment buildings are vulnerable, especially the downtown area which consist of older buildings that have been renovated several times. Fires in the downtown area can have a significant economic impact.

While building and fire code enforcement have contributed to improved fire and life safety in new and existing buildings in recent years, fire prevention and awareness of the owners and occupants of buildings is key. Smoke detectors, automatic fire alarm systems, automatic sprinkler systems, fire doors, and fire extinguishers can all aid in preventing and reducing deaths, injuries, and damage from fire.

Fire Causes – City of Bismarck				
2010	**2011**	**2012**	**2013**	**2014**
101 Total Fires	*96 Total Fires*	*126 Total Fires*	*96 Total Fires*	*111 Total Fires*
Operating equipment 30%	Cooking 29%	Undetermined ignition source 26%	Cooking 28%	Cooking 44%
Cooking 23 %	Operating Equipment 21%	Cooking 21%	Operating Equipment 25%	Operating Equipment 20%
Undetermined ignition source 17%	Undetermined ignition source 20%	Operating Equipment 20%	Undetermined ignition source 15%	Undetermined ignition source 11%
Ember 8%	Open Flame Source 8%	Cigarettes 7%	Open Flame Source 8%	Open Flame Source 7%
Electrical Arcing 7%	Electrical Arcing 7%	Ember 6%	Ember 8%	Ember 7%
Cigarettes 6%	Cigarettes 5%	Electrical Arcing 3%	Electrical Arcing 6%	Chemical Reaction 5%
Open Flame Source 4%	Ember 5%	Chemical Reaction 3%	Cigarettes 6%	
Other Causes 5%	Other Causes 5%	Other Causes 14%	Other Causes 4%	Other Causes 6%

Risk

Risk: the potential for damage, loss, or other impacts created by the interaction of hazards with community assets.

Risk Assessment: product or process that collects information and assigns values to risks for the purpose of informing priorities, developing or comparing courses of action, and informing decision making.

THIRA Ratings – Fire (Conflagration)

Frequency	Consequence			
	Human	Economic	Psychological	Government
Unlikely	Moderate	Catastrophic	Moderate	Minor

THIRA Ratings – Fire (Residential)

Frequency	Consequence			
	Human	Economic	Psychological	Government
Very Likely	Minor	Moderate	Minor	None/Negligible

Vulnerability Assessment

Scenario	Residential Fire	Commercial	Conflagration
Probability	Very Likely	Very Likely	Unlikely
Speed of Onset	No Notice Event	No Notice Event	Possible escalation event
Geographic Area	Localized Event – may impact any area	Localized Event – may impact any area	May spread to city blocks
Death / Injury 1. Primary Causes A. Highest vulnerability	1. Smoke inhalation or direct flame contact A. Residents in older apartment bldgs. The elderly and very young.	1. Smoke inhalation or direct flame contact A. The elderly and very young.	1. Smoke inhalation or direct flame contact if evacuation is not completed in a timely manner A. The elderly and very young.
Mass Casualty Incident	Low probability	Low to Moderate probability	Low probability Explosion / collapse may cause mass casualty
Property Losses (points of vulnerability – high priority)	1. Room and contents to the entire structure. 2. Mobile homes	1. Room and contents to the entire structure	1. Multiple Structures
Environmental	1. Toxic smoke and other gases released 2. Water run-off	1. Toxic smoke and other gases released possibly hazardous materials depending on the business. 2. Run-off from water used to suppress fire.	1. Toxic smoke and other gases. 2. Water run-off. 3. Possible hazmat releases. 4. Possible gas main issues.
COG/COOP		1. City/County building content and records. 2. FD structures and equipment.	1. City/County building content and records. 2. FD structures and equipment.

Scenario	Residential Fire	Commercial	Conflagration
Critical Facilities		1. City/County Bldg. 2. Qwest Communications 3. Power substations 4. Capital Complex 5. Water Treatment Plant 6. Fraine Barracks 7. Waste Water Treatment Plant	1. City/County Bldg. 2. Qwest Communications 3. Power substations 4. Capital Complex 5. Water Treatment Plant 6. Fraine Barracks 7. Waste Water Treatment Plant
Critical Infrastructure		1. Qwest Communications 2. Power substations 3. Water Treatment Plant 4. Waste Water Treatment Plant	1. Qwest Communications 2. Power substations 3. Water Treatment Plant 4. Waste Water Treatment Plant
Schools		1. Unsprinklered schools and portable classrooms.	1. All schools
High Risk Facilities (chemical)		1. Praxair 2. Ferrell Gas 3. Exide Battery 4. Interstate Battery 5. R&J Refrigeration 6. Dean Foods 7. Dry Cleaners 8. Qwest Communication 9. Food Service of America	1. Praxair 2. Ferrell Gas 3. Exide Battery 4. Interstate Battery 5. R&J Refrigeration 6. Dean Foods 7. Dry Cleaners 8. Qwest Communication 9. Food Service of America 10. Super Value Warehouse

Scenario	Residential Fire	Commercial	Conflagration
		10. Super Value Warehouse	
Specific Populations: Public Assembly, Vulnerable / Special Populations	1. St. Vincent Nursing Home 2. Marillac Manor 3. Missouri Slope Nursing Home 4. Valley View 1 & 2 5. Edgewood Vista Retirement Community (Dominion and Colorado) 6. St. Gabriel Care Center 7. Good Samaritan Care Center 8. Maple View Memory Care 9. Baptist Home	1. Belle Mehus 2. Dakota Stage 3. Memorial Bldg. 4. FW All Seasons Arena 5. Schamberg Ice Arena 6. Churches 7. Bars and Restaurants with occupant loads of less than 300	1. Properties and populations in closer proximity to each other are more vulnerable. 2. Otherwise, all sections of the city are of equal vulnerability.
Economy (community wide)	Minor impact (THIRA rating)	Moderate impact (THIRA rating) Downtown Business District	Catastrophic Impact (THIRA rating)
OTHER:		FD equipment due to response.	FD equipment and personnel due to response.

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Flood – Hazard Profile

Description

Floods are naturally occurring hazards that happen frequently throughout the world. The National Flood Insurance Program (NFIP), which is administered by the Federal Emergency Management Agency (FEMA), defines floods in the following way:

- A general and temporary condition of partial or complete inundation of two or more acres of normally dry land area or of two or more properties from:
    - Overflow of inland or tidal waters; or
    - Unusual and rapid accumulation or runoff of surface waters from any source; or
    - Mudflow; or
- Collapse or subsidence of land along the shore of a lake or similar body of water as a result of erosion or undermining, caused by waves or currents of water exceeding anticipated cyclical levels that result in a flood as defined above.

Floods are a natural phenomenon; however, human activities often intensify flood hazards because of the alteration of natural conditions. Floods often occur along rivers and streams, in poor drainage areas, or in oversaturated soils.

Flooding is North Dakota's most costly and repetitive natural hazard. All 53 counties have experienced severe damages and losses to public and private properties due to floods. The floodplain in Bismarck is developed with housing, streets, railroads, businesses, and recreational facilities. Hazardous materials (fixed facilities) in the floodplain leads to the potential for contamination and complicates and increases the extent of damage caused by flooding.

Surface water is that water found on the land surface, and includes overland flow and flow in distinct channels. The three major sources of surface water include streams and rivers flowing into the state, precipitation, and groundwater discharge along streambeds. Surface water leaves the state in out-flowing streams and rivers, by evaporation, and by percolating downward into the subsurface into the groundwater flow system.

Many floods in North Dakota occur because the ground is frozen and/or saturated with moisture and cannot absorb any further moisture. This moisture can come from several different sources and circumstances. One source is a heavy snowpack, which is affected by a rapid warming trend as well as spring rain falling directly on the snow pack.

The spring flood danger period generally occurs during March and April. The magnitude of the flooding varies from year to year depending on such factors as characteristics of the snow cover, soil moisture conditions, frost depth, winter temperatures, temperatures during spring melting, spring precipitation, and the extent of ice jams. A wet fall, early freeze up with saturated ground at the time of freezing, heavy winter precipitation, and warm rains during and after spring thaw add to the seriousness of the spring flooding situation. Smaller streams are more susceptible to flooding in the summer with peak flows resulting from thunderstorms.

Riverine Flooding
Riverine flooding originates from a body of water, typically a river, creek, or stream, as water levels rise onto normally dry land. The riverine hazard areas in Bismarck are mapped as part of the National Flood Insurance Program (NFIP). Under this program, an area is broken into zones to depict the level of flood hazard.

Most commonly, the areas within the 100-year floodplain are considered the greatest risk. The 100-year floodplain has a 1% chance of exceedance in any given year. Over a 100-year period, a flood of this magnitude or greater has a 63.5% chance of occurring. Structures in the 100-year floodplain are three times more likely to be damaged by flood than a major fire. Locations outside the 100-year floodplain may also experience flood conditions during greater magnitude floods, localized events, or along unmapped creeks, streams, and ditches.

Most riverine floods are slow developing events with a natural, predictable source of water or moisture, such as snowmelt, slow rain, or a controlled dam release. This type of flood can often be forecast based on the amount of moisture or water available. The timing and location of flood conditions can often be calculated to a reasonable degree. If implemented in a timely manner, protective measures can sometimes mitigate the potential damage and loss. Because river levels of the Missouri River at Bismarck are controlled to a large extent by the COE via the Garrison Dam, flood forecast products (NWS) do not exist for the Missouri River near Bismarck.

Ice Jams
Flooding can also result from **ice jamming or blockage** along streams and rivers. Ice breaking up into pieces, called floes, moves along with the flowing rivers or streams. The ice floes can jam at curves, narrow places in the channel, structures, river/stream confluences, or where there is a sharp decrease in river bed gradient, creating an effective dam that produces water backup and overflow. Ice jams can cause considerable increases in upstream water levels, while at the same time downstream water levels may drop. According to the US Army Corp of Engineers, the types of ice jams include freeze up jams, breakup jams, or combinations of both. When an ice jam releases, the effects downstream can be similar to that of a flash flood or dam failure.

Flash Flood
Another source of flooding, called flash flooding, occurs when heavy rain falls in such a short time that the soil cannot absorb it and/or drainage systems (natural or man-made) cannot carry the volume of water away as quickly as it accumulates. Flash flooding also occurs when heavy rain falls over a prolonged period of time and the ground becomes saturated and cannot absorb the additional moisture fast enough.

A flash flood is usually caused by severe thunderstorms, heavy rains on snowpack, slow moving storms, dam, dike, or levee failures, or ice jam releases. Flash floods can occur anywhere when a large volume of water inundates an area over a short time period. Because of the localized nature of flash floods, clear definitions of hazard areas do not exist. These types of floods often occur rapidly with significant impacts. Rapidly moving water, only a few inches deep, can lift people off their feet, and only a depth of a foot or two, is needed to sweep cars away. Most flood deaths result from flash floods.

Urban flooding is the result of development and the ground's decreased ability to absorb excess water without adequate drainage systems in place. Typically, this type of flooding occurs when land uses change from fields or woodlands to roads and parking lots. According to the National Oceanic and Atmospheric Administration, urbanization increases runoff two to six times more than natural terrain. The flooding of developed areas may occur when the amount of water generated from rainfall and runoff exceeds a storm water system's capability to remove it.

Groundwater levels fluctuate from season to season and from year to year. Excessive groundwater may flood basements and crawlspaces but never reach the Earth's surface. Often this type of flooding occurs during or following periods of heavy rainfall or snowmelt.

Hundreds of significant floods occur in the United States each year and kill an average of 150 people annually. Flooding is one of the most deadly hazards nationwide and in North Dakota. Most injuries and deaths occur when people are swept away by flood currents, and most property damage results from inundation by sediment-laden water. Fast-moving water can wash buildings off their foundations and sweep vehicles downstream. Pipelines, bridges, and other infrastructure can be damaged when high water combines with flood debris. Basement flooding can cause extensive damage.

A tremendous amount of soil erosion takes place by water movement and its pressures on land surfaces. Runoff from the eroded areas is swift, thus contributing to flood magnitude. Additionally, when the floodflow slackens, the suspended materials will settle to the bottom of the channel, reducing the space that was previously available to keep the river within its banks. This sedimentation increases flood potential.

Missouri River Basin

Comprised of seven major sub-basins, the Missouri River Basin, the state's largest, drains nearly 48 percent of the state's total area. The seven subdivisions included in the Missouri River Basin are the Grand, the Cannonball, the Heart, the Knife, the Little Missouri, the Missouri, and the Yellowstone rivers and direct, minor tributaries. The climate is mostly semiarid. Buttes, hills, and smaller valleys characterize the topography and are most prominent in the Badlands along the Little Missouri River. The area east of the Missouri River is marked with numerous small lakes and wetlands. Annual mean precipitation ranges from 13 inches in the northwest to 17 inches in the east.

Flood control measures in the basin include Fort Peck Dam located in northeast Montana, the Garrison Dam which forms Lake Sakakawea, Oahe Dam in South Dakota which forms Lake Oahe, and the Heart Butte and Dickinson Dams on the Heart River.

Lake Sakakawea was formed by the construction of the Garrison Dam in 1953. Lake Sakakawea covers 368,000 surface acres, can store a maximum of 24.5 million acre-feet, and has 1,600 miles of shoreline in six counties. Lake Oahe Dam in South Dakota covers 40,000 to 80,000 surface acres in North Dakota, with an average storage of 989,605 acre-feet and a maximum storage of 1,626,588 acre-feet, depending upon the management elevation of the lake. The two projects required a total of 550,000 acres of land in North Dakota, including shoreline acres needed for flood conditions.

Risk Assessment

Risk: the potential for damage, loss, or other impacts created by the interaction of hazards with community assets.

Risk Assessment: product or process that collects information and assigns values to risks for the purpose of informing priorities, developing or comparing courses of action, and informing decision making.

THIRA Ratings – **Urban Flooding**

Frequency	Consequence			
	Human	Economic	Psychological	Government
Very Likely	None/Negligible	Minor	Minor	Minor

THIRA Ratings – **Ice Jam**

Frequency	Consequence			
	Human	Economic	Psychological	Government
Possible	Minor	Minor	Minor	Moderate

THIRA Ratings – **500 Year Flood**

Frequency	Consequence			
	Human	Economic	Psychological	Government
Unlikely	Minor	Moderate	Moderate	Moderate

HISTORY

Flood Related Declarations for Burleigh County Since 1989		
Flood Declaration	**Declaration Date**	**Incident Period**
North Dakota Flooding (DR-1981)	Major Disaster Declaration declared on May 10, 2011	Incident period: February 14, 2011 to July 20, 2011 Burleigh County was added Thursday, June 2, to the federal disaster declaration issued by President Obama on May 10 in response to North Dakota flooding beginning Feb. 14 and continuing.
North Dakota Flooding (EM-3318)	Emergency Declaration declared on April 7, 2011	April 5, 2011 to July 1, 2011
North Dakota Flooding (EM-3309)	Emergency Declaration declared on March 14, 2010	Incident period: February 26, 2010 to April 30, 2010
North Dakota Severe Storms and Flooding (DR-1829)	Major Disaster Declaration declared on March 24, 2009	Incident period: March 13, 2009 to August 10, 2009
North Dakota Severe Storms, Flooding, and Ground Saturation (DR-1597)	Major Disaster Declaration declared on July 22, 2005	Incident period: June 1, 2005 to July 7, 2005
North Dakota Floods (DR-1376)	Major Disaster Declaration declared on May 28, 2001	Incident period: March 1, 2001 to August 9, 2001
North Dakota Severe Storms And Flooding (DR-1334)	Major Disaster Declaration declared on June 27, 2000	April 5, 2000 to August 12, 2000
North Dakota Severe Storms, Tornadoes, Snow and Ice, Flooding, Ground Saturation, Landslides and Mudslides (DR-1279)	Major Disaster Declaration declared on June 8, 1999	March 1, 1999 to July 19, 1999
North Dakota Severe Storms/Flooding (DR-1174)	Major Disaster Declaration declared on April 7, 1997	Incident period: February 28, 1997 to May 24, 1997
North Dakota Flooding (DR-1118)	Major Disaster Declaration declared on June 5, 1996	Incident period: March 12, 1996 to June 21, 1996
North Dakota Severe Storms, Flooding, Ground Saturation (DR-1050)	Major Disaster Declaration declared on May 16, 1995	Incident period: March 1, 1995 to July 5, 1995
North Dakota Flooding, Severe Storms (DR-1001)	Major Disaster Declaration declared on July 26, 1993	Incident period: June 22, 1993 to September 24, 1993

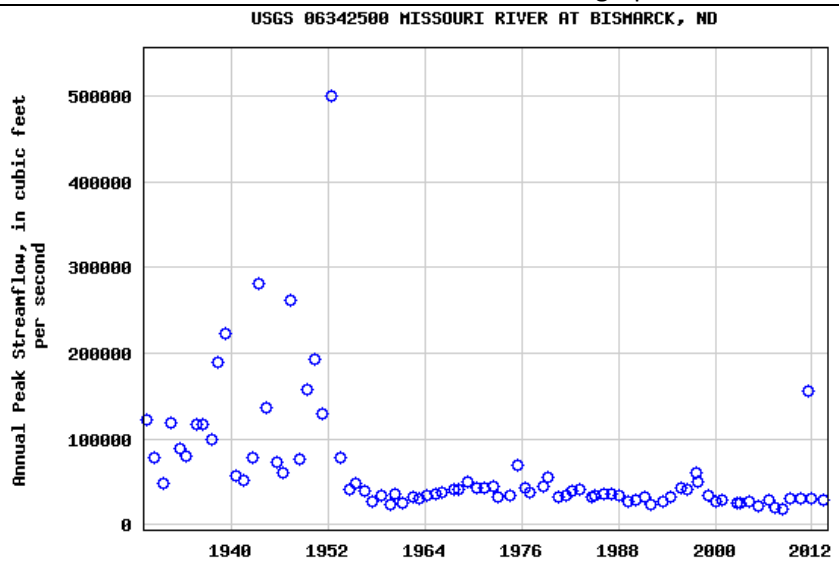
http://www.fema.gov/disasters?field_state_tid=11&field_disaster_type_term_tid=All&field_disaster_declaration_type_value=All&items_per_page=10&page=3

Riverine Flooding

Missouri River at Bismarck - Flood stages and Historical Crests (via Bismarck NWS website)		
Flood Stages		**Historical Crests**
Major Flood Stage	**18**	(1) 31.60 ft on 03/31/1883
Moderate Flood Stage	**16**	(2) 31.10 ft on 01/01/1887
Flood Stage	**14.5**	(3) 30.40 ft on 03/14/1910
Action Stage	**12.5**	(4) 27.90 ft on 04/06/1952
		(5) 27.70 ft on 04/08/1897
Note: As of 2012, "flood stage" is changed to 14.5 feet. Prior to 2012, 16 feet was defined as flood stage.		
In 1939, the Flood Stage was 19 Feet.		

Annual Peak Streamflow – Missouri River at Bismarck

Riverine Flooding (Missouri River at Bismarck) was a common occurrence prior to the construction of the Garrison Dam in 1953 as shown in the graph below.



Source: http://nwis.waterdata.usgs.gov/nd/nwis/peak/?site_no=06342500&agency_cd=USGS

2011 Flood: The 2011 Flood is the most significant Missouri River riverine flooding event impacting Bismarck since the construction of the Garrison Dam. The peak river elevation reached 19.24 feet on July 1, 2011. The peak releases from the Garrison Dam were 151,000 CFS on June 25, 2011. The river exceeded "action stage" (14 feet) from May 23 through August 31, 2011. Temporary protective measures (levee systems) were put in place to protect critical infrastructure (wastewater treatment plant) and south Bismarck in general (homes, streets, access, etc.).

Impact to homes within Bismarck city limits was limited to damage associated with basement seepage as a result of high groundwater due to the higher river levels for an extended period of time and heavy rains throughout the summer. The Missouri River did not overtop or breech the temporary levee

systems. Overland river flooding impact was limited to the Meriwether's facility, Meriwether's parking lot, and Pioneer Park in Bismarck. Extensive heavy rains throughout the summer along with the need to close the gate (flood control structure) on South Washington did exacerbate flash flooding impacts (urban street flooding) on a few occasions. However, the pumping operations were successful and worked as planned. The costs of fighting the flood were extensive, but public infrastructure including the wastewater treatment plant and south Bismarck were protected as a result of combined flood fight efforts in Bismarck.

2011 Flood Event – Bismarck Flood Fight Cost *Total Cost: $17,700,838.73 90% Federal Share: $15,930,473.59 *(based on submitted Project Worksheets via the FEMA Public Assistance Program)*	Category A – Emergency Work Debris Removal: $5,941,821.36 Category B – Emergency Protective Measures: $11,323,273.13 Category C – Road and Bridges: $633,709.26 Category D – Water Control Facilities: $0.00 Category E – Buildings and Equipment: $8,273.01 Category F – Utilities: $95,440.35 Category G – Parks, Recreational Facilities, Other: $148,321.62

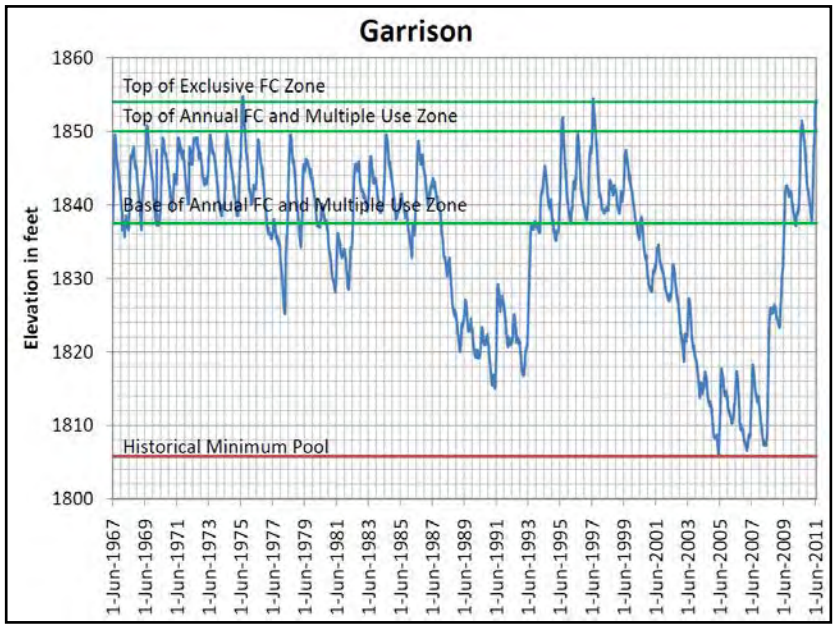
The following description came from the USACE website regarding the 2011 Flood:

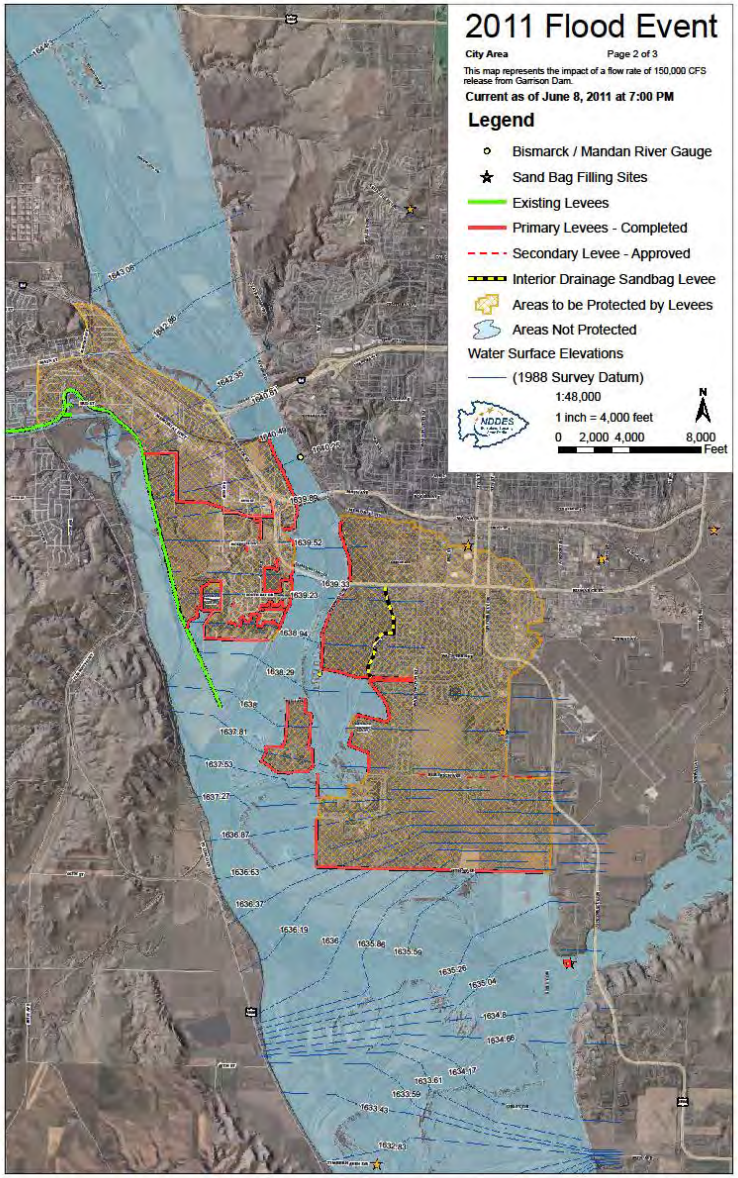
"Where is this flooding occurring?" Flooding is along the entire length of the longest river in the United States: the Missouri River- and many of its tributaries throughout Montana, North and South Dakota, Nebraska, Iowa, Kansas and Missouri. At 2,321 miles, the Missouri River's headwaters begin at Three Forks, MT and join the Mississippi River in St. Louis, MO.

"When did this inundation begin?" May 23, 2011 is recognized as the day that unparalleled flooding would soon commence.

"Why did this come about?" Flooding commenced with unseasonably heavy snows across the Great Plains. This was followed by three to six times the normal rainfall in May in eastern Montana, northern Wyoming and the western Dakotas. Then the snowpack melt came perhaps two weeks later than usual with an accumulation that was around 23 to 40 percent greater than normal. The June 2011 runoff in the Missouri River Basin above Sioux City was 13.8 million acre feet (MAF), the single highest monthly runoff amount since 1898. May 2011 runoff was 10.5 MAF, the third single highest monthly runoff amount since 1898 and more than one and a half times the previous record May inflow of 7.2 MAF in 1995. Combined runoff in May and June, at 24.3 MAF was short of the normal annual runoff of 24.8 MAF. The forecast for total annual runoff into the Missouri River basin during 2011 is 57.7 MAF, more than double the normal.

Garrison Dam levels from 1967 to 2011





What may have happened without the protective measures put in place during the 2011 flood fight response? Missouri River flood inundation mapping prepared by Houston Engineering, Inc., is provided for public use by the Burleigh County Water Resource District. The maps available at this site illustrate estimated inundation based on protective measures NOT being in place. http://www.houstoneng.com/missouri-river-flood/

1997 Flood Five years of high precipitation coupled with record and late season snowfall led to the extreme flood event of 1997. As the record snows began melting and an April blizzard compounded the problem, water levels all across the state began rising to unprecedented levels.

1993 Flood Statewide, excessive rains during the spring destroyed crops and heavy thunderstorms on July 15-16 (4-7 inches of rain), July 22-27 (6-10 inches of rain), and August 21-22 (up to 7 inches of rain) caused flash flooding and damage to public and private property. Minor to moderate flooding occurred in the Missouri, James, Souris, and Devils Lake basins.

1952 Flood Event Article:
http://www.bismarckcafe.com/blogs/252/remembering-the-flood-of-april-1952

Remembering The Flood of April 1952
Source: Bismarck Tribune. May 1, 2009 **Posted in:** 2011 Flood

Recent flooding has caused devastation across the state, and within Bismarck itself. It has left many in southern Bismarck worrying about flood potential of the Missouri River. 2009 marked the first major flooding of the Missouri River in 57 years.

Flooding was a common occurrence in Bismarck prior to the closure of Garrison Dam, which occurred in April 1953. It was not uncommon for springtime floods to cover much of the land south of present-day Main Avenue.

Missouri River Flooding in April 1952 - Liberty Memorial Bridge in background.

One of the worst of such floods occurred in April 1952, when the Missouri River crested at 27.9 feet. On April 6, the river rose 5 feet in just 2 hours, increasing from 20.2 feet at 11:30am to 25 feet at 1:30pm. Nearly everything south of U.S. Hwy 10 (Memorial Hwy/Main Ave) was under water. 200 houses were destroyed and the Wachter Family reported the loss of 300 cattle.

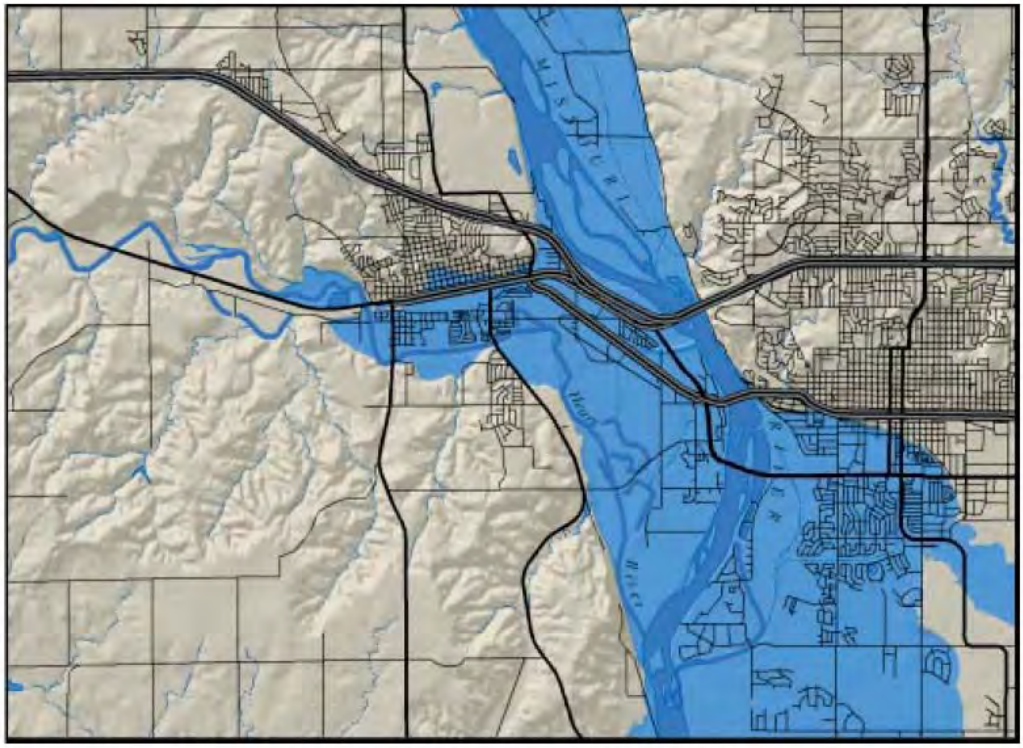
The completion of Garrison Dam allowed, for the first time, major development south of Main Avenue. Prior to this, the Wachter Family and Yegen Family owned most of the land.

Like the flooding seen this year (2009), the 1952 Flood was also primarily caused by ice jams. According to the National Weather Service, the April 1952 river level was the 4th highest recorded. The highest was 31.6 feet on March 31, 1881 *(year corrected).* Flood stage is 16 feet.

Date: 3/26/1939 - Gage Number: 6342500 -Bismarck, ND Missouri River
The gage at Bismarck, North Dakota on the Missouri River recorded water levels of 19.1 feet on March 26, 1939 due to an ice gorge below the gage. Flood stage is 19 feet. The gorge was recorded through 30 March. -- Keywords: Missouri River at Bismarck, ND on Mar 26, 1939 [20020103133602]
https://rsgisias.crrel.usace.army.mil/apex/f?p=273:2:0::NO

Date: 03/31/1881 - Gage Number: 6342500 - Bismarck, ND Missouri River
Maximum annual gage height of 31.6 feet, affected by backwater from ice, reported at USGS gage Missouri River at Bismarck on March 31, 1881. This is the maximum stage for the period 1881, 1929-1963; maximum open-water stage for the same period was 27.9 feet on April 6, 1952 (500,000 cfs). -- Keywords: Missouri River at Bismarck, ND on Mar 31, 1881 [9352]
https://rsgisias.crrel.usace.army.mil/apex/f?p=273:2:0::NO

FLOODING AND SEEPAGE



Area inundated (in blue) by the historic flood of March 31, 1881.

The highest recorded level of the Missouri River (1,649.88 feet) occurred on March 31, 1881. At this elevation, most of the area now occupied by the southern portions of Bismarck and Mandan would have been under 10 feet of water (see adjacent map.)

Overland flooding from unusually large rainfall events is a potential problem for homeowners in the area. Overland flow is focused into ravines and coulees that lead into the Heart and Missouri rivers. These ravines formed over the last 10,000 years, since the last glacier receded from this area. Development, particularly in north Bismarck, has partially or completely filled portions of these drainages with construction fill. Surface water and shallow groundwater still tend to concentrate along these courses. One of these, a four-mile long ravine, runs from Hay Creek to Zonta Park via the Tom O'Leary golf course. Perched groundwater can be concentrated at a number of stratigraphic horizons including: the base of construction fill, the contact between Cannonball sandstone and underling mudstone, as well as the upper surface of thin, well cemented sandstone layers in the Cannonball Formation. Seepage is a potential problem for basement slabs that are in close proximity to any of these settings.

Source: ND Geological Survey, Department of Mineral Resources
https://www.dmr.nd.gov/ndgs/documents/Publication_List/pdf/geoinv/GI_3.pdf

National Flood Insurance Policy and Loss Statistics, as of April 9, 2014

City of Bismarck

Number of NFIP polices: 741
Number of Polices within the A Zone: 273
Total Claims Since 1978: 410
Total Paid Since 1978: $6,893,228
Total Premium: $499,515
Total Coverage: $206,235,600

Bismarck has been a participating community in the NFIP since 09/18/1985.
Current Effective Map Date: 07/19/2005
CID: 380149

Bismarck	A-Zone
Repetitive Loss (RL) Buildings (Total)	26
RL Buildings (Insured)	25
RL Losses (Total)	53
RL Losses (Insured)	51
RL Payments (Total)	$2,348,596.70
- Building	$2,186,274.19
- Contents	$159,322.51
RL Payments (Insured)	$2,299,312.61
- Building	$2,140,122.04
- Contents	$159,190.57

Repetitive Loss Property (defined):
A repetitive loss property is any insurable building for which two or more claims of more than $1,000 were paid by the National Flood Insurance Program (NFIP) within any rolling ten-year period since 1978. The losses must be within 10 years of each other and be at least 10 days apart.

A severe repetitive loss (SRL) property is a residential property that has had at least four NFIP claim payments over $5,000 each with two such claims occurring within any ten-year period or a residential property that has had at least two separate claim payments within any ten-year period that have cumulatively exceeded the value of the property. Bismarck does not have any SRL properties.

Flood Insurance Study (FIS)

The last Flood Insurance Study (FIS), effective 7-19-05, covered the jurisdiction of Burleigh County, North Dakota and is available at http://www.msc.fema.gov/ Item Number: 38015CV000A. The Study reaffirms the history of the principal flood problems on pages 4-5:

"2.3 Principal Flood Problems Short-duration, high-intensity spring rainstorms, in combination with snowmelt and ice jams, are the principal cause of flooding on the Missouri River and Burnt and Apple Creeks in Burleigh County. High-intensity summer rainstorms also cause minor flooding on Burnt and Apple Creeks.

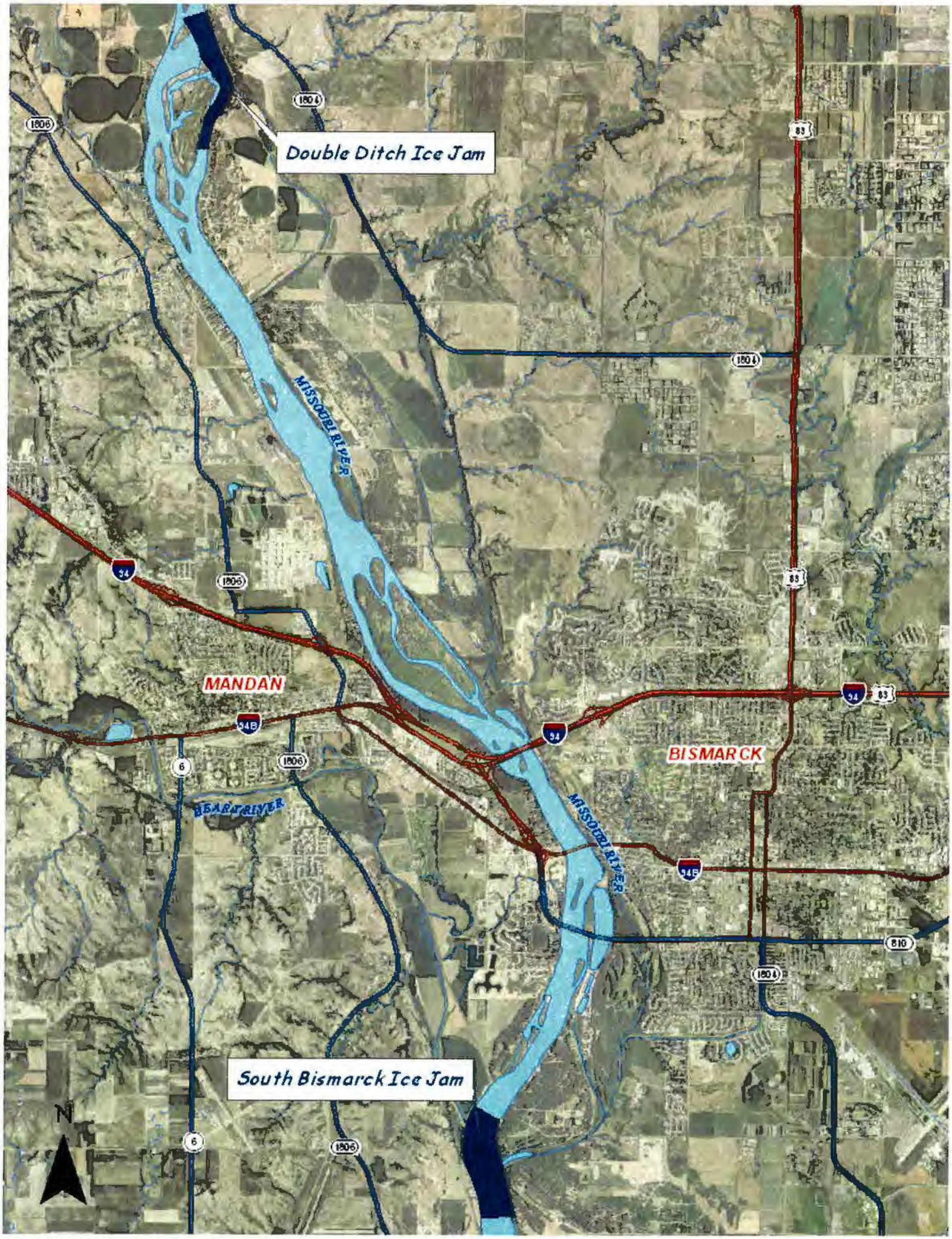
The maximum discharge from Apple Creek during the periods of March 1905 through June 1905 and October 1945 through September 1976 occurred on April 18, 1950, reaching an elevation of 1,657.08 ft at the USGA gage near Menoken, North Dakota (Reference 6). This event had a return frequency of approximately 50 years.

The maximum discharge for Burnt Creek from October 1967 through September 1976 occurred on April 8, 1969 (Reference 6). This event had a return frequency of 15 years.

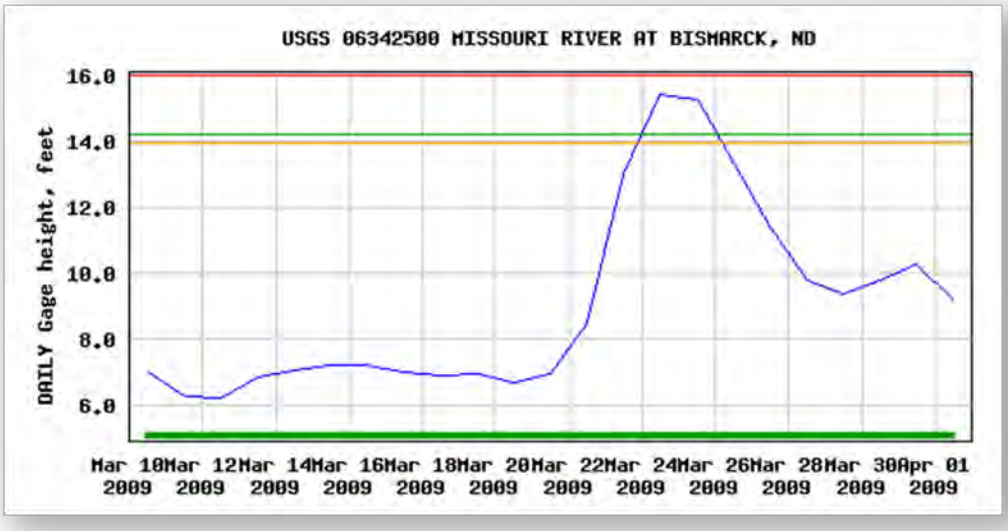
Major flooding from the Missouri River occurred in 1883, 1887, 1910, 1917, 1938, 1939, 1943, 1947, 1950, and 1952. The March 31, 1881, flood reached an elevation of 1,651.26 ft. at the USGS gage at the City of Bismarck. Flooding reached an elevation of 1,647.58 ft. at the same gage on April 6, 1952 (References 6 and 7). Since the completion of Garrison Dam in 1953, floods of this magnitude would have a recurrence interval greater than 500 years."

Ice Jams

March 23-27, 2009 Spring Flood event was caused primarily by ice jams. Extensive amounts of ice floes from the Heart River were discharged into the Missouri and created an ice jam south of Bismarck. An ice jam also formed north of Bismarck near the Double Ditch area. (see ice jam location map) The ice jam (or ice dam) was created by ice and debris. The bends in the river, sediment, sandbars, and potentially the long cold winter of 2008 and 2009 contributed to the formation of the ice jam. Also, an extensive amount of snowfall from the winter season (73.9 inches through March 22), significant snow melt with 54 degrees as the high on March 20th, **a** thunderstorm on March 23rd adding 0.75 inches of rain on frozen ground, and a blizzard over March 23 and 24th dumped an additional 8.1 inches of snow. These events cumulatively exacerbated the flooding situation. High winds and blizzard conditions delayed evaluation (aerial view) of the ice jam by the COE ice jam expert. Prior to the flood event, snowmelt was causing isolated problems throughout the community – primarily relating to landscape and runoff issues. Throughout the flooding event, snow melt, additional moisture, and the ice jam contributed to backing up the storm drain system affecting the Airport Village / Skyway Park Village mobile home park residents and closing 12th Street and a section of Expressway from 9th Street to 12th Street. Bismarck Property impacted by the flooding was primarily in the areas of Fox Island (county), Southport, Munich Drive area, Santa Fe area, and the mobile home parks of Skyway Park Village and Airport Village. Solheim School relocated its students and staff to other area schools. Ultimately, the school was not impacted. Prairie Rose Elementary (just south of Bismarck) was threatened, but not impacted by the flood event.


Double Ditch Ice Jam
MISSOURI RIVER
MANDAN
BISMARCK
BEAR RIVER
MISSOURI RIVER
South Bismarck Ice Jam
N
1806
1804
83
34
34B
6
810

The graph below illustrates limited time to react to an Ice Jam.



ICE Jam Flood Characteristics:

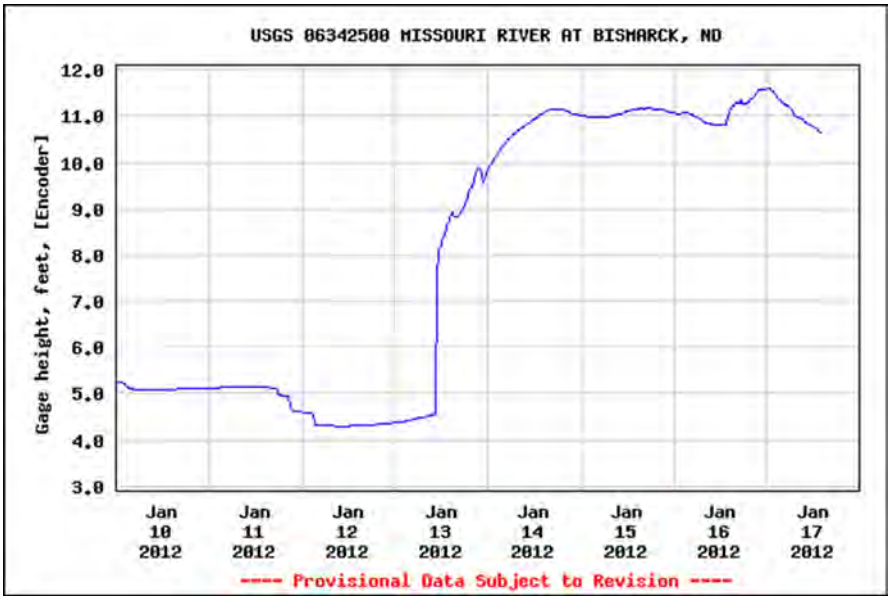
- **River Pool Effect**
- **Unpredictable (Timing and Location)**
- **Very Little Warning**
- **Require Closure of Key Internal Drainage Systems**
- **Protection Must be In Place Before the Event**

<u>Freeze In 10-Year Average Rise at Bismarck</u>

5.6-feet (2003-2012)

<u>Freeze In 10-Year Average Stage at Bismarck</u>

10.7-feet (2003-2012)



2012 Freeze-In

Missouri River – Ice Jam Date: March 23, 2009. Jam Type: Break-Up

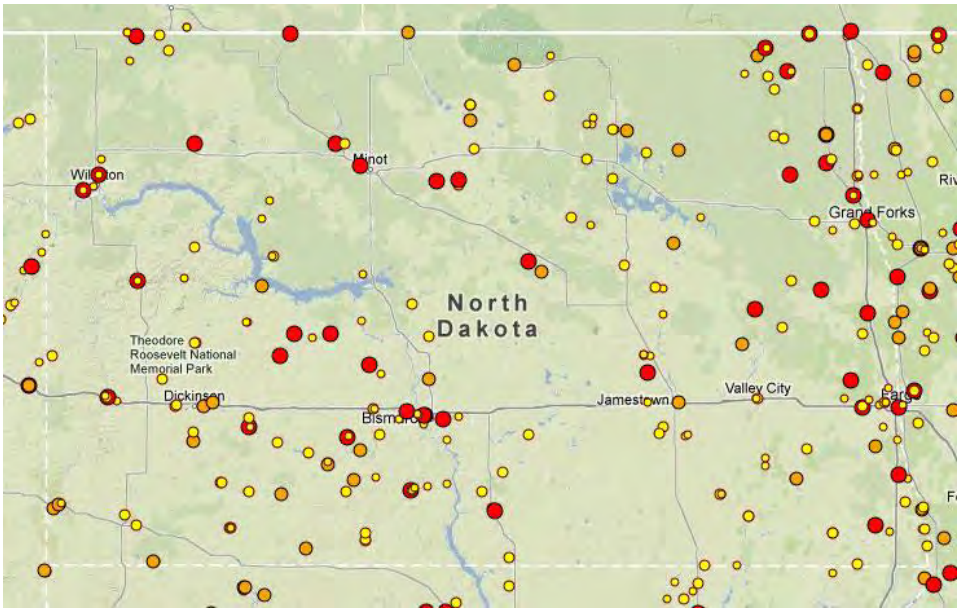
Rapid warmup over heavy snowpack led to large increases in discharge on Missouri River tributaries throughout North Dakota, leading to breakup of ice in the headwaters region of Lake Oahe. USACE-Northwest Division Missouri River Region Water Management Office released news release 23 Mar 2009 that Garrison Dam releases were being reduced to near record low levels due to influx of tributary water and ice into Missouri River in Bismarck region. Burleigh County EM issued a Civil Emergency message shortly after noon (CDT) on 23 Mar 2009 asking residents of Fox Island to voluntarily evacuate as the river continues to rise and the unpredictability of stages due to a probable ice jam. Morton County EM issued a Civil Emergency Message at 534 pm Monday 23 March. Residents in the Jetty Beach and Tokach Bottoms area were also asked to voluntarily evacuate the area due to the rising river levels and unpredictable nature of the ice affected river. At 815 am Tuesday 24 March, the stage was 15.04 feet, Flood Stage is 16.0 feet. Burleigh County EM reported the Missouri River continuing to rise due to an ice jam, and advising any area south of Bismarck Expressway, west of South Washington Street, or south of Burleigh Ave, from the Missouri River to Apple Creek, to prepare for potential flooding. Lake Oahe is ice covered and river water will flow north. Monday, 0.75 inches of rain fell in Bismarck, with an additional 0.32 inches by 730 am Tuesday, as well as 3.0 inches of snow. The forecast for Bismarck at 1152 am Tuesday, was for heavy snow, freezing fog and wind, with a temperature of 28 F. At 220 pm Tuesday, NWS reported flooding or the potential for flooding across all of central and most of western ND. The stage was within 0.5 feet of Flood Stage, and rising, as a result of a jam just south of Fox Island. An additional jam was being reported north of Bismarck, near Double Ditch, with the effect uncertain, should the upstream jam release first. NWS reported the stage to be at 16.00 feet at 653 pm CDT Tuesday. By 615 am Wednesday, the stage had receded slightly to 15.77 feet. On Wednesday morning, 903 AM CDT, the ice jam north of Bismarck released and the ice was moving downstream. Officials were concerned about the potential for this ice to cause further increases in water level if it re-jammed at the ice jam at Fox island, south of Bismarck. Roger Kay of the USACE Omaha District was providing ice jam mitigation expertise at the scene. He relayed an update to Steve Daly of CRREL Wednesday morning, 25 March. The jam was reported to be 3 feet thick, having formed by ice released from the Heart River. Permits were in place to use rock salt on the sheet ice, located just downstream of the jam. Upstream of the jam, a 7-8 foot backwater rise was measured by USGS on Tuesday. Cooler temperatures and the river's response to Garrison Dam's water cutback on Monday, are likely causes for the drop in stages today, however, Roger Kay reported interior drainage to be a problem, with flooding ongoing. At 1030 am CDT NWS employees visually confirmed that the jam north of Bismarck, which was reported to have released, still remained in place. This jam is located from the Indian village of Double Ditch to Hogue Island. At 102 pm Weds NWS released a Public Information Statement reporting that the Morton County EM Office and the City of Mandan were downgrading the Mandatory Evacuation of residential areas along the west side of the Missouri River to a Voluntary Evacuation, in response to the fact that the jam north of Bismarck was still in place, but urged residents to be prepared, as a new Mandatory Evacuation Notice would be issued immediately should that jam release. Another Public Information Statement was issued at 127 pm Weds, reporting that the ND Department of Emergency Services needed the Morton County Sheriff's Department and Mandan Police Department to close Highway 1806 from Nineteenth St south to County Road 138 immediately so that experts can blast the ice jam, which was expected to occur between 1pm and 2pm. Water was reported to be flowing around the Double Ditch jam at 5 pm Wednesday. Overloaded storm drains have resulted in localized flooding in south Bismarck. By 915 am CDT Thursday 26 March, the stage at Bismarck had fallen to 13.52 feet, however, the ice jams still remained. Ongoing efforts continue Thursday to weaken the jam to the south of Bismarck. At 115 pm Saturday 28 March, the stage had dropped to 9.66 feet, below Flood Stage of 16.0 feet. In a 2010 review of the jam, it was noted that Gov. John Hoeven has said the cost of temporary levees, cleanup and repairs from last spring's flooding exceeded $78 million
https://rsgisias.crrel.usace.army.mil/apex/f?p=273:2:0::NO

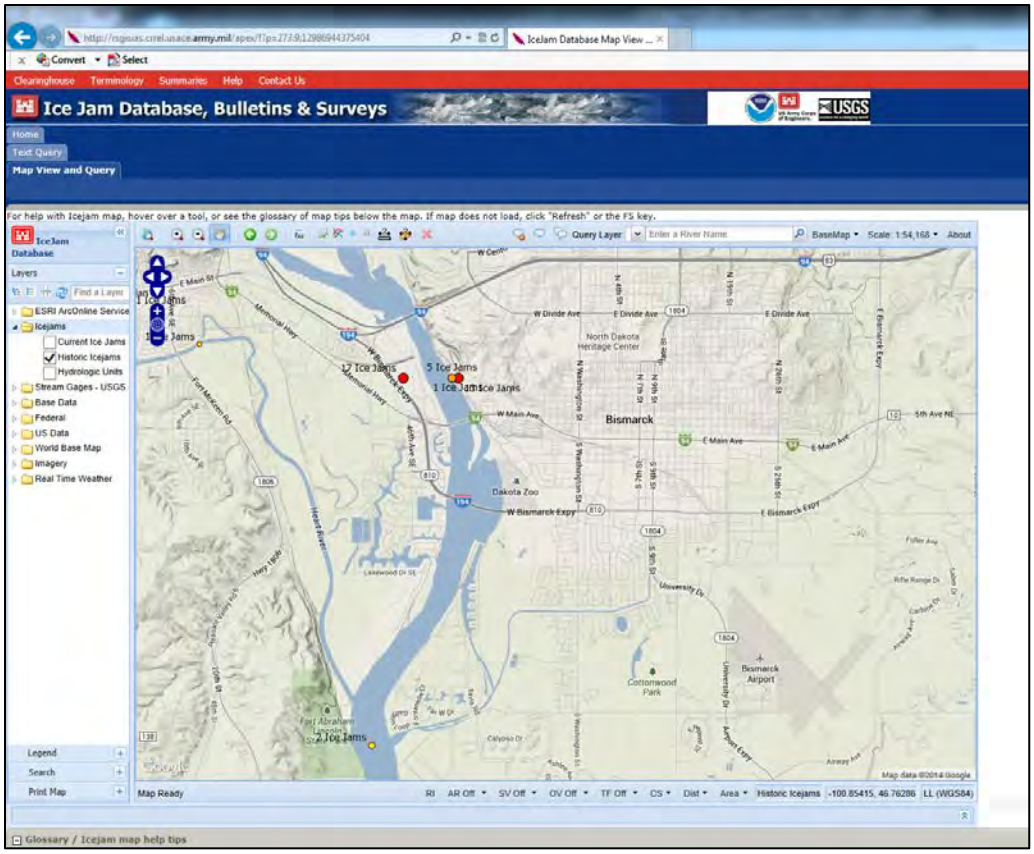
Ice Jams in North Dakota 1881-May 2013

The US Army Corps of Engineers, Cold Regions Research and Engineering Laboratory (CRREL) maintains a database of historic ice jams. http://icejams.crrel.usace.army.mil/

Historic Icejams

- 1 Ice Jam
- 2 - 5 Ice Jams
- 5 - 10 Ice Jams
- > 10 Ice Jams





Ice Jam/Ice Damming Summary: 1980 – 2012

The table below identifies maximum gage heights due to backwater from ice at the Missouri River USGS gaging station 644250 at Bismarck.

Jam Date	Maxium Gage Height	Estimated Daily Avg Discharge
1/23/2012	12.08	22,000 cfs
3/23/2009	16.00	
USACE reduced Garrison Dame release to Zero CFS, first time in history of the dam as a result of the March 2009 ice jam.		
12/1/2006	11.10	14,800 cfs
12/10/2005	11.34	15,200 cfs
12/26/2004	10.63	NA
1/2/2004	12.08	NA
2/14/2003	10.91	NA
12/27/2001	10.25	13,300 cfs
12/20/2000	13.01	18,800 cfs
1/15/2000	13.01	NA
1/16/1999	12.22	25,000 cfs
11/28/1993	13.55	13,800 cfs
2/5/1989	13.12	26,200 cfs
1/1/1989	14.44	19,500 cfs
2/25/1987	13.92	30,400 cfs
1/13/1983	14.8	Not reported

https://rsgisias.crrel.usace.army.mil/apex/f?p=273:2:0::NO

Flash Flooding (Urban Flooding)

July 30, 2011: Multiple reports were received from across Bismarck of water up to 18 inches deep flowing over roads. Mainly the flash flooding was in low lying and poor drainage areas of the city. In some cases water washed up to the foundation of homes and into window wells. Rain amounts were around two inches.

June 15/16, 2009: Rain amounts varied within the Bismarck and surrounding areas - from just over 3 inches to over 7 inches of rain. Bismarck/Burleigh Experienced flash flooding the evening of June 15 into the early am hours of June 16th. Within Bismarck, flash flooding lifted/removed manhole covers and caused street flooding. Dispatch was inundated with calls. Four road closures occurred within Bismarck - Divide Avenue (35th street area impacted by Hay Creek), 12th Street between Expressway and University; Main Ave from 19th to 26th, and 3rd Street from Expressway to Front.

August 23, 2004: Streets and underpasses flooded causing several major arteries to be closed. Water flowed across yards and into several basements of homes.

August 31, 2002: Streets and underpasses filled with water in Bismarck.

July 27, 2001: Rainfall of 3 to 4 inches over Bismarck caused flooding of streets and underpasses. Two mudslides on River Road covered northbound lanes.

July 26, 2001: Around 2 inches of rain fell in a very short time causing street flooding and pooling of water in Bismarck.

June 9, 2001: Widespread street flooding throughout the city of Bismarck where a foot or more covered the roads. Travel not advised. Up to 12 feet of water accumulated in the railroad underpasses.

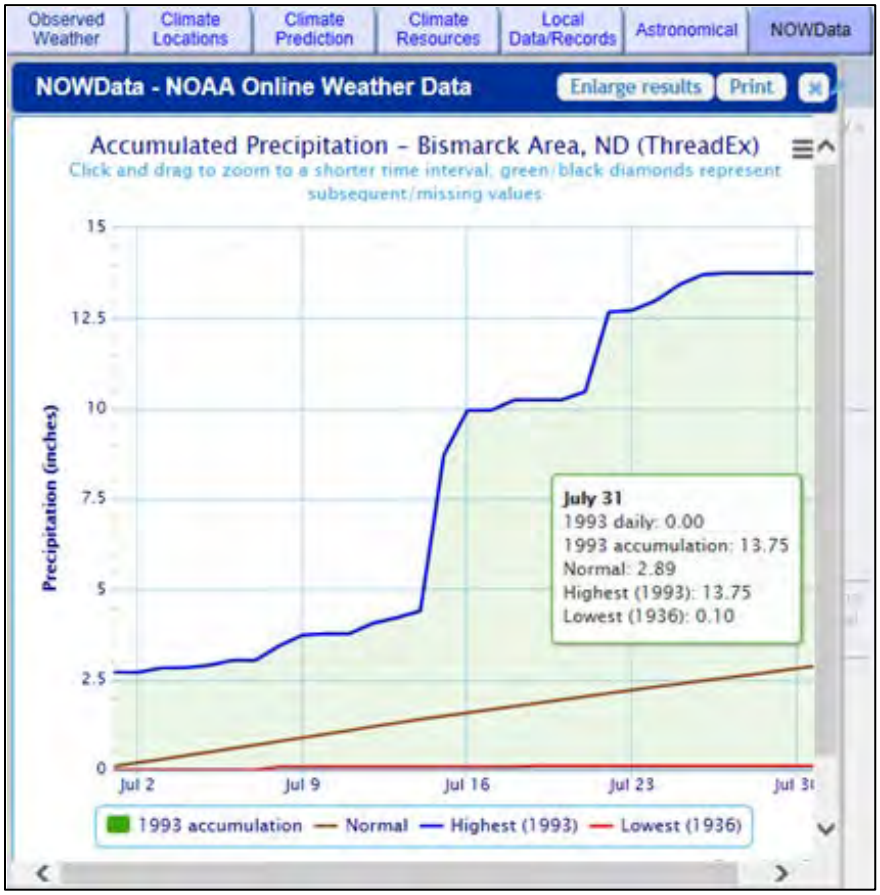
The June 9 storm also produced significant hail (also noted in the "Thunderstorm" section of the mitigation plan:
In June 2001, a hailstorm caused an estimated $230 million in property damage in Burleigh and Morton Counties; an estimated 57,000 insurance claims were filed. (North Dakota Insurance Department, 2007) This hailstorm affected the urban Bismarck and Mandan areas. As the most damaging hailstorm in the state's history, the insurance industry was severely impacted, and insurance availability and premiums were affected statewide; many insurance companies pulled out of the state after the storm. (North Dakota State Water Commission, 2007c) According to the state situation report, officials estimated the North Dakota State Capitol Complex received approximately $100,000 worth of damage. Thirteen windows in the tower were broken; shingles on the State Library were damaged as well as the skylight in the atrium of the Judicial Wing. The exteriors of the State Office Building and the Grounds Maintenance Building were also damaged. Officials estimated that 400 North Dakota State Fleet vehicles suffered hail damage. Approximately 50 required glass replacement (North Dakota Department of Emergency Services, 2007).

August 12, 1999: Heavy rainfall from 4 to 7 inches. Hardest impact in the cities of Bismarck and Mandan. Two hundred twenty-one (221) homes and businesses received water damage. Twelve (12) road sites were damaged and a significant mudslide closed portions of Highway 1804 in north Bismarck.

August 21, 1998: 4.48 inches of rain in two hours

March 21, 1997: Minor overland flooding – wet basements.

July 15, 1993: National Weather Service reported 4.32 inches of rainfall. Cumulative rain for the month of July was 13.75, the record high for the month of July. Normal is 2.89 for the month.



Per Bismarck Tribune archived articles: 7 inches of rain in the Bismarck area causing damages of over $2 million in private property damages. Mayor Sorenson estimated that two-thirds of the flooded basements were on the north side, out of the flood plain, but that the most serious cases of individual damage were on the south side. The American Red Cross provided services (clothes, housing and feeding) to 50 victims in Bismarck-Mandan, many of whom had been displaced from their homes. Norwest Bank set up unsecured low interest loans to help cover uninsured or underinsured flood related costs. Source: archived Bismarck Tribune articles

1993 Flood *Statewide, excessive rains during the spring destroyed crops and heavy thunderstorms on July 15-16 (4-7 inches of rain), July 22-27 (6-10 inches of rain), and August 21-22 (up to 7 inches of rain) caused flash flooding and damage to public and private property. Minor to moderate flooding occurred in the Missouri, James, Souris, and Devils Lake basins.*

Vulnerability Assessment

Vulnerability: Characteristics of community assets that make them susceptible to damage from a given hazard.

*Items in last column specific to 500 year flood are noted with an asterisk. 100 Year flood impacts are included in 500 year flood.

Flooding type	**Flash Flooding** **Urban Flooding**	**Ice Jam** **Debris / Blockage**	**Riverine** **100 & *500 Year Flood**
Probability	Very Likely	Possible	Possible (100 Year) Unlikely (500 Year)
Speed of Onset	Limited warning Minutes to Hours	Some warning, Generally at least 24 hours	Controlled River (Garrison Dam / COE)
Geographic Area	All areas of Bismarck subject to urban flooding	Generally low lying areas along river and in South Bismarck. See 100 Year Flood map.	See 100 Year and 500 Year Flood mapping
Death / Injury 1. Primary Causes A. Highest vulnerability	1. Driving through flood waters A. Driving through water – assuming roadbed is intact and vehicle will remain on street Most flood deaths result from flash flooding. Source: ND DES Mitigation Plan	1. Driving through flood waters A. Driving through water – assuming roadbed is intact and vehicle will remain on street	1. Driving through flood waters A. Driving through water – assuming roadbed is intact and vehicle will remain on street
Mass Casualty Incident	Limited probability	Limited probability	Limited probability
27 people have died from floods in North Dakota since 1993. *Source: 2014 NDDES Mitigation Plan.*			

Flooding type	**Flash Flooding** **Urban Flooding**	**Ice Jam** **Debris / Blockage**	**Riverine** **100 & *500 Year Flood**
Property Losses	1. Basement flooding – basement contents 2. Airport and Skyway Park Village 3. Basin Avenue Area	1. Basement Flooding – basement contents & utilities 2. Fox Island 3. Washington Street Bridge (concrete damages) 4. Riverwood Golf Course	1. Structures within 100 Year or 500 Year Flood Plain. 2. Main floor and contents (below base flood elevation)
Environmental	1. Basement flooding – basement contents	1. Debris / hazardous materials contaminating flood water 2. Septic systems *Flood waters are typically contaminated*	1. Structures in low lying areas (ie: 100 Year Flood plain) 2. Debris / hazardous materials contaminating water 3. Septic systems *Flood waters are typically contaminated*
COG/COOP	1. Employee/ Family Impact – availability of personnel 2. Bismarck PD	1. Employee/ Family Impact – availability of personnel	1. *Bismarck PD 2. Employee / Family impact – availability of personnel
Critical Facilities	1. South Fire Station	1. Wastewater Treatment Plant 2. South Fire Station access	1. Bismarck Airport 2. *Wastewater Treatment Plan
Critical Infrastructure	*Street Access:* 1. 12th Street – from University to Bismarck Expressway 2. Bismarck Expressway from 7th to 12th Street 3. 7th and 9th Street underpasses 4. S 3rd Street – Arbor Avenue to Bismarck Expressway 5. Broadway – 12th to 14th Street		*Railroad Access:* 1. *DMVW North/South Railroad
Schools		1. Prairie Rose Elementary	

Flooding type	**Flash Flooding** **Urban Flooding**	**Ice Jam** **Debris / Blockage**	**Riverine** **100 & *500 Year Flood**
High Risk Facilities (chemical)		1. Southport Marina (2009)	1. Southport Marina 2. *Wastewater Treatment Plant 3. Little Dukes 4. Pony Express 5. Holiday Gas 6. BP Amoco (Red Carpet)
Specific Populations: Public Assembly, Vulnerable / Special Populations			1. Dakota Zoo 2. *Diane's Hope House 3. *Crescent Manor
Economy (community wide)	Minor (THIRA rating)	Minor (THIRA rating)	Moderate (THIRA rating)
OTHER:	Mobile HazMat (transportation)	Mobile Hazmat (transportation)	Mobile Hazmat (transportation)
Vulnerability related to Jackman Coulee Dam #2 is addressed on page 29. The Jackman Coulee Dam structure is required to pass a 0.5 PMP event (10.7" 6-hour rainfall) without overtopping. PMP= Probable Maximum Precipitation.			

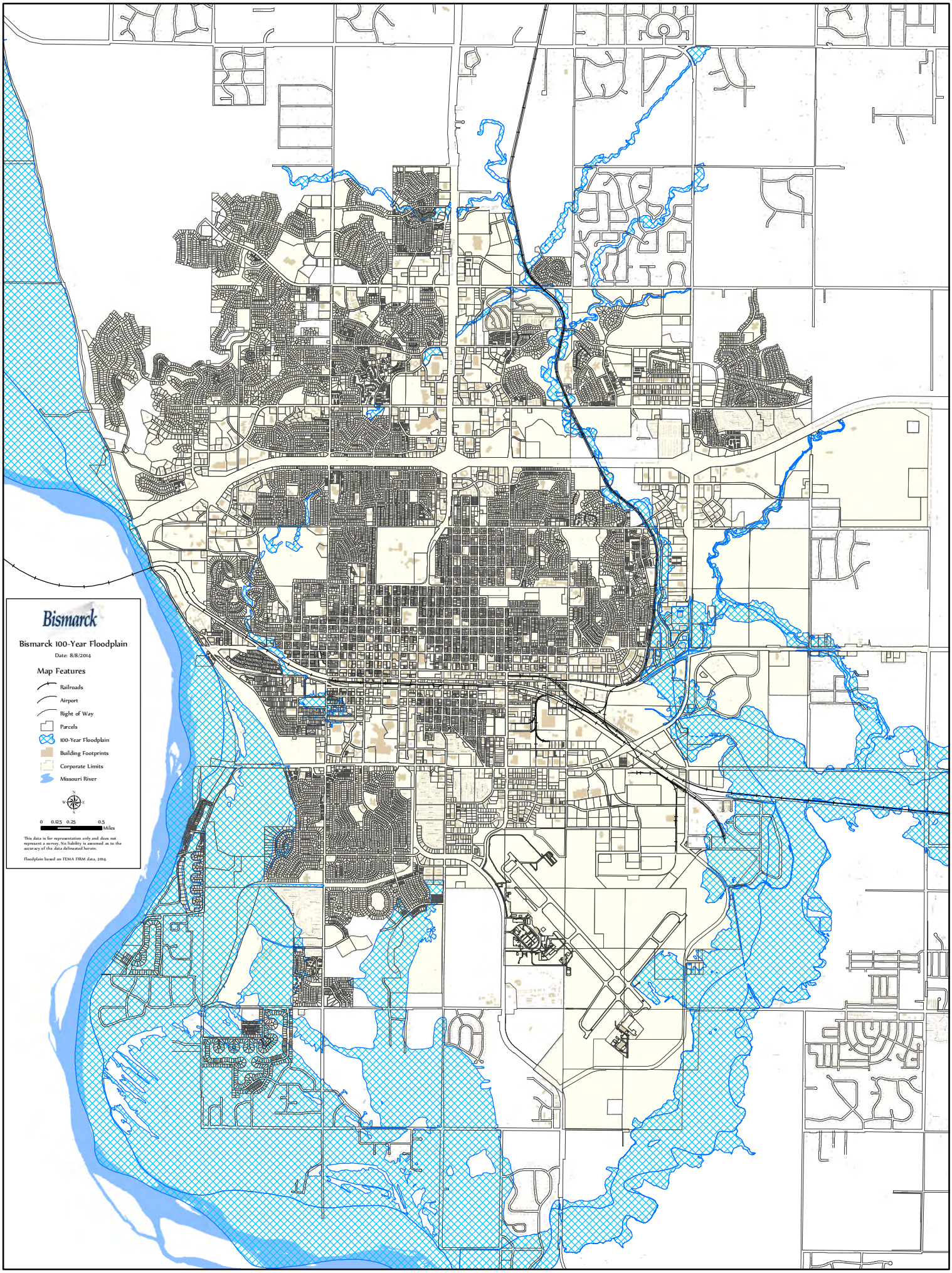
Population and Property Values Vulnerable to 1-Percent Annual Chance Riverine Flood by County

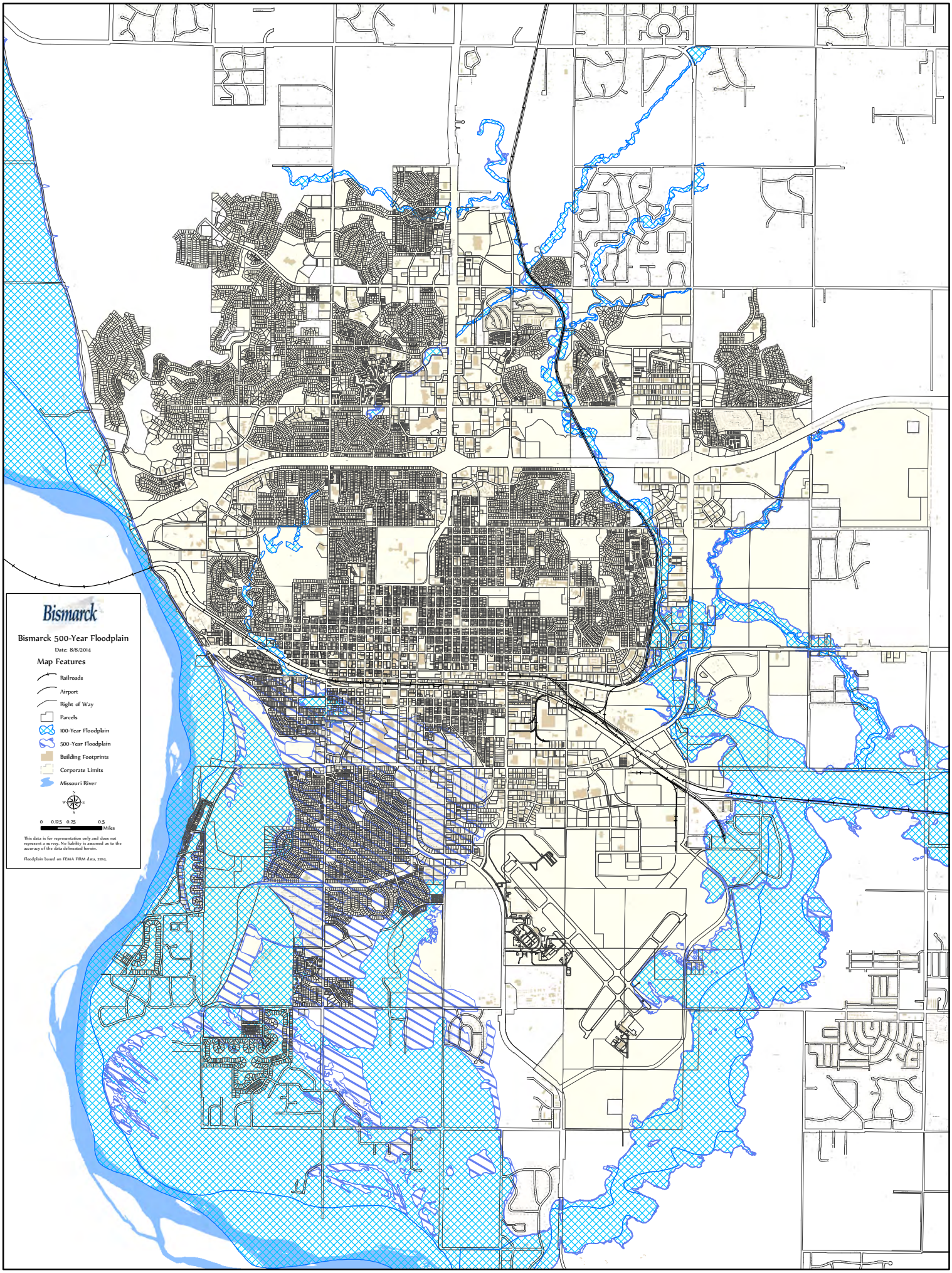
County	Population	Building Count	Building Value	Estimated Content Value	Total Value
Burleigh	3,286	1,379	$362,470,000	$181,235,000	$543,705,000
Source: 2014 NDDES Mitigation (FEMA DFIRM, Preliminary DFIRM, and Q3 Data: HAZUS-MH 2.1)					

Bismarck Facilities and Infrastructure within 100 Year Floodplain	
Critical Infrastructure	
Bridge: Railroad over Hay Creek	East of 3727 Pebbleview Lp
Bridge: Railroad over Main Av	South of 906 Missouri Av
Bridge: Riverwood Dr	2300 Riverwood Dr
Bridge: Rosser Av Over Hay Creek	North of 3605 E Rosser Av
Bridge: Tavis Rd	3300 Tavis Rd
Clear Channel Radio - KFYR/Y93	3500 E Rosser Av
Fox Island Boat Ramp	North of 2650 Mills Av
Grant Marsh Bridge Boat Ramp	North of 1103 River Rd
Pipeline at Missouri River	West of 4051 Sandy River Rd
Power Line at Missouri River	West of 6948 Burnt Creek Lp
Power Line at Missouri River	West of 5716 Misty Waters Dr
Railroad Crossing at Rosser Av	East of 3422 E Rosser Av
Railroad Over Hay Creek	East of 3120 E Capitol Av
Railroad Over Hay Creek	SE of 2920 E Capitol Av
Sanitary Sewer Pump Station	2516 River Rd
Sanitary Sewer Pump Station	3701 E Bismarck Ex
Hazmat Sites (ie: Tier II sites)	
South Port Marina	1120 Riverwood Dr
Western Area Power Administration	719 N Bismarck
Schools	
Prairie Rose Elementary (Bismarck Public Schools)	2200 Oahe Bend
Vulnerable/Special Populations	
Dakota Zoo	600 Riverside Park Rd

Bismarck Facilities and Infrastructure within 500 Year Floodplain	
Critical Facilities	
Bismarck Police Department	700 S 9th St
Bismarck Public School Facilities & Transportation	705 S 9th St
Cash Wise Foods	1144 E Bismarck
Dan's Supermarket - South	835 S Washington St
Fire Station 2 - South	835 E Bismarck
Salvation Army	601 S Washington St
Sanford Clinic - South	1040 Tacoma Av
Sanford Health Warehouse	1112 S 12th St
United Blood Service	517 S 7th St
Critical Infrastructure	
Bridge: 3rd St over drainage ditch	Southeast Of 1922 S 3rd St
Bridge: Railroad over Hay Creek	East of 3727 Pebbleview Lp
Bridge: Railroad over Main Av	South of 906 Missouri Av
Bridge: Railroad over River Rd and Missouri River	North of 1103 River Rd
Bridge: Riverwood Dr	2300 Riverwood Dr
Bridge: Rosser Av Over Hay Creek	North of 3605 E Rosser Av
Bridge: Southport Lp	1500 Southport Lp
Bridge: Tavis Rd	3300 Tavis Rd
Bridge: Wachter over Drainage Ditch	800 Wachter Av E
Bridge: Washington over Drainage Ditch	2201 Washington St
Clear Channel Radio - KFYR/Y93	3500 E Rosser Av
Fox Island Boat Ramp	North of 2650 Mills Av
Grant Marsh Bridge Boat Ramp	North of 1103 River Rd
Railroad Crossing at Divide Av	SE of 3500 Divide Av E
Railroad Crossing at Rosser Av	East of 3422 E Rosser Av
Railroad Over Hay Creek	East of 3120 E Capitol Av
Railroad Over Hay Creek	SE of 2920 E Capitol Av
Sanitary Sewer Pump Station	100 E Indiana Av
Sanitary Sewer Pump Station	2516 River Rd
Sanitary Sewer Pump Station	850 E Wachter Av
Sanitary Sewer Pump Station	3701 E Bismarck Ex
Wastewater Treatment Plant	601 W London Av

Bismarck Facilities and Infrastructure within 500 Year Floodplain cont'd	
HazMat Sites (Ie: Tier II Sites)	
Alltel	541 S 7th St
AmeriPride Linen & Apparel	1238 Frontier Dr
Bismarck Public School Facilities & Transportation	705 S 9th St
BP Amoco (aka Red Carpet)	919 S Washington St
Holiday Gas	905 E Bismarck
Little Dukes	1140 E Bismarck
Pony Express	1020 S Washington St
South Port Marina	1120 Riverwood Dr
Wastewater Treatment Plant	601 W London Av
Western Area Power Administration	719 N Bismarck
Schools	
Ascension Church School	1911 S 3rd St
Dorothy Moses Elementary	1312 Columbia Dr
ECLC	1901 Oakland Dr
Jeanette Myhre Elementary	919 S 12th St
Noah's Ark Daycare	1550 Wichita Dr
Open Door Community Center	1140 S 12th St
Prairie Rose Elementary	2200 Oahe Bend
Preschool Program - House of Prayer	1470 S Washington St
South Central High School	406 S Anderson St
Shepherd of the Valley Preschool	801 E Denver Av
Super Kids Jr. Academy	1227 Park Av
Victor Solheim Elementary	325 Munich Dr
Wachter Middle School	1107 S 7th St
Vulnerable/Special Populations	
Crescent Manor	107 E Bowen Av
Dakota Zoo	600 Riverside Park Rd
Diane's Hope House	315 W Indiana Av


Bismarck
Bismarck 100-Year Floodplain
Date: 8/8/2014
Map Features
Railroads
Airport
Right of Way
Parcels
100-Year Floodplain
Building Footprints
Corporate Limits
Missouri River
N
W
E
S
0 0.125 0.25 0.5
Miles
This data is for representation only and does not represent a survey. No liability is assumed as to the accuracy of the data delineated herein.
Floodplain based on FEMA FIRM data, 2014.


Bismarck
Bismarck 500-Year Floodplain
Date: 8/8/2014
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Corporate Limits
Missouri River
N
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S
0 0.125 0.25 0.5
Miles
This data is for representation only and does not represent a survey. No liability is assumed as to the accuracy of the data delineated herein.
Floodplain based on FEMA FIRM data, 2014.

Jackson Coulee Dam #2 (Tom O'Leary Golf Course) – Vulnerability Assessment:

The letter from Houston Engineering regarding Jackman Coulee Storm Water Facility Improvements and Tom O'Leary Storm Water Detention Applications dated September 4, 2002 describes the low probability: "…It seems appropriate to note the breach failures and methods requested are reflective of a catastrophic, or instantaneous, failure of both embankments simultaneously. Such failures would require these embankments to be fully saturated or have significant structural defects. The probability of a multiple breach is extremely remote since embankment saturation during events lasting six hours and a complete erosive failure event associated with spillway flows of three hours is unreasonable, though it is worst case. We understand these embankments are being held to a very high standard and in our opinion the proposed designs now comply with the required criteria. It is important to understand, however, that if all future and/or existing embankments, including roadways, are held to this level of jurisdictional authority or design criteria some may be impractical to construct and the cost to evaluate the potential failure impacts extensive…"

The inserted map on the following page identifies five residential properties at potential risk for flooding on either a 0.5 PMP (probable maximum precipitation) flood event or a 0.5 PMP flood event with a multiple breach. The 6 hour precipitation event for the 0.5 PMP is 10.7 inches.

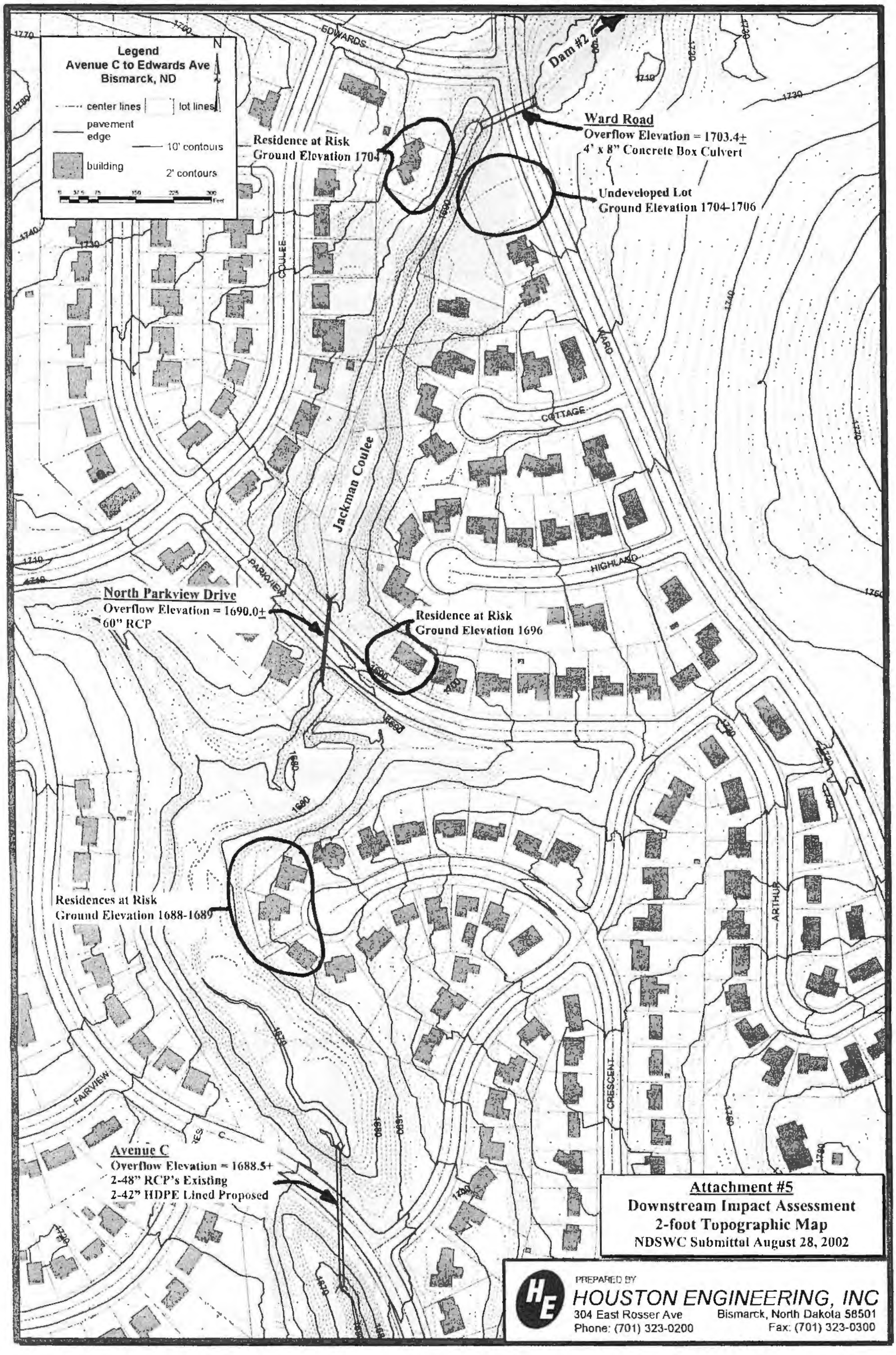
The first residence is located on the west side of Jackman Coulee just to the west of Ward Road. The potential risks to this residence were determined using a selected channel section and a conveyance capacity rating based on downstream backwater conditions.
This rating indicates the maximum elevation on a 0.5 PMP event, using a peak flow of 3,400 cfs, is approximately 1698.5 msl. The upstream elevation at Ward Road on this event is 1706.6 and would transition from the overflow back into the channel at this location. Using the City of Bismarck's 2-foot aerial topography was determined the ground level at this residence is at or above elevation 1704. While a finished floor elevation could not be determined this is a slab on grade structure. Based on a projected multiple breach peak flow of 5,355 cfs the water surface elevation in the channel increases to 1700.5 with the elevation over Ward Road at 1707.4. Again the projected water surface elevation in the channel at the residence is below the estimated floor elevation. The unknown, however, is the actual boundary of the transition from overflows on Ward Road into the channel. Reviewing the topography it appears there is a moderate risk for shallow water flooding to reach the north side of this residence on a multiple breach 0.5 PMP event.

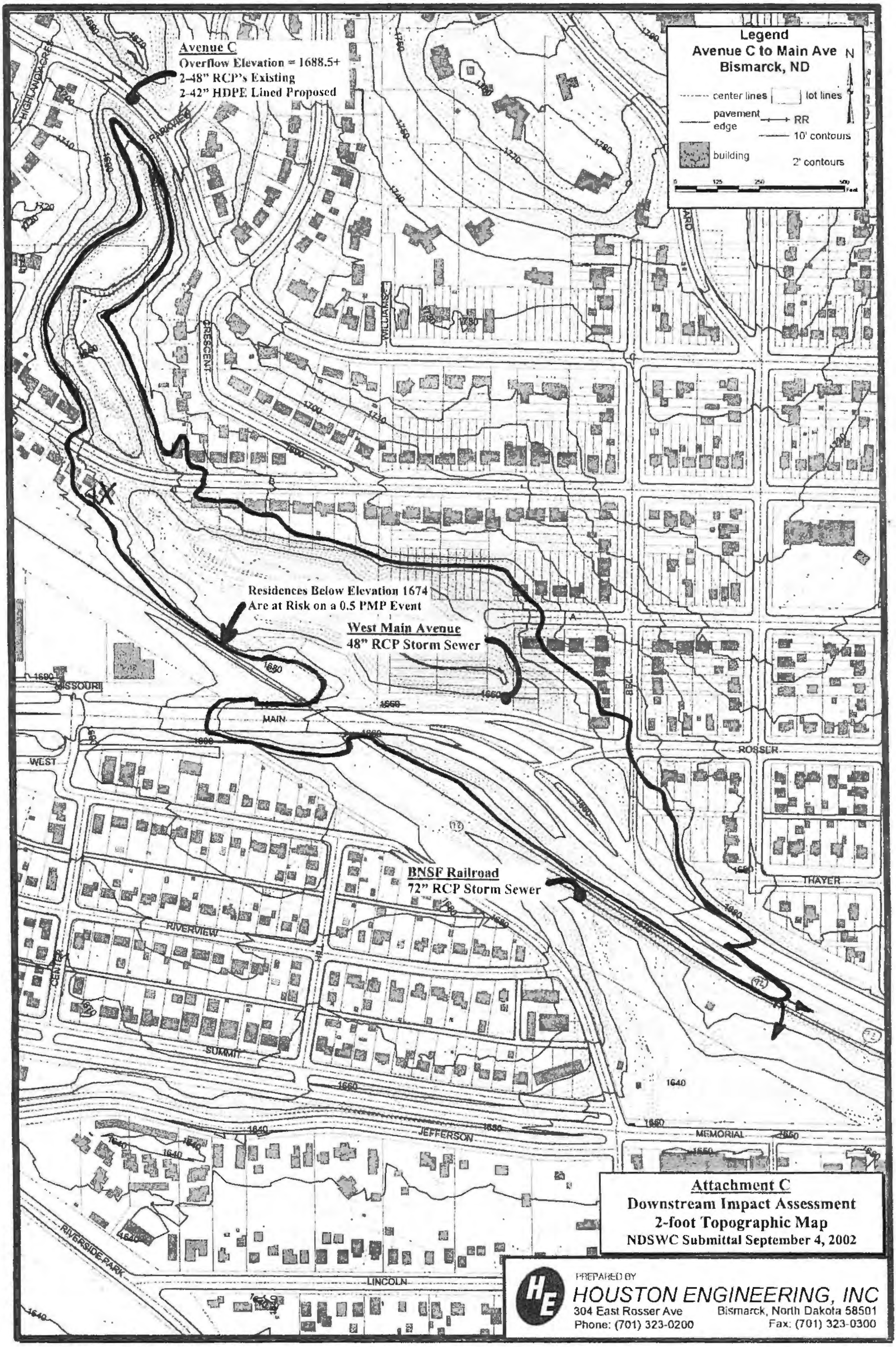
The second impact site is an undeveloped lot located on the west side of Ward Road south of the channel. This lot is not at risk for flooding on a 100-year event and has been removed from the current FIRM. This lot and any future residence are, however, at potential risk for flooding on events greater than the 100-year event, especially a 0.5 PMP or multiple breach event. While this lot and any future residence could be raised this action would restrict the overflows on Ward Road and flows around the structure into the channel would not be desirable. The City has been informed about this situation and will need to carefully consider the associated risks when reviewing any building permit request for this lot. The option to purchase this lot is should also be reviewed.

The third impact site is a residence located on the east side of Jackman Coulee just north of North Parkview Drive. The 0.5 PMP flood event and 0.5 PMP multiple breach flood event yielded elevations of 1693.7 and 1694.l respectively at this crossing. Using the City of Bismarck's 2-foot aerial topography the ground level around this is residence was determined to be at or above elevation 1696. Therefore, this residence is not deemed at risk for flooding on these events.

The fourth impact site contains three residences located on the east side of Jackman Coulee at the west end of Crescent Lane. Using the City of Bismarck's 2-foot aerial topography the ground level around these residences was determined to be between elevation 1688 and 1690. This potentially places the finished floor elevations of these walkout basements below the overflow elevation on Avenue C, which are approximately 1688.5. Based on the tables in Attachment #3 these residences are potentially first affected by shallow flooding on about a 500-year event under existing conditions, flood elevation 1688.3. They would however be provided additional protection under projected conditions, which lowers the 500-year flood elevation to 1685.8. In all cases these residences will be affected by floodwaters on events larger than a 500-year event. Since the 0.5 PMP flood event and 0.5 PMP multiple breach event yielded the same flood elevation at Avenue C the incremental impacts are deemed to be minimal. It should be noted that the most likely change would be a slight increase in the potential for shallow water flooding.

The next impact area is between Avenue C and West Main Avenue as illustrated within the inserted map labeled as "Attachment C." This is a confined storage area with a discharge capability limited to 350-450 cfs. Therefore, no matter when the floodwaters arrive from the 0.5 PMP event, breach overflows or not, the maximum flood elevation will not change appreciably as the total inflow volume is too significant to be discharged in a timely manner. Based on the City of Bismarck's aerial topography, the estimated overflow elevation at the BNSF railroad tracks or east along the south side of West Main Avenue is around 1672.5+. Using an estimated maximum water surface elevation of 1674, approximately twelve residences surrounding this area could be affected, most with shallow flooding with the exception basement impacts. Reviewing the path for overflows from Avenue C no residences will be impacted along the reach from Avenue C and Avenue B. The principal impact of all overflows will be from increased floodwater elevations from Avenue B south to West Main Avenue.


Legend
Avenue C to Edwards Ave
Bismarck, ND
N
center lines
lot lines
pavement edge
10' contours
building
2' contours
EDWARDS
Dam #2
Ward Road
Overflow Elevation = 1703.4±
4' x 8" Concrete Box Culvert
Residence at Risk
Ground Elevation 1704
Undeveloped Lot
Ground Elevation 1704-1706
COULEE
WARD
COTTAGE
Jackman Coulee
HIGHLAND
PARKVIEW
North Parkview Drive
Overflow Elevation = 1690.0±
60" RCP
Residence at Risk
Ground Elevation 1696
Residences at Risk
Ground Elevation 1688-1689
ARTHUR
CRESCENT
FAIRVIEW
Avenue C
Overflow Elevation = 1688.5+
2-48" RCP's Existing
2-42" HDPE Lined Proposed
Attachment #5
Downstream Impact Assessment
2-foot Topographic Map
NDSWC Submittal August 28, 2002
PREPARED BY
HOUSTON ENGINEERING, INC
304 East Rosser Ave
Bismarck, North Dakota 58501
Phone: (701) 323-0200
Fax: (701) 323-0300



Attachment C
Downstream Impact Assessment
2-foot Topographic Map
NDSWC Submittal September 4, 2002

PREPARED BY
HOUSTON ENGINEERING, INC
304 East Rosser Ave
Bismarck, North Dakota 58501
Phone: (701) 323-0200
Fax: (701) 323-0300

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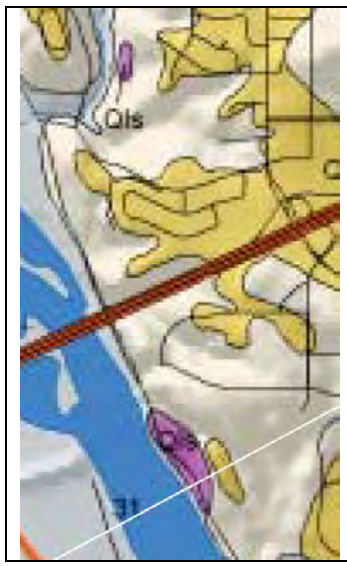
Geologic Hazard – Hazard Profile

Description

SLOPE FAILURE
Seventeen landslides have been identified in the Bismarck – Mandan area. Most of these slides likely predate settlement of the area and are hundreds, if not thousands, of years old. Typically, more recent landslides are reactivations of these older, much larger landslide complexes. Landslides may occur throughout the year but are most prevalent in the spring and early summer due to the availability of moisture from snowmelt and rainfall events. In addition, studies have shown that landslides are most active during a wet period that follows an extended dry period. For these reasons, water is often said to "lubricate a slide." Although this is an oversimplification of the mechanisms and rock properties, such as differential pore pressures, involved in slope failure, it is correct in its emphasis of the importance of water to slope movement. To a degree, landslides are self-perpetuating because more water seeps into the subsurface after a slide occurs due to the ponding of water in the newly formed surface depressions and infiltration of this water through numerous tension cracks.

Rivers and streams erode by undercutting the river banks on the outside of a meander or curve. This erosion creates over-steepened cliff faces that are highly susceptible to slope failure. Such is the case in west Mandan where landslides have occurred in the steep, tall cliffs overlooking the Heart River. A series of landslides in this area has displaced trees, a rock wall, and resulted in the abandonment of at least two lots due to safety concerns.

The mudstone of the Cannonball Formation contains interbedded lenses of sandstone and siltstone (grayish brown) and claystone (dark gray). The sand and clay content of the Cannonball mudstones is also variable, some mudstones are dominated by clay and others by sand and silt. Most of the mudstones in the Bismarck-Mandan area are dominated by claystone. The clays in the mudstone are mixed and contain varying percentages of swelling clays. Differential pore pressures within lenses in the mudstone and the presence of swelling clays may potentially damage building foundations.
All of the landslides identified in the Bismarck-Mandan area involve mudstones in the Cannonball Formation. Not only are these mudstones involved, but most of the slope failures appear to have originated within these rocks. https://www.dmr.nd.gov/ndgs/documents/Publication_List/pdf/geoinv/GI_3.pdf



The areas in pink shading show previous areas of slope failure in Bismarck. The top location is north of Burnt Boat Drive. The bottom location is along River Road just south of the Interstate 94.
https://www.dmr.nd.gov/ndgs/documents/Publication_List/pdf/geoinv/GI_3.pdf

The ND Geological Survey (within ND Department of Mineral Resources) has Bismarck area Landslide maps available: https://www.dmr.nd.gov/ndgs/landslides/Bismarck/
as well as a surface geology map:
https://www.dmr.nd.gov/ndgs/surfacegeo/BISMARCK_100K/WebSurfaceGeology/24k/bsmk_sg.pdf

Slope failure, also referred to as mass wasting, is the downslope movement of rock debris and soil in response to gravitational stresses. Three major types of mass wasting are classified by the type of downslope movement: falls, slides, and flows. Land subsidence is another type of ground failure covered.

Landslide

A landslide is the movement of rock, soil, artificial fill, or a combination thereof on a slope in a downward or outward direction. The primary causes of landslides are slope saturation by water from intense rainfall, snowmelt, or changes in ground-water levels on primarily steep slopes, earthen dams, and the banks of lakes, reservoirs, canals, and rivers (US Geological Survey). Other causative factors include steepening of slopes by erosion or construction, alternate freezing or thawing, earthquake shaking, volcanic eruptions, and the loss of vegetation from construction or wildfires. The saturation or destabilization of a slope allows the material to succumb to the forces of gravity or ground movement.

Many different types of landslides exist: slides, falls, topples, flows, and lateral spreads. Slides involve the mass movement of material from a distinct zone of weakness separating the slide material from the more stable underlying material. The primary types of slides are rotational slides and translational slides. Falls occur when materials, mostly rocks and boulders, fall abruptly from a steep slope or cliff. Falls are strongly influenced by gravity, mechanical weathering, and the presence of interstitial water. Topples are similar to falls, yet they pivot around a connection point at the base of the material and are most often caused by gravity or fluids in the cracks of the rocks. Flows typically have a higher percentage of water material embedded in them and behave more like a liquid than other types of landslides. The five primary categories of flows are: debris flows, debris avalanches, earthflows, mudflows, and creeps. Lateral spreads usually occur on gentle slope or flat surfaces when liquefaction occurs and leads to fractures on the surface. Complex landslides involve any combination of these types (US Geological Survey).

Landslides are typically associated with mountainous regions, but they can also occur in areas of low relief. In these areas, the landslides are often the result of cut-and-fill failures (from roadway and building excavations), river bluff failures, lateral spreading, or mine collapse (US Geological Survey).

Landslides occur in natural and anthropogenic settings in North Dakota and are most commonly found within major river valleys and on engineered slopes along major transportation corridors. Landslides are dominantly found in two settings, controlled by the surface geology of the Great Plains in western and southwestern North Dakota and along major river valleys of the Missouri, Sheyenne, James, Souris, and Red Rivers (North Dakota Geological Survey).

Riverbank slumping can be considered a form of landslide and is often found along the rivers in North Dakota. The riverbank soils are inherently weak, and natural forces are always moving river channels.

Land subsidence is a gradual settling or sudden sinking of the Earth's surface owing to subsurface movement of earth materials. The principal causes are aquifer-system compaction, drainage of organic soils, underground mining, hydrocompaction, natural compaction, sinkholes, and thawing permafrost.

RISK

Risk: the potential for damage, loss, or other impacts created by the interaction of hazards with community assets.

Risk Assessment: product or process that collects information and assigns values to risks for the purpose of informing priorities, developing or comparing courses of action, and informing decision making.

THIRA Ratings – Geologic Hazard (Slope Failure along River Road)

Frequency	Consequence			
	Human	Economic	Psychological	Government
Possible	None/Negligible	Minor	Minor	Minor

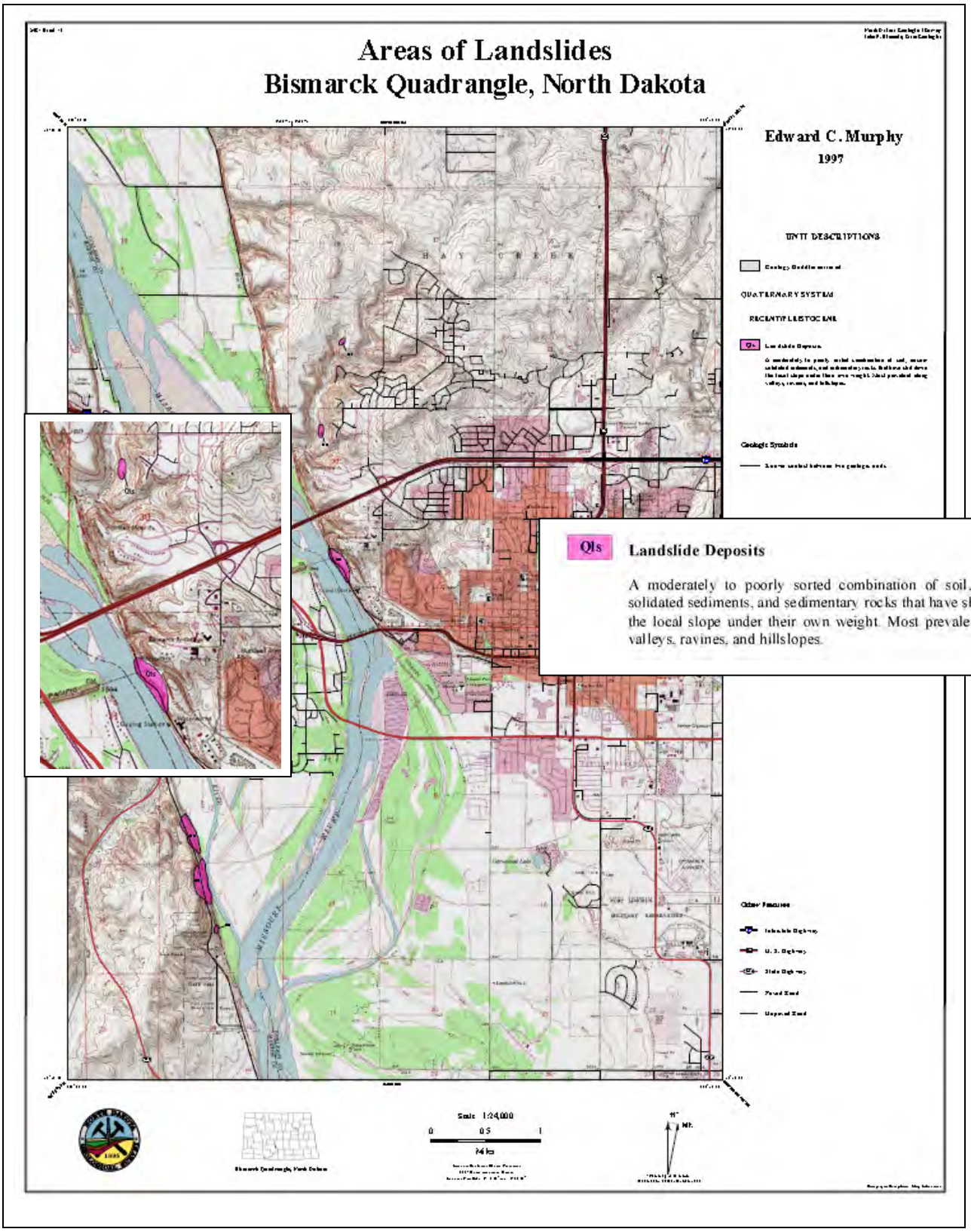
Historical Occurrences:

June 2009 thru December 2009: River Road between the Memorial Bridge and the Railroad Bridge was closed as a result of slope failure (land subsidence). Sloping of the half-mile stretch between north of Bismarck's water plant and Keel Boat Park forced the city to close the road in June. Pavement had to be removed and pilings put in place. Permanent surfacing had to be applied in 2010.

Figure 6. Several landslide scarps are visible along the east slopes of the Missouri River Valley above the Bismarck Railroad Bridge. The top of a City of Bismarck water reservoir is visible just below the largest tree at the top of the east slope. Photograph taken by Ralph Peck in 1951.

The ND Department of Mineral Resources (DMR) July 2009 newsletter cites slope instability issue affecting the Northern Pacific Railway Bridge for several decades after it was completed in 1882: "…. Shortly after the railroad bridge was completed, the east pier began sliding towards the river. For the next 68 years, Northern Pacific engineers applied a variety of slope stabilization techniques in an attempt to stop the pier from moving. …. Peck seized the opportunity that was afforded during the straightening of the railroad track to remove a considerable amount of the hillside above the east pier and reduce the remaining slope to within his desired factor of safety. Finally, after all of those years, his efforts resulted in relative stability of the slope above the east bridge pier…" https://www.dmr.nd.gov/ndgs/documents/newsletter/2009Summer/pdf/IceJamsLandslides.pdf

Historical locations of landslides in the Bismarck area are also noted within the map on page 5.



https://www.dmr.nd.gov/ndgs/landslides/Bismarck/Bsmk_l.pdf

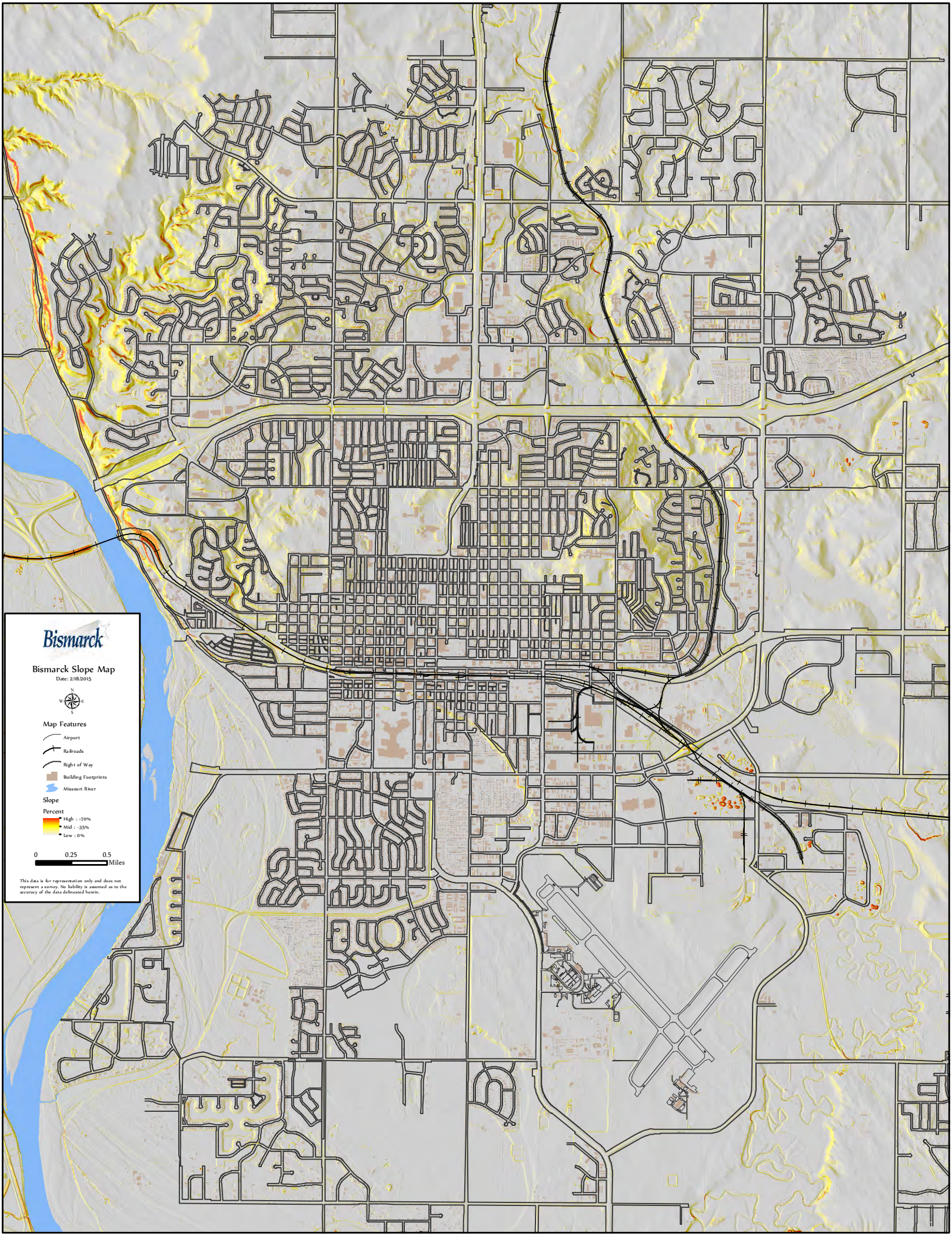
Photos below show slumping north of Burnt Boat Drive Photo Date: October 9, 2009	

NDSU has documented (photos) of slumping in the Double Ditch Area http://www.ndsu.edu/nd_geology/nd_mass_wasting/index_mass_wasting.htm	
This large slump is located north of Bismarck, at the site of the Double Ditch Indian Village. It was initiated by erosion against this slope by the Missouri River (just out of view to the right on this photo). *In the next photo, we see the progress of this slump over just nine months. (Use the telephone pole and highway as reference points between the two photos).* *(Photo by J. Kostelecky, 1987).*	*This is the same slump as in the previous photo, but nine months later. (Use the telephone pole and highway as reference points between the two photos).* *(Photo by D.P. Schwert, North Dakota State University, 1988).*

Vulnerability Assessment

Vulnerability: Characteristics of community assets that make them susceptible to damage from a given hazard.

	Landslide (Slope Failure)
Probability	Possible
Speed of Onset	No Notice event in many cases.
Geographic Area	See applicable maps.
Death / Injury 1. Primary Causes A. Highest vulnerability	 1. Falling Rock, road washouts. A. Those living or traveling near areas of potential land subsidence.
Mass Casualty Incident	Unlikely
Property Losses (points of vulnerability – high priority)	1. Properties built, potentially on backfill or without adequate setback (prior to current master planning methods). - Tyler Coulee area - Promontory Point – West of Clairmount Road
Environmental (points of vulnerability – high priority)	1. Hay Creek (waterway impacted). 2. Impact to the Missouri River would be minimal.
COG/COOP (points of vulnerability – high priority)	1. No impacts
Critical Facilities (points of vulnerability – high priority)	1. Water Treatment Plant, located off River Road
Critical Infrastructure (points of vulnerability – high priority)	1. River Road – potential loss of access similar to June 2009: closed for 5 months to make repairs. Necessary detour can potentially cause delays in emergency response. 2. DMVW tracks run adjacent to Hay Creek through much of Bismarck. 3. BNSF Railroad Bridge Piers. 4. Private Utility Infrastructure in NW Bismarck – both overhead and underground utilities (ie: near River Road) - gas main near water treatment plant - gas force main – below the Missouri River
Schools (points of vulnerability – high priority)	1. Burnt Boat Drive – bus route.
High Risk Facilities (chemical) (points of vulnerability – high priority)	1. No impacts
Specific Populations: Public Assembly, Vulnerable / Special Populations (points of vulnerability – high priority)	1. Limited to populations affected to by road closure (ie: River Road) or site specific property impacts (ie: slope failure).
Economy (community wide)	
OTHER: (points of vulnerability – high priority)	The failure zone in both the Mary College *(University of Mary*) and the NP Railroad Bridge slides appeared to occur in the Hell Creek – a unit that contains more swelling clays. E-mail comment: Edward C. Murphy, State Geologist North Dakota Geological Survey, ND Department of Mineral Resources, ND Industrial Commission


Bismarck
Bismarck Slope Map
Date: 2/18/2015
N
W
E
S
Map Features
Airport
Railroads
Right of Way
Building Footprints
Missouri River
Slope
Percent
High : >70%
Mid : 35%
Low : 0%
0
0.25
0.5
Miles
This data is for representation only and does not represent a survey. No liability is assumed as to the accuracy of the data delineated herein.

Hazardous Materials Release – Hazard Profile

Description

Hazardous materials are materials that if released, can pose a threat to human health or the environment. Hazardous material releases can cause long/short term health effects, damage to property, expensive cleanup/contractor costs, serious injury, and even death.

A Hazardous material release in Bismarck could result in either evacuation or "shelter-in-place" situations. A hazardous material release may be a rare occurrence, but one major release could have a significant impact.

This plan section will address three primary origins of hazmat incidents: Fixed Facilities, Transportation, and Pipeline. Train Derailment (including hazmat) is addressed in its own hazard profile section.

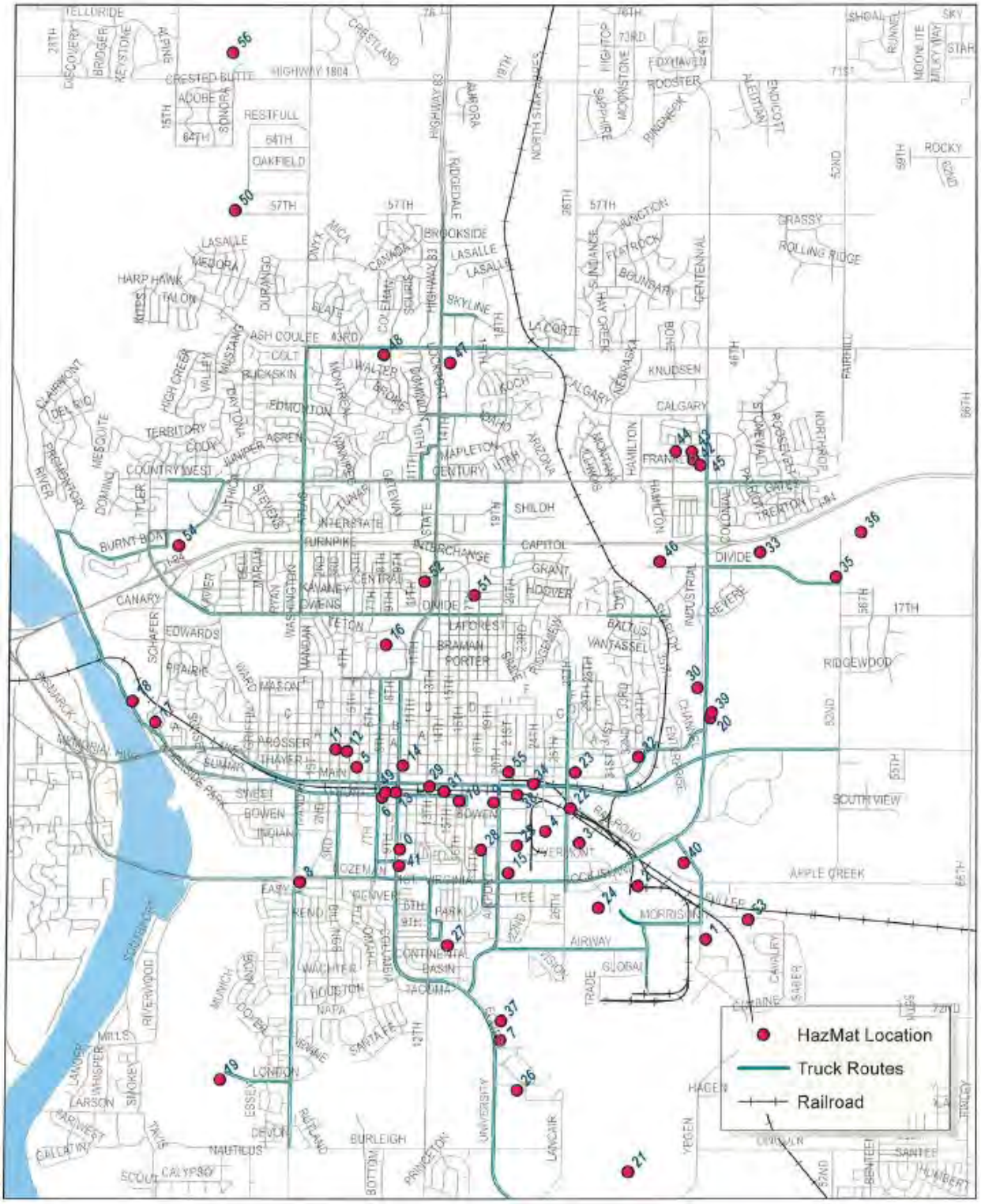
Fixed Facilities

Hazardous materials being used or stored at industrial facilities and in buildings is defined as a *fixed facility* hazardous material release hazard. The Emergency Planning and Community Right-to-Know Act (EPCRA), also known as SARA Title III, was enacted in November 1986 to enable state and local governments to adequately prepare and plan for chemical emergencies. Facilities covered by EPCRA must submit an emergency and hazardous chemical inventory form to the Local Emergency Planning Committee (LEPC), the State Emergency Response Commission (SERC) and the local fire department annually.

Bismarck has 56 facilities that are described as "Tier II" facilities (year 2013) which are required to report due to the quantity and/or type of material stored or used on site. Many facilities (ie: gas stations) are not considered "Tier II" facilities and are not required to report. However, the Bismarck Fire Department inspects all commercial and industrial businesses annually and is aware of those additional fixed facilities and materials on site.

The total number of facilities using, storing, or selling hazardous materials, including non-Tier II facilities, will fluctuate on a regular basis. The approximate number of facilities in Bismarck is 242 sites using, storing, or selling materials that are classified as hazardous (including common household products). The vast majority are NOT "Tier II" facilities, and are not required to report per EPCRA.

Tier II Facilities in Bismarck - 2013



Tier II Facilities in Bismarck - 2013		
Name	**Address**	**Chemical**
Alliance Ag Coop	1505 Yegen Rd	Anhydrous Ammonia, RT3, Glyphosate, Diesel Fuel, Class Act, Rapid Fire
AT&T - ND0410	1823 N 16th St	Sulfuric Acid, Lead, Diesel Fuel
AT&T Mobility	1925 N 11th St	Sulfuric Acid
Automotive & Industrial Distributors	1721 Michigan Ave	Motor Oil
Bismarck Public Schools Facilities and Transporta*	705 S 9th St	Gasoline, Diesel Fuel
Bismarck Public Works	601 S 26th St	Gasoline, Diesel Fuel, Propane
Bismarck Public Works-Municipal Landfill	2111 N 52nd St	Diesel Fuel
Bismarck Public Works-Wastewater Treatment Plant	601 London Ave	Chlorine, Sulfur Dioxide, Ferric Chloride
Bismarck Public Works-Water Treatment Plant	615 River Rd	Chlorine, Carbon Dioxide
Bismarck Tribune	707 E Front Ave	CentraNews Vintage O/S Ink
Bridgestone (GCR Tire Centers - Bismarck - 504)	1405 Frontier Drive	Polyurethane Component (Part A), Polyurethane Component (Part B)
Burleigh County Highway Dept Shop	2000 N 52nd St	Gasoline, Diesel Fuel, Asphalt Cement
Central Power Electric Cooperative	4111 State St N	Gasoline
CenturyLink	220 N 5th St	Sulfuric Acid, Lead Acid Batteries, Fuel Oil
Coca-Cola Refreshments	3225 E Thayer Av	Carbon Dioxide, Lead, Sulfuric Acid, Sodium Hydroxide, Anhydrous Ammonia
Cofells Plumbing & Heating Inc.	1000 Industrial Dr	Gasoline, Diesel Fuel
Crop Production Service	1240 Hemlock St	Actamaster, RT3, Roundup PowerMax, Gromoxone Inteon, Mad Dog Plus, Wolverine, N-Pact, Riser, Gypsum
Dakota Carrier Network (DCN)	4202 Coleman St	Sulfuric Acid
DAL Global Services	2301 University Dr	Propylene Glycol
Dean Foods North Central	1207 E Main Ave	Ammonia, Diesel Fuel, Sulfuric Acid, Lead, Nitric Acid
Doosan - Bobcat	521 S 22nd St	Diesel Fuel, Hydrotreated Heavy Naphtha, Acetylene, Ammonia, Argon, Carbon Dioxide, Ethylene, Phosp*
Executive Air Taxi (EATC)	2301 University Dr	100LL Aviation Gasoline, Type A Jet Fuel
Exide Technologies	3705 Saratoga Av	Battery Acid
Farmers Union Oil Company Bismarck/Mandan- Broadw*	2006 E Broadway Ave	Motor Oil
Ferrellgas Bismarck	2300 E Main Av	Propane,
GCCD Bismarck Terminal	1316 E Front Ave	Cement
Jiffy Lube #519	1017 S Washington St	Motor Oil
Knife River ND - Bismarck Front Ave	2030 East Front Ave	Fly Ash, Cement
Knife River ND - Bismarck Rock Island Pl	3305 Rock Island Place	Fly Ash, Cement, Diesel Fuel
Lafarge - Bismarck Terminal	714 E Front Ave	Cement, Fly Ash
Lowe's of Bismarck #2533	1402 Century Ave W	Diesel Fuel
Minnesota Valley Testing Laboratories	2616 Broadway Ave E	Argon
Montana-Dakota Utilities Bismarck Service Center	909 Airport Rd	Mineral Oil
Montana-Dakota Utilities GO Generator	400 N 4th St	Diesel Fuel
National Weather Service	2301 University Dr Bldg 27	Diesel Fuel
ND Department of Transportation Bismarck HQ	218 S 19th St	Diesel Fuel, Gasoline, Tar Oil
ND Department of Transportation-Capitol Ground	608 E Boulevard Av	Gasoline
ND National Guard - Army Aviation Support Facility	3410 Airway Av	Aviation Fuel, Diesel Fuel, Gasoline
ND National Guard - Fraine Barracks	432 Fraine Barracks Rd	Diesel Fuel, Gasoline, Sulfuric Acid
ND National Guard - Raymond J Bohn Armory	4200 E Divide Ave	Diesel Fuel, Gasoline

Tier II Facilities in Bismarck - 2013		
Name	**Address**	**Chemical**
Praxair Distribution Inc. Main Plant	820 E Front Ave	Oxygen
Praxair Distribution Inc. Plant	207 S 26th St	Carbon Dioxide, Nitrogen Cryogenic Liquid, Argon
Safety-Kleen System Inc.	3704 Saratoga Ave	Petroleum Naphtha
Sam's Club #4933	2821 Rock Island Pl	Motor Oil, Lead Acid Batteries
Schwan's Home Service Inc. 115300	3500 Miriam Ave	Propane,
Sprint United	215 S 15th St	Diesel Fuel, Lead Acid Batteries, Sulfuric Acid
St Alexius Hospital	900 E Broadway	Phosphorus, CycloHexylamine, Styrene
Strata Concrete	900 Yegen Rd	Diesel Fuel
Supervalu Inc. Bismarck #31211	707 Airport Rd	Ammonia, Diesel Fuel, Sulfuric Acid, Lead Acid Batteries
United Parcel Service Inc.	3814 Franklin Av	Diesel Fuel, Gasoline
US Food Service/GFG Division	3500 Saratoga Ave	Sulfuric Acid, Lead
Verizon Wireless-Expressway 4932311	911 S 9th St	Sulfuric Acid
Western Area Power Administration - Bismarck Subs*	719 N Bismarck Expressway	Transformer Oil, Battery Acid
Western Area Power Administration - Bismarck Ware*	700 N Bismarck Expressway	Transformer Oil
Western Area Power Administration - Ward Delivery*	7200 Sonora Way	Battery Acid, Transformer Oil
William Guy Federal Building	220 E Rosser Ave	Fuel Oil
Williston Basin Interstate - Bismarck Station	850 57th Ave NW	Motor Oil

The following table lists chemicals that are used at various facilities in Bismarck and are identified as EHS, and/or pose an inhalation hazard, and/or have a relatively low IDLH. This list is not all inclusive of chemicals used or stored in Bismarck.

Chemical Name	EHS	Inhalation Hazard	IDLH
Chlorine		x	10 ppm
Anhydrous Ammonia	x	x	300 ppm
Ammonia	x	x	300 ppm
Sulfuric Acid	x	x	15 mg/m
Nitric Acid	x	x	25 ppm
Sulfur Dioxide		x	
Sodium Hydroxide			10mg/m
Oxygen			0.5 ppm
Liquid Nitrogen			20 ppm
Benzene (gasoline)	x		500 ppm
Benzene (diesel fuel)	x		500 ppm
Lead (lead acid batteries)	x		100 mg/m
Paraquat Dichloride	x		1 mg/m
Petroleum Naphtha			1100 ppm
Propane	x		2100 ppm
Actamaster (ammonium sulfate)			1500 mg/m
Carbon Dioxide			40,000 ppm
Petroleum Distillate (liquid asphalt)			1100 ppm
Heptane			750 ppm
Mercury			10mg/m
Toluene			500 ppm
Trichloroethylene			1000 ppm

EHS= Extremely Hazardous Substance (per EPA List of Lists)
Inhalation Hazard – per NIOSH Guide
IDLH: Immediately Danger to Life or Health (parts per million)

The most common hazardous materials within Bismarck at fixed facilities are gasoline and diesel fuel in the sense that they are used, stored, and/or sold at the most locations throughout Bismarck. The number of locations is approximate since they can change frequently. The purpose of the table is to illustrate the common hazardous materials at many of the fixed facilities.

Product	Number of Locations
Gasoline	32
Diesel Fuel	28
Propane	16
Sulfuric Acid	12
Oxygen	10
Motor Oil	8
Acetylene	7
Fuel Oil #1	6
Sodium Hydroxide	6
Chlorine	4
Argon	4

Transport (ie: Truck)

Note: Hazardous Materials Release is also addressed in the "Train Derailment" Hazard Profile. Hazmat incidents as a result of train derailment will not be duplicated in this section.

Bismarck has designated truck routes which serve as hazmat routes. However, there are no hazmat routes specifically designated at this time.

Although a Hazmat Flow Study was conducted in 2012 for all of Burleigh County, it's assumed that all materials stored or used at fixed facility locations in Bismarck or anywhere in North Dakota are transported through Bismarck via I-94 and US83 primarily, and also throughout the city (ie: truck routes) if used or stored at a local fixed facility.

The US Department of Transportation (DOT) defines hazardous material as items which pose a risk to health, safety, and property during commerce related transportation. Vehicles transporting hazardous materials are common. These materials could pose a risk should a spill or other release occur. The DOT divided these materials into nine hazard classes, each exhibiting a common threat to health and/or property. These classes offer the general nature of the material being transported when exact identification is not possible. US DOT class identifications are listed below:

- Class 1: Explosives
- Class 2: Gases
- Class 3: Flammable Liquids
- Class 4: Flammable Solids/Spontaneously Combustible/Water Reactive
- Class 5: Oxidizers/Organic Peroxides
- Class 6: Toxic/Infectious
- Class 7: Radioactive
- Class 8: Corrosive

- Class 9: Miscellaneous
  http://phmsa.dot.gov/hazmat

The harm posed to humans can be characterized by one or more characteristics:

- *Ignitability:* Sustains fire which may cause physical harm.
- *Corrosivity:* May corroding metal or other material, poses a chemical hazard.
- *Reactivity:* Can create explosions or toxic releases, posing a physical harm.
- *Toxicity:* Harmful ingested, breathed, or absorbed, posing a chemical harm.
  Definitions from USEPA at www.epa.gov

The US DOT in the Code of Federal Regulations has standards for marking, labeling, placarding, shipping papers, emergency response information, packaging, handling, and transporting of hazardous materials, but there are no reporting requirements for hazardous material transportation. (49 CFD 100-185)

Northern Plains Commerce Centre - Bismarck

The Northern Plains Commerce Centre (NPCC) is a premier industrial park with immediate access to road and rail transport located in Bismarck, North Dakota. The NPCC allows companies to improve their ability to efficiently distribute products within the Northern Plains region and globally. The facility offers both rail and non-rail served sites.

Located adjacent to the Bismarck Airport, the NPCC is home to a 100,000 square foot Bobcat Company Manufacturing Sequencing Center (MSC) and Tubular Transport and Logistics (TTL). Tubular Transport and Logistics offers rail to truck reloading, trucking and storage services allowing non-rail served businesses to take advantage of long haul cost savings by using rail.

The NPCC has access to both Canadian Pacific and the BNSF via the DMVW Railroad. The truck route between US I-94 and the Northern Plains Commerce Centre is considered a heavy haul corridor.
More information: https://www.bmda.org/northern-plains-commerce-centre/

Hazmat Traffic Flow Overview

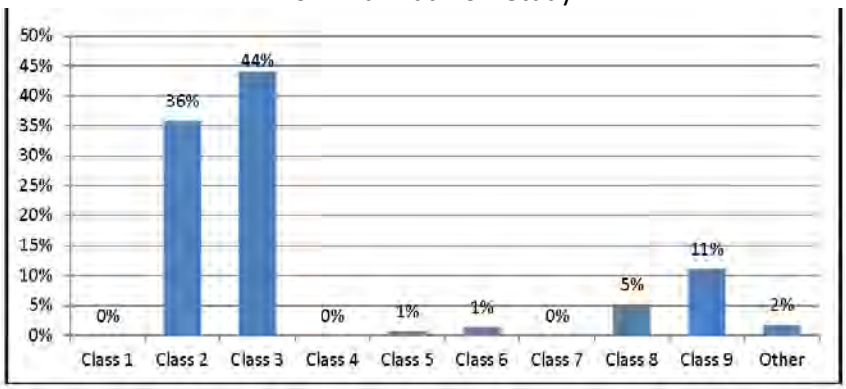
(The following overview is based on the 2012 Hazmat Flow Study for Burleigh County funded by the Local Emergency Planning Committee)

Surface Transportation by Highway: Within Burleigh County, the majority of hazardous materials transported by highway are transported via I-94 (approx. 71%) and US 83 (approx. 26%). Both I-94 and US83 intersect Bismarck. The remaining highways (ND1804, ND14, ND36, and ND41) account for the remaining 3%. The sample included 247 vehicles observed during the 2012 hazmat flow study.

The most common commodities transported by highway were identified as Anhydrous Ammonia, Gasoline, Diesel, Asphalt, and Propane. These top five commodities accounted for 78% of the hazardous materials during the traffic flow study in 2012.

The following graph, from the 2012 Hazmat Flow Study illustrates the hazard classification of the materials transported by highway noted during the study.

DOT Hazard Classification of Materials Transported by Highway
2012 Hazmat Flow Study



Schools and other locations of higher vulnerability based on proximity to I-94 are noted in the table below. Potential icy road conditions along with the higher traffic speed of I-94 enhances the risk of a more significant traffic accident which may involve hazardous materials. Certainly, additional locations are vulnerable, and those listed here would not necessarily be impacted depending on incident location, wind conditions, etc.

Schools and Other Populations in close proximity to I-94 (hazmat traffic)	
Schools	**Other**
Bismarck State College	Dan's Supermarket (near I-94 clover leaf – west Bismarck)
Theo Art School	Hampton Inn (near I-94 clover leaf – west Bismarck)
Montessori Daycare (adjacent to I-94, significant slope)	Residential community Adjacent to 1-94 (properties are approximately 200 feet from I-94)
Grimsrud Elementary (> ¼ mile)	
Centennial Elementary (1/3 mile)	

Air Transportation: The 2012 hazmat flow study included hazardous materials transported in and out of the Bismarck Airport. Air transportation of hazardous materials has the smallest presence by mode as expected due probably to its relative high cost. Hazardous material shipments by air are handled by UPS and FedEx.

In the sample data period of June 1, 2011 through May 31, 2012 there were 960 inbound shipments of hazardous materials at the Bismarck Airport by FedEx (UPS declined to participate in the study citing homeland security concerns). These shipments are significantly smaller than the shipments that are transported by truck or by railway. When inbound hazardous shipments are categorized according to general DOT hazard classifications, hazards falling into class seven are the most reported. Hazard class seven is radioactive material. The majority of these shipments are shipped in Type A Packaging. Material typically shipped in Type A Packages include nuclear medicines (radiopharmaceuticals). Type A packaging are only used to transport non-life-endangering amounts of radioactive material. Type B(U) packaging is also used for shipments into Burleigh County. This packaging includes shipments in 55-gallon drums. Material typically shipped in Type B(U) packaging includes spent nuclear fuel, high-level radioactive waste, and high concentrations of other radioactive material such as cesium and cobalt.

The sample data period of June 1, 2011 through May 31, 2012 there were 192 outbound shipments of hazardous materials at the Bismarck Airport by FedEx. Hazards falling into class three are the most reported outbound shipments by air.

<u>Top Commodities by Count</u>
Radioactive Material: Type A
Compressed Gas, n.o.s.
Radioactive Material: expected
Sulphuric Acid
Radioactive Material: Type B(U)

<u>Top Commodities by Count</u>
Diesel Fuel
Gasoline
Radioactive Material: Type B(U)
Infectious Substance: Affecting Humans
Petroleum Crude Oil

<u>Rail</u>

The most common commodities transported by rail during the 2012 flow study are Petroleum Crude Oil, Liquefied Petroleum Gas, Alcohols, Anhydrous Ammonia, and Fak-Hazardous Materials with the vast majority being Petroleum Crude (72% in 2012). Since 2012, the percentage of crude oil shipments has increased dramatically. See Train Derailment Hazard Profile for more information.

Pipeline:
Bismarck has a petroleum pipeline running east/west along north Bismarck which also runs under the Missouri River to Tesoro in Mandan. There is a natural gas pipeline (WBI) in northwest Bismarck running north/south.

NuStar

- Product names: Gasoline, Diesel, Jet Fuel
- Quantities: @1800 bbls per hour
- Pressure: 500 PSI

WBI

- Product names Compressed Methane / Natural Gas
- Quantities 12" Diameter Pipeline
- Pressure 204 PSI MAOP (maximum allowable operating pressure)
- Most common Methane / Natural Gas only
- Highest level of concern:

  Per the 2008 Emergency Response Guide Book :

  - Extremely Flammable
  - Easily ignited by heat, sparks or flames
  - Forms explosive mixtures with air
  - Displaces air and can cause asphyxiation without warning
  - High pressure compressed gas

MDU

- Product names: Natural Gas
- Quantities : ~200,000 dkt/yr (dekatherms – heating measure)
- Pressure pressures range from 90 psi to .5 psi.
- Most common: 35 psi
- Highest level of concern: explosive.

Utility Map showing Natural Gas and Petroleum Pipelines

WBI Pipeline – High Consequence Area

RISK

Risk: the potential for damage, loss, or other impacts created by the interaction of hazards with community assets.

Risk Assessment: product or process that collects information and assigns values to risks for the purpose of informing priorities, developing or comparing courses of action, and informing decision making.

THIRA Ratings – Hazardous Materials Release

Fixed Facility: Significant Incident requiring full local response resources

Frequency	Consequence			
	Human	Economic	Psychological	Government
Possible	Moderate	Moderate	Minor	Minor

Truck – I-94 (Transportation Accident: Anhydrous Ammonia)

Frequency	Consequence			
	Human	Economic	Psychological	Government
Likely	Moderate	Moderate	Minor	Moderate

Pipeline – Natural Gas (HCA)

Frequency	Consequence			
	Human	Economic	Psychological	Government
Possible	Significant	Significant	Minor	Minor

Within the last 20 years, Bismarck has not experienced many significant hazardous materials incidents. Actual Hazmat incidents of potential significant impact within the last 20 years include:

1. A Gasoline Tanker Leak
   An MC 306 tank trailer, containing gasoline was unhooked from the semi-tractor, which was in the shop for engine repairs. It was parked on the street and set on the trailer's landing gear, which are not designed to support the trailer loaded. The excessive weight coupled with the slope of the street caused the landing gear to collapse and puncture the tank, releasing gasoline. The gasoline was running down the gutter towards a storm sewer that drained into the Hay Creek Watershed. The spill was confined and the trailer contents were offloaded successfully.
2. SuperValue Warehouse Ammonia piping system. All personnel evacuated safely and there was not impact outside the facility.

Vulnerability Assessment

Vulnerability: Characteristics of community assets that make them susceptible to damage from a given hazard.

*Note: Train Derailment is addressed separately within the mitigation plan.

Incident Type	**Fixed Facility Incident**	***Transportation (ie: Truck)**	**Pipeline**
Probability	Possible	Likely	Possible
Speed of Onset	No notice event	No notice event	No notice event
Geographic Area	Localized	Localized	Localized
Death / Injury 1. Primary Causes A. Highest vulnerability	1. Fire, explosion, inhalation hazards A. Employees of hazmat facilities	1. Fire, explosion, inhalation hazards A. Involved parties in closer proximity	1. Fire, explosion A. WBI pipeline High Consequence Area as mapped
Mass Casualty Incident	Possible	Possible	Possible
Property Losses (points of vulnerability – high priority)	1. Involved property and properties in close proximity to incident	1. Property in close proximity 2. Properties along Interstate 94	1. Property in close proximity 2. WBI HCA as mapped
Environmental	1. Stormwater drainage system 2. Sanitary Sewer System	1. Stormwater drainage system 2. Sanitary Sewer System	1. Oil Pipeline – east/west pipeline 2. Hay Creek 3. Missouri River
COG/COOP	1. Public Works – proximity to Praxair 2. Water Treatment Plant 3. Wastewater Treatment Plant		

Incident Type	**Fixed Facility Incident**	***Transportation (ie: Truck)**	**Pipeline**
Critical Facilities	1. Public Works – proximity to Praxair Public Works 2. Fraine Barracks (proximity to Water Treatment Plant)	1. Sanford Health 2. CHI St. Alexius Health 3. Fire Station 2 4. Police Department 5. Water Treatment Plant - organic material overwhelming the sewage treatment process (ex: milk truck) 6. Metro Area Ambulance South 7. Public Health 8. Public Works	1. Water Treatment Plant (near WBI pipeline) 2. Fraine Barracks (WBI pipeline)
Critical Infrastructure	1. Potential impact to water or wastewater treatment plant	1. Temporary blocked streets / Interstate	1. Temporary disruption of petroleum or natural gas distribution.
Schools	1. Emmanuel Christian School (proximity to Ferrelgas) 2. Ehrmantraut Academy (proximity to Ferrelgas)	1. Jeanette Myhre Elementary 2. Bismarck High School 3. Century High School 4. Solheim Elementary 5. Wachter Middle School 6. Centennial Elementary 7. Emmanuel Christian School 8. St. Mary's Elementary 9. ECLC 10. Rasmussen College 11. Exploring Minds 12. Montessori Daycare 13. YMCA Daycare 14. Northridge Elementary 15. Open Door Community Center 16. Super Kids Jr. Academy 17. Bismarck State College 18. Theo Art School	1. Bismarck State College (WBI) 2. Horizon Middle School 3. Grimsrud Elementary School 4. Centennial Elementary School

Incident Type	**Fixed Facility Incident**	***Transportation (ie: Truck)**	**Pipeline**
High Risk Facilities (chemical)	1. Praxair (near Public Works) 2. Ferrell Gas (ie: propane bulk tanks) 3. Waste Water Treatment Plant (ie: chlorine) 4. Water Treatment Plant (ie: chlorine)		
Specific Populations: Public Assembly, Vulnerable / Special Populations		1. Kirkwood Mall 2. Maple View (north) 3. Numerous Churches along truck (hazmat) routes 4. Primrose Assisted Living	1. Waterford Apartment (HCA) 2. Touchmark Nursing Home 3. Horizon Care Home 4. Primrose Assisted Living 5. Women's Health Center (HCA)
Economy (community wide)	Moderate (THIRA rating)	Moderate (THIRA rating)	Significant (THIRA rating)
OTHER:			

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Severe Summer Weather – Hazard Profile

Including Lightning, Wind, Hail, and Extreme Heat.
Note: Tornado is addressed as a separate hazard.

Description: Thunderstorm

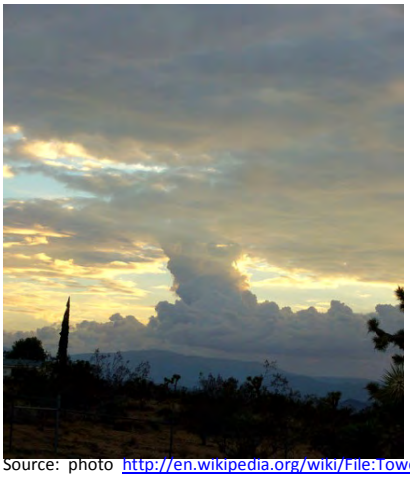
Severe summer storms can result in loss of life, injuries, and damage to property and crops. Although thunderstorms affect relatively small areas when compared to other hazards such as winter storms, all thunderstorms are dangerous. Every thunderstorm produces lightning, which kills more people each year than tornadoes. Heavy rain from thunderstorms can lead to flash flooding. Strong winds, hail, and tornadoes are also dangers associated with some thunderstorms.

Of the estimated 100,000 thunderstorms that occur each year in the United States, only about 10 percent are classified as severe. The typical thunderstorm is 15 miles in diameter and lasts an average of 30 minutes. The National Weather Service considers a thunderstorm severe if it produces hail at least 1" in diameter, winds of 58 mph or stronger, or a tornado.

Thunderstorms are most likely to happen in the spring and summer months during the afternoon and evening hours, but they can occur year round and at all hours. Annually, the central and northern parts of North Dakota may have an average of 10 to 30 days with thunderstorm activity, while the southern part of the state averages between 30 to 50 days.

Thunderstorms form when moisture, unstable air, and lift are present in the atmosphere. Thermal instability, fronts, and the sun's heat are capable of lifting the air to help form thunderstorms. All thunderstorms proceed through a three-stage life cycle.

The Cumulus Stage



Source: photo http://en.wikipedia.org/wiki/File:Towering_Vertical_Cloud_1.jpg

The cumulus stage occurs when thunderstorm development begins. At this stage, the storm consists only of upward-moving air currents called updrafts. These updrafts reach heights of around 20,000 feet above the ground, but the base of the storm may lower, as moisture becomes more plentiful. As a thunderstorm develops, towering cumulus clouds indicate rising air. There is usually little rain during this stage and only occasional lightning.

The Mature Stage

The mature stage is the strongest and most dangerous stage of a storm's life cycle. As the storm matures, the clouds have a black or dark green appearance. Hail, heavy rain, frequent lightning, strong winds, and tornadoes are most likely to occur during this phase, lasting an average of 10 to 20 minutes. At this stage, the storm contains both upward and downward moving air currents (updrafts and downdrafts) with precipitation in the downdraft area. These updrafts and downdrafts can reach velocities of 170 mph.

Source: Photo http://upload.wikimedia.org/wikipedia/commons/0/0c/FoggDam-NT.jpg

When the cool downdraft hits the ground, it spreads out and forms a gust front, which may include damaging wind called a downburst. The updraft also causes the top of the storm to spread out.

The Dissipating Stage

In the dissipating stage, the precipitation and downdraft dominate the storm and weaken the updraft. As the gust front moves away from the storm, the inflow of energy into the storm is cut off. As the thunderstorm dissipates, rainfall may decrease in intensity, but lightning and strong winds remain a danger.

RISK

Risk: the potential for damage, loss, or other impacts created by the interaction of hazards with community assets.

Risk Assessment: product or process that collects information and assigns values to risks for the purpose of informing priorities, developing or comparing courses of action, and informing decision making.

THIRA Ratings – **Thunderstorm (ie: Severe Summer WX: High Wind/Hail Event)**

Frequency	Consequence			
	Human	Economic	Psychological	Government
Very Likely	Minor	Moderate	Minor	Minor

Probability and Magnitude (Statewide)

Based on the historical record, the following can be expected on average in North Dakota:

- In an average year, 173 severe hail events resulting in about $69 million in property and crop damage and 1-2 injuries. Fatalities are possible, but have not been noted in the past 13 years.
- In an average year, 1-2 extreme hail events resulting in about $1.9 million in property and crop damage, and ho human fatalities or injuries. Fatalities and heat-related injuries are possible, but have not been noted in the historic data.
- In an average year, 163 severe thunderstorm wind events resulting in a bout $1.4 million in property and crop damage and 1-2 injuries. Fatalities are possible, averaging one every 10 years or more over the past 13 years.
- In an average year, 6-7 damaging lightning events resulting in $139,974 in property damage. Fatalities and injuries are possible, averaging one every two years over the past 19 years.
- Hail sizes up to 5.00 inches, or even larger, can be expected throughout the state based on historical reports. This size hail and even smaller sizes can damage structures, break windows, dent vehicles, ruin crops, and kill or injure people and livestock.

Lightning

Lightning Season Start/End Dates 1995-2013	
March 8, 2000	Earliest seasonal lightning strike
October 19, 2004	Latest seasonal lightning strike

Lightning develops when ice particles in a cloud move around, colliding with other particles. These collisions cause a separation of electrical charges. Positively charged ice particles rise to the top of the cloud and negatively charged ones fall to the middle and lower sections of the cloud. The negative charges at the base of the cloud attract positive charges at the surface of the Earth. Invisible to the human eye, the negatively charged area of the cloud sends a charge called a stepped leader toward the ground. Once it gets close enough, a channel develops between the cloud and the ground. Lightning is the electrical transfer through this channel. The channel rapidly heats to 50,000 degrees Fahrenheit and contains approximately 100 million electrical volts. The rapid expansion of the heated air causes thunder. (National Weather Service, 2007c)

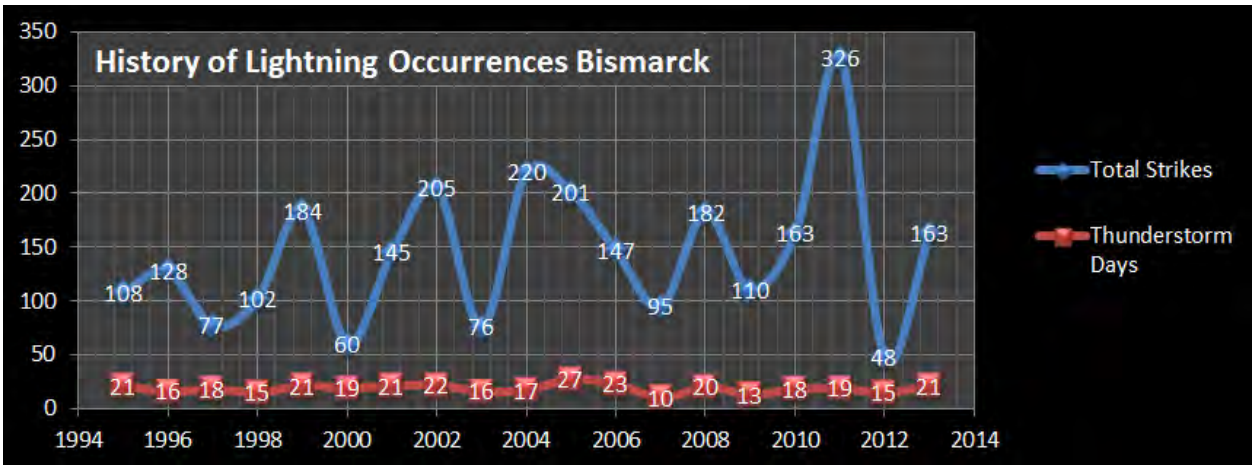
Lightning occurs with all thunderstorms, and averages 80 to 93 deaths and 300 injuries in the United States each year. Lightning also causes several hundred million dollars in damage to property and forests annually. Most lightning deaths and injuries occur when people are caught outdoors, especially under or near tall trees, in or on water, or on or near hilltops. Between 1984 and 1994, over 15,000 lightning induced fires nationwide resulted in several hundred million dollars in damages and the loss of two million acres of forest.

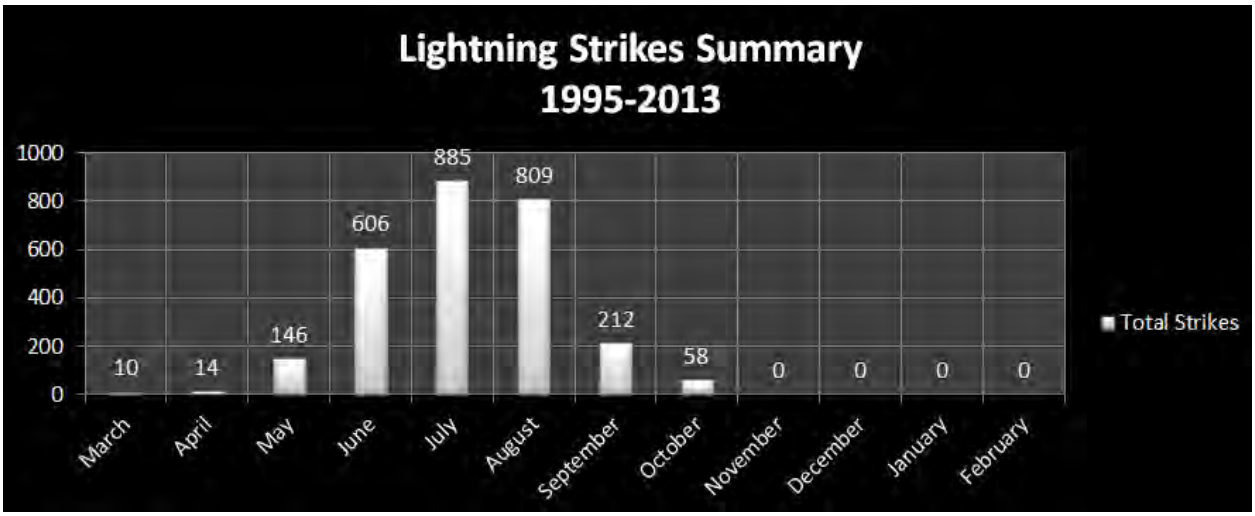
Lightning can cause fatalities, injuries, and property damage directly and indirectly. Lightning can strike humans, animals, aircraft, buildings, equipment, and the surface of the earth causing death and destruction. Lightning can trigger other hazards including fires, power surges, interruption of communications, downed power lines, and exposure to noxious gas due to vaporization of materials. Computer equipment is especially vulnerable to damage from power surges.

Lightning History:

August 2, 1996: Lightning struck the roof of a garage in Bismarck. Property damage as a result of this storm is estimated at $2,000.

Probability – Lightning





Wind

Strong winds can form along the leading edge of a thunderstorm. Downburst winds occur when air is carried into a storm's updraft, cools rapidly, and comes rushing to the ground. Cold air is denser than warm air, and therefore, wants to fall to the surface. On warm summer days, when the cold air can no longer be supported up by the storm's updraft, or an exceptional downdraft develops, the air crashes to the ground in the form of strong winds. These winds are forced horizontally when they reach the ground and can cause significant damage. These types of strong winds can also be referred to as straight-line winds. Downbursts with a diameter of less than 2.5 miles are called microbursts and those with a diameter of 2.5 miles or greater are called macrobursts. A derecho, or bow echo, is a series of downbursts associated with a line of thunderstorms. This type of phenomenon can extend for hundreds of miles and contain wind speeds in excess of 100 mph.

Straight-line winds are responsible for most thunderstorm wind damage. During the summer in the western states, thunderstorms often produce little rain but very strong wind gusts and dust storms. Downbursts can be extremely dangerous to aviation. Damage attributed to tornadoes is frequently caused by straight-line winds from a downburst. Downbursts can produce a "roaring" sound and damage similar to a tornado. These strong winds can damage trees, blow vehicles off the road, break windows, down power lines, damage roofs and fences, and cause other structural damages. Individuals caught outside are also at risk of injury from blowing dust and debris.

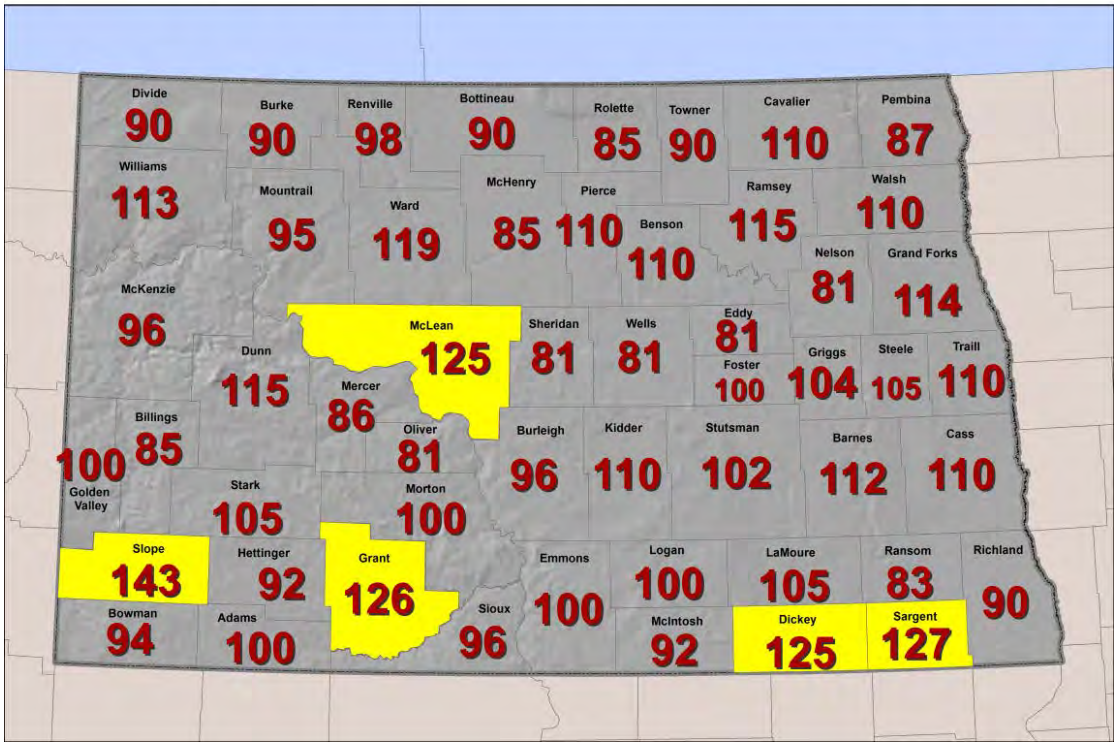
Between 2000 and 2013, NCDC recorded 2,114 thunderstorm wind events. The 2,114 thunderstorm wind events resulted in an estimated $11,932,700 in property damage, $917,900 in average annualized property damages, 1 death, and 31 injuries. The deaths and injuries occurred because of flying debris, collapsed structures, and to those in tractor trailers, vehicles, mobile homes, a camper, an apartment construction site, tents, and an aircraft.

Strong winds can also occur outside of tornadoes and severe thunderstorms. These winds typically develop with strong pressure gradients and gusty frontal passages. The closer and stronger two systems (one high pressure, one low pressure) are, the stronger the pressure gradient, and therefore, the stronger the winds are. Strong winds can occur at any time of year.

Based on historical record, North Dakota can expect over 87 high wind events, not related to tornadoes or thunderstorm winds, in any given year. The Federal Emergency Management Agency places the majority of North Dakota, including Bismarck, in Zone II (160mph) for structural wind design. As history demonstrates, these types of winds can remove roofs, move mobile homes, topple trees, take down utility lines, and destroy poorly-built or weak structures.

Maximum wind speed reported <u>1950-2009</u>

Strongest Non-Tornadic Wind Gust (MPH)



NWS Statistics for Burleigh County:
Highest wind speed (non-tornadic thunderstorm gust)...
-90 mph at -9:40 PM CDT June 25, 1999 in Bismarck
Widespread damage to buildings. Power lines down. Trees uprooted.

July 31, 2011: High winds peaking at 68 mph were measured at the National Weather Service ASOS at the Bismarck Airport during this severe thunderstorm. The wind gusted at or above 60 mph for 20 minutes. This storm also impacted many trees in flood impacted areas including Fox Island and Sibley Park areas. Due to saturated soils as a result of the 2011 flood, many trees were tipped or leaning because the soils could not hold the root systems in place. This caused additional damages to homes already impacted by the Missouri River Flood of 2011.

October 26, 2008: A 59 mph wind gust was reported three miles east of Moffit. High winds were also blamed for a house fire in Bismarck. Local authorities reported the high winds tore down a tree onto power lines, which then started a house basement on fire. No injuries or fatalities were reported.

August 23, 2004: The severe thunderstorm brought strong winds, very heavy rainfall and hail across the Bismarck area. Numerous tree damage was reported. Power lines were downed by the winds causing citywide power outages. Hail sizes up to 2.00 inches were reported in the city. Streets and underpasses flooded causing several roads to become impassible. Water flowed across yards and into several basements of homes.

March 13, 2004: An Alberta Clipper brought very strong winds, sustained at 50 mph and gusting to around 60 mph at times, to western and central North Dakota during the afternoon and early evening hours on March 13, 2004. The winds subsided during the late evening hours on the 13th.

November 29, 2002: After record high temperatures on Thanksgiving Day a strong Canadian cold front moved rapidly south through the state producing strong northwest winds of 40 to 70 mph over western and central North Dakota. The winds diminished during the evening hours. The cold front brought much colder air and a few snow showers to the region Friday night and Saturday.

June 9, 2002: Thunderstorm winds (54 knots) reported at Bismarck Municipal Airport.

February 11, 2002: Strong low pressure system moving across southern Canada produced a tight surface pressure gradient over North Dakota. Wind speeds averaged 50 to 70 miles an hour beginning early in the day and ending late in the evening. Overall, wind damage was minimal, however one semi-truck, which was empty, was blown over on its side along Interstate 94 in Bismarck. In Jamestown, a power outage occurred, but just for a short time period. Other locations reported loose objects were tossed around in the wind. (69 knots)

July 22, 2001: Thunderstorm winds (61 knots) were reported at the Bismarck Airport.

July 21, 2001: Thunderstorm winds (52 knots) were reported in Bismarck.

July 19, 2001: Thunderstorm winds (66 knots) were reported at the Bismarck Airport. Widespread tree damage across the southern half of the city of Bismarck. The property damage figure ($50,000) was for cleanup only. Power outage across much of the city. Several homes and business, including the Bismarck airport terminal building sustained damage.

April 5, 2000: A low-pressure system over Alberta, Canada moved southeast and intensified along the Canadian/North Dakota border. A very tight pressure gradient resulted in very high winds causing injuries and property damages throughout western and central North Dakota. Wind gusts of 55 to 70 mph were common. The injuries were mainly in Burleigh County in the city of Bismarck where 9 people were taken to area hospitals injured from flying debris. One person suffered a broken wrist from falling. Damage was widespread. Widespread power outages occurred. Homes, automobiles, trees, power lines, and businesses were damaged. Several grass fires erupted across the region.

July 18, 1997: Thunderstorm winds (65 knots) were reported in Bismarck. Strong winds blew a 10-inch diameter branch down onto a Jeep. Power was also lost to 500 homes. Property damage from this storm is estimated at $10,000.

September 15, 1997: Thunderstorm winds (57 knots) were reported at the Bismarck Airport.

June 25, 1999: Thunderstorm winds (78 knots) were reported in Bismarck. Widespread damage to buildings, downed power lines, uprooted trees, street flooding and water damage to homes. Property damage from this storm is estimated at $2 million.
June 29, 1997: Thunderstorm winds (52 knots) were reported in Bismarck. Four-inch diameter branches were down in northern Bismarck.

August 2, 1996: Thunderstorm winds (55 knots) were reported in Bismarck.

July 28, 1996: Thunderstorm winds (55 knots) were reported in Bismarck.

July 17, 1996: The Bismarck area received anywhere from 1 to 2 inches of rain in an hour. There were reports of manhole covers being blown out. An 80 yr. old man suffered a heart attack while shoveling water away from his apartment complex.

June 11, 1996: Winds at the National Weather Service Field Office gusted to 52 mph with this storm. Large trees were reported downed near the Capitol building.

May 16, 1996: As the storm moved into the Bismarck area, the National Weather Service at the airport received a gust to 79 mph. A small plane was tipped over at the airport, with part of the airport terminal roof blown off. There was at least 1 mobile home that was destroyed. Significant damage was done to trees, buildings and road signs. An estimated 3,000 people in Bismarck lost power. The Melroe Company had its roof lifted off. Property damage from this storm is estimated at $3.2 million.

February 10, 1996: Bismarck reported a peak gust of 62 mph.

July 12, 1995: Thunderstorm winds (61 knots) were reported in Bismarck.

July 11, 1995: Thunderstorm winds (60 knots) were reported in Bismarck.

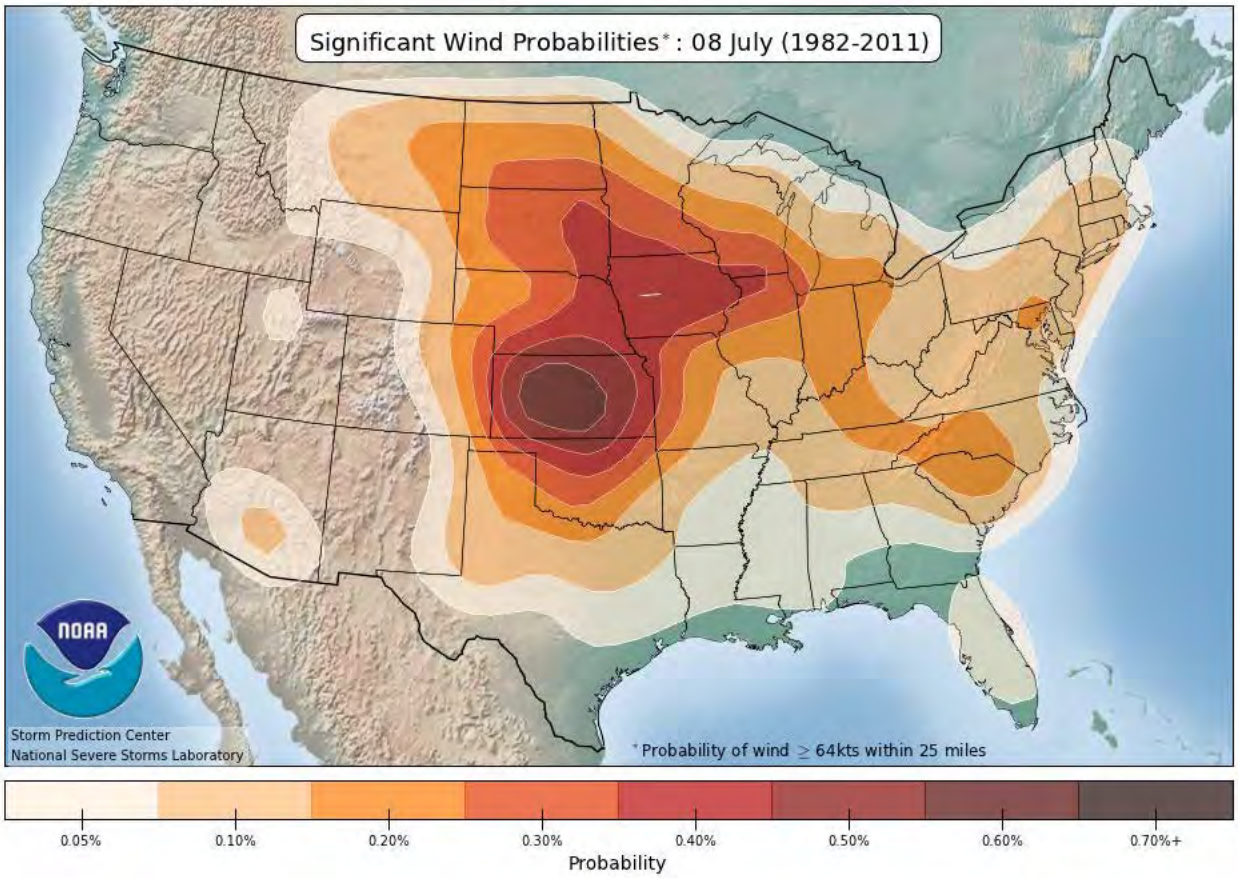
May 21, 1995: Thunderstorm winds (55 knots) were reported in Bismarck. Two thunderstorms merged north of Mandan causing torrential rain, hail up to golf ball-size for over 20 minutes, and winds to 65 mph, in Bismarck and Mandan. Piles of pea to golf ball-size hail covered the ground. Homes in Mandan had windows broke due to the hail.

September 15, 1994: Heavy rain caused water to run over roads and flood buildings and basements. Two schools in Bismarck were closed due to the water. McLean County west of Washburn.

January 22, 1992: Wind storm with one fatality.

Burleigh County High Wind Speed Records Source: NWS Bismarck			
Speed	Date	Location	Damage Estimate
90	June 25, 1999	Bismarck	$2 Million
78 knots. Widespread damage to building, downed power lines, uprooted trees, street flooding and water damage to homes. Property damage from this storm is estimated at $2 million.			
96	July 10, 2011	3.5 miles southwest of Moffit	$250,000
Double poled wood transmission lines were snapped. A ranch sign with three foot long concrete anchors was torn from the ground. A camper was flipped off the highway and tossed over a tree row 25 yards away.			

Probability – High Wind



*These probability values were estimated from a 30-year period of severe weather reports from 1982-2011. http://www.spc.noaa.gov/new/SVRclimo/climo.php?parm=sigWind

http://www.ncdc.noaa.gov/stormevents/

Insurance Claims Paid, 1989 -2013 Source: ND DES Mitigation Plan (2013) via ND State Fire and Tornado Fund, 2013			
Hazard	**County**	**Facility Type**	**Claim Paid**
Wind	Burleigh	State Government Facilities	$168,735
Wind	Burleigh	Local Government Critical Facilities	$673,910
Wind	Burleigh	Public School District Facilities	$47,284

Burleigh County High Wind Events Summary

30 event(s) were reported between 01/01/1996 and 11/30/2013 (6544 days)
Those events reporting property damage, death or injury are noted in the table below.

Location	Date	Type	Magnitude	Deaths	Injuries	Property Damage
BURLEIGH (ZONE)	02/13/2011	High Wind	38 kts. MS	0	0	20.00K
BURLEIGH (ZONE)	05/25/2010	High Wind	52 kts. EG	0	0	30.00K
Sustained winds measuring over 45 mph with gusts in excess of 60 mph resulted in numerous reports of tree damage, a few reports of power lines blown down, and scattered reports of damage to property.						
BURLEIGH (ZONE)	10/26/2008	High Wind	51 kts. MG	0	0	50.00K
High winds were also blamed for a house fire in Bismarck. Local authorities reported the high winds tore down a tree onto power lines, which then started a house basement on fire. No injuries or fatalities were reported.						
BURLEIGH (ZONE)	05/01/2008	High Wind	52 kts. EG	0	0	15.00K
Wind speed was estimated based on damage to a roof and to trees in east and south Bismarck.						
BURLEIGH (ZONE)	12/11/2004	High Wind	42 kts. MS	0	1	0.00K
A male carrying his luggage from the Bismarck Airport to his vehicle was blown over by the high winds causing minor injuries to his leg.						
BURLEIGH (ZONE)	04/05/2000	High Wind	62 kts. M	0	10	0.00K
The injuries were mainly in Burleigh county in the city of Bismarck where 9 persons were taken to area hospitals injured from flying debris. One (1) person suffered broken wrist from falling. Damage was widespread. Homes...automobiles...trees...power lines...business and widespread power outages suffered during the wind storm. Several grass fires erupted across the region.						

Wind Magnitude Definitions: Measured Gust:'MG', Estimated Gust:'EG', Measured Sustained:'MS', Estimated Sustained:'ES'
Source: http://www.ncdc.noaa.gov/stormevents/

June 22, 2013

Tree debris primarily located from Divide Avenue south to Denver Avenue and from Washington Street to 3rd Street Area. Extensive tree damages in Sertoma Park area as well.

Source: Bismarck Tribune regarding Jun 22, 2013 Storm:

Severe thunderstorms produced high winds, torrential rains and flash floods that blocked thoroughfares and underpasses with water on Saturday night, and left 4,000 homes in Bismarck and Mandan without power overnight.

Bismarck – June 22, 2013 Tree debris primarily located from Divide Avenue south to Denver Avenue and from Washington Street to 3rd Street area. Extensive tree damages in Sertoma Park area as well. Photos: Gary Stockert, Bismarck Emergency Manager

Uprooted and broken off trees crashed onto homes, businesses and vehicles. Winds and hail shattered homeowners' and retail windows. But, for all the calamity, law enforcement agencies reported no injuries as of early Sunday evening.

Bismarck reported 1 inch of rain in 10 minutes. The Bismarck Airport recorded a total of 1.51 inches between the two storm systems. Most of the hail was reported to be nickel and quarter size, but there were reports of up to an inch-diameter hail in Lincoln.

Flash floods

The National Weather Service reported that 5 to 6 inches of water was running over 12th Avenue near the Bismarck Expressway in south Bismarck. Eight inches of water was running over Washington Street near Divide Avenue. The Seventh Street underpass was filled.

No motorists had to be rescued because of flash floods, according to local law enforcement agencies.

"We shut the underpass down at Seventh Street right after it flooded and East Divide right after it flooded," said Bismarck Police Sgt. Nolan Canright. "Officers were checking vehicles where trees had fallen on them to see if anyone was in there. There weren't."

"It looks like southwest Bismarck got hit the worst. It hit Expressway Avenue and Main," he said of structural damage.

Wind gusts up to 75 mph sheared a roof top two miles northeast of Bismarck and blew it into a nearby home and car, totaling the car, reported the National Weather Service.

Power outages Recovery continued into late Sunday afternoon as Montana-Dakota Utilities crews made repairs along Sioux Street, where fallen trees snapped several power lines in the neighborhood.

Bismarck Pioneer Park – July 21, 2005 Photos: Gary Stockert, Bismarck Emergency Manager

July 21, 2005
Thunderstorm, High Winds & Hail – Winds estimated between 60 and 70 mph – golf ball-size hail. The storm occurred on July 21 around 8:00 pm.

DEATH AND INJURIES: None Reported

DAMAGE: Damage includes destroyed trees, tree damage, broken windows, damaged shingles, and damage to cars. It had been reported by citizens that a few man-hole covers had been displaced.

Downed trees reported were primarily in the areas of River Road north of the interstate, North Grandview, Juniper, Ave B near the Cathedral Church, 12th Street, and Pioneer Park.

Hail

Hail is precipitation in the form of a lump of ice. Hail occurs when strong rising currents of air within a storm, called updrafts, carry water droplets to a height where freezing occurs. The ice particles grow in size, finally becoming too heavy to be supported by the updraft and fall to the ground. Hailstones are usually round but can be conical or irregular in shape. They can range from pea size to the size of grapefruit, and large hailstones can fall at speeds faster than 100 mph. Hail tends to fall in swaths that range from a few acres to an area ten miles wide and one hundred miles long. (National Severe Storms Laboratory, 2007)

Most hail events affect only relatively small areas. Hail causes considerable damage to crops and property in the United States, occasionally causing death to farm animals, but seldom causing loss of human life. The damaging aspects of hail falls include the hailstone sizes (average and maximum), number of hailstones per unit area, and associated winds; hail risk is a combination of these factors plus the frequency of hail at a point or over an area. Crop hail losses in recent years nationally are estimated at $1.3 billion annually, representing between 1 and 2 percent of the annual crop value. Hail losses vary considerably regionally, representing, for example, 1 to 2 percent of the crop value in the Midwest, 5 to 6 percent of the crops produced in the High Plains, and much less elsewhere in the nation. Property hail losses have been increasing with time, now appearing to approximate crop-hail losses recently with crudely estimated annual losses of $1 billion. (Changnon, 1997)

Hail History:

During the 13-year period from 2000 to 2013, 2,249 severe hail events were reported in North Dakota with an estimated $383,804,600 in property damage, $29,523,431 in average annualized property damage, 0 fatalities, and 10 injuries. Note that the number of severe hail events over the period does take into account the 2010 switch from 0.75 inch diameter to 1 inch diameter severe criteria. Most of the injuries occurred to those outdoors such as golfers and hikers and those driving through storms that received broken windshields. (National Climatic Data Center, 2013)

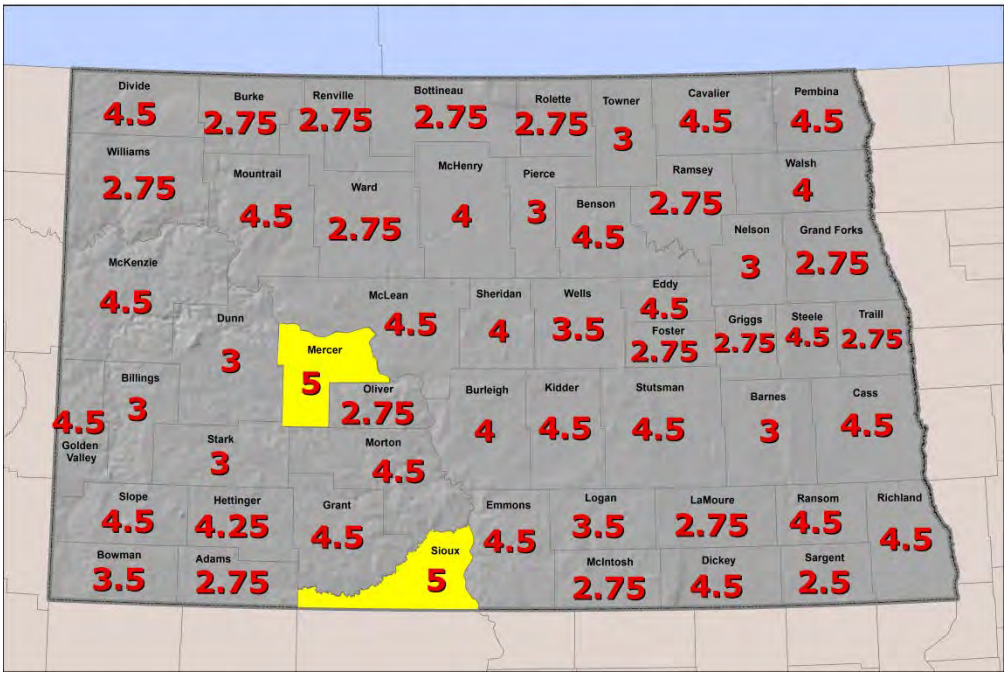
In June 2001, a hailstorm caused an estimated $230 million in property damage in Burleigh and Morton Counties; an estimated 57,000 insurance claims were filed. (North Dakota Insurance Department, 2007)

This hailstorm affected the urban Bismarck and Mandan area. As the most damaging hailstorm in the state's history, the insurance industry was severely impacted and insurance availability and premiums were affected statewide; many insurance companies pulled out of the state after the storm. (North Dakota State Water Commission, 2007c)

In July 2005, nickel size to tennis ball size hail combined with 70 mph winds and caused extensive and widespread damage in Bismarck. The larger hail fell on the north side of the city where most of the damage occurred. Numerous homes and vehicles were damaged. There was damage to siding and roofs, and windows were broken. (National Climatic Data Center, 2007)

Maximum hail size reported <u>1950-2013</u>

Largest Hail Size (Inches/Diameter)



August 11, 2007: 0.75 inches of hail was reported at Bismarck Municipal Airport. Wind gusts of 51 mph were also measured at Bismarck Municipal Airport.

August 11, 2007: 0.75 and 1.00 inches of hail was reported in Bismarck.

June 16, 2007: 0.88 inches of hail was reported in Bismarck.

August 24, 2006: 1.25 inches of hail was reported at Bismarck Municipal Airport.

August 9, 2006: 0.75 inches of hail was reported at Bismarck Municipal Airport.

July 21, 2005: 2.50 inches of hail was reported in Bismarck. Nickel size to tennis ball size hail combined with 70 mph winds caused extensive and widespread damage in Bismarck. The larger hail fell on the north side of the city where most of the damage occurred. Numerous homes and vehicles damaged. There was damage to siding and roofs, and windows were broken. Property damage estimates were provided by the North Dakota Insurance Commissioner.

June 26, 2005: 0.75 inches of hail was reported in Bismarck. Penny size hail in north Bismarck.

June 6, 2005: 0.75 inches of hail was reported in the northeast part of the city of Bismarck.

July 3, 2003: 1.00 inches of hail was reported at the Bismarck Municipal Airport. Wind gust to 52 knots (60 mph) accompanied the storm.

August 31, 2002: 1.00, 2.00, and 2.50 inch hail reported in Bismarck. 1.50 inch hail reported 3 miles north of Bismarck. .75 inch hail reported 11 miles east of Bismarck and 4 miles north east of Menoken.

August 30, 2002: 1.00 inch hail reported at the Bismarck Municipal Airport. 1.75 inch hail reported south west of Bismarck Municipal Airport. 2.50 inch hail reported in Bismarck.

June 9, 2001: 1.00 inch hail reported at the Bismarck Airport. An approaching upper level system provided lift to produce severe thunderstorms over central North Dakota Saturday afternoon and evening. Abundant low-level moisture combined with relatively cool air aloft lead to the formation of an incredible amount of hail with many of these storms. The hail caused a tremendous amount of damage to homes and vehicles in the Bismarck and Mandan areas. An estimated damage from the hail in the two cities amounted around $260 million. The wind speed associated with the storm ranged between 50 to 60 mph.

June 9, 2001: 1.75 inch hail reported 3 miles north of Bismarck Airport causing an estimated $113,000,000 in property damages.

November 1, 2000: 0.75 inch hail reported 8 miles North West of Bismarck.

June 12, 2000: 0.75 inch hail was reported in Bismarck.

July 6, 1998: 1 inch hail was reported in Bismarck.

July 10, 1996: 0.88 inch hail was reported in Bismarck.

July 10, 1996: 1 inch hail was reported in Bismarck.

June 20, 1995: 0.75 inch hail and 60 to 80 mph winds were reported. Extensive damage done to the city of Bismarck. Extensive tree damage. A mobile home northeast of Bismarck had its roof blown off. Reports of a few vehicles totaled due to large trees or tree branches falling on them. Extensive house damage due to falling trees or tree branches.

May 21, 1995: Two thunderstorms merged north of Mandan causing torrential rain, hail up to golf ball size for over 25 minutes, and winds to 65 mph, in Bismarck and Mandan. Piles of pea to golf ball-size hail covered the ground. Homes in Mandan had windows broke due to the hail.

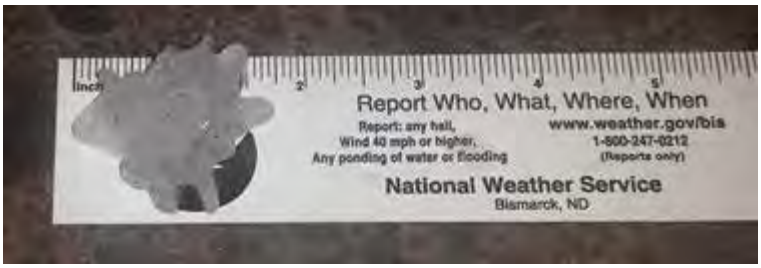


Photo Location: North of Bismarck
Photo Date: 8-20-2014
Photo Credit: Dale Zastoupil
Through SkySpy KFYR

Largest hailstone...
-4.00 inch diameter, 9:10 PM CDT July 29, 1986
(Updated 02-05-2010)
John Paul Martin WCM (Warning Coordination Meteorologist) NWS Bismarck ND

State Historical Society of North Dakota

http://www.crh.noaa.gov/bis/?n=ndtorhistory
http://www.crh.noaa.gov/images/bis/Tor1_1950_2013.pdf

June 9, 2001

Severe Storms Pummel Southern North Dakota

An approaching upper level system provided lift to produce thunderstorms across western North Dakota Saturday afternoon. The storms intensified as they traveled east southeast along an instability axis extending into South Dakota. Abundant low level moisture combined with relatively cool air aloft lead to the formation of an incredible amount of hail with many of these storms. The hail caused a tremendous amount of damage to homes and vehicles in Bismarck and Mandan. One tornado was reported just north of Hazelton, which is about 30 miles southeast of Bismarck. No known deaths occurred with these storms but numerous injuries were reported. The pictures below will help put the damage into perspective.

http://www.crh.noaa.gov/bis/?n=june9

The day after: clearing hail from the railroad underpass on 7th street in Bismarck. Photo taken by NWS employee.

North Dakota Severe Weather History

North Dakota County Statistics 1950-2013 (pdf file...Counties listed alphabetically)

NWS Bismarck Severe Weather Statistics 1986-2013 (pdf file)

Extreme Heat

According to information provided by FEMA, extreme heat is defined as temperatures that hover 10 degrees or more above the average high temperature for the region and last for several weeks. Heat kills by taxing the human body beyond its abilities. In a normal year, about 175 Americans succumb to the demands of summer heat. In the 40-year period from 1936 through 1975, nearly 20,000 people were killed in the United States by the effects of heat and solar radiation. In the heat wave of 1980, more than 1,250 people died.

Heat disorders generally have to do with a reduction or collapse of the body's ability to shed heat by circulatory changes and sweating or a chemical (salt) imbalance caused by too much sweating. When heat gain exceeds the level the body can remove, or when the body cannot compensate for fluids and salt lost through perspiration, the temperature of the body's inner core begins to rise and heat-related illness may develop. Elderly persons, small children, chronic invalids, those on certain medications or drugs, and persons with weight and alcohol problems are particularly susceptible to heat reactions, especially during heat waves in areas where moderate climate usually prevails.

The following two charts show the Heat Index (HI) as a function of heat and relative humidity. The Heat Index describes how hot the heat-humidity combination makes it feel. As relative humidity increases, the air seems warmer than it actually is because the body is less able to cool itself via evaporation of perspiration. As the HI rises, so do health risks.

- When the HI is 90°F, heat exhaustion is possible with prolonged exposure and/or physical activity.
- When it is 90°-105°F, heat exhaustion is probable with the possibility of sunstroke or heat cramps with prolonged exposure and/or physical activity.
- When it is 105°-129°F, sunstroke, heat cramps or heat exhaustion is likely, and heatstroke is possible with prolonged exposure and/or physical activity.
- When it is 130°F and higher, heatstroke and sunstroke are extremely likely with continued exposure. Physical activity and prolonged exposure to the heat increase the risks.

Temperature (°F)

Relative Humidity (%)	80	82	84	86	88	90	92	94	96	98	100	102	104	106	118	110
40	80	81	83	85	88	91	94	97	101	105	109	114	119	124	130	136
45	80	82	84	87	89	93	96	100	104	109	114	119	124	130	137	
50	81	83	85	88	91	95	99	103	108	113	118	124	131	137		
55	81	84	86	89	93	97	101	106	112	117	124	130	137			
60	82	84	88	91	95	100	105	110	116	123	129	137				
65	82	85	89	93	98	103	108	114	121	126	130					
70	83	86	90	95	100	105	112	119	126	134						
75	84	88	92	97	103	109	116	124	132							
80	84	89	94	100	106	113	121	129								
85	85	90	96	102	110	117	126	135								
90	86	91	98	105	113	122	131									
95	86	93	100	108	117	127										
100	87	95	103	112	121	132										

Likelihood of Heat Disorders with Prolonged Exposure or Streuous Activity

Caution | Extreme Caution | Danger | Extreme Danger

Possible Heat Disorders by Heat Index Level

Heat Index	Category	Possible heat disorders for people in high risk groups
130°F or higher	Extreme Danger	Heatstroke risk extremely high with continued exposure.
105° - 129°F	Danger	Sunstroke, Heat Cramps and Heat Exhaustion likely. Heatstroke possible with prolonged exposure and/or physical activity.
90° - 105°F	Extreme Caution	Sunstroke, Heat Cramps and Heat Exhaustion possible with prolonged exposure and/or physical activity.
80° - 90 °F	Caution	Fatigue possible with prolonged exposure and/or physical activity.

Source: National Weather Service

The NWS has in place a system to initiate alert procedures (advisories or warnings) when the Heat Index is expected to have a significant impact on public safety. The expected severity of the heat determines whether advisories or warnings are issued. A common guideline for the issuance of excessive heat alerts is when the maximum daytime high is expected to equal or exceed 105°F and a nighttime minimum high of 80°F or above is expected for two or more consecutive days. The NWS offices in Bismarck and Grand Forks can issue the following heat-related advisory as conditions warrant.

- **Excessive Heat Outlook**: are issued when the potential exists for an excessive heat event in the next 3-7 days. An Outlook provides information to Heat Index forecast map for the contiguous United States those who need considerable lead time to prepare for the event, such as public utilities, emergency management and public health officials.
- **Excessive Heat Watch**: is issued when conditions are favorable for an excessive heat event in the next 12 to 48 hours. A Watch is used when the risk of a heat wave has increased, but its occurrence and timing is still uncertain. A Watch provides enough lead time so those who need to prepare can do so, such as cities that have excessive heat event mitigation plans.
- **Excessive Heat Warning/Advisory:** are issued when an excessive heat event is expected in the next 36 hours. These products are issued when an excessive heat event is occurring, is imminent, or has a very high probability of occurring. The warning is used for conditions posing a threat to life or property. An advisory is for less serious conditions that cause significant discomfort or inconvenience and, if caution is not taken, could lead to a threat to life and/or property.

Vulnerability Assessment

Vulnerability: Characteristics of community assets that make them susceptible to damage from a given hazard.

	Lightning	Hail	High Winds or Downbursts
Probability	Very Likely	Very Likely	Very Likely
Speed of Onset	Warning lead time: 30 minutes to several hours	Warning lead time: 30 minutes to several hours	Warning lead time: 30 minutes to several hours
Geographic Area	All of Bismarck Typically 15 miles in diameter	All of Bismarck	All of Bismarck
Duration	Average of 30 minutes Can last much longer	Usually 30 minutes or less.	Usually 30 minutes or less.
Death / Injury 1. Primary Causes A. Highest vulnerability	1. Direct or indirect lightning strike. A. Those outdoors, especially under or near tall trees, or B. On Water, or C. On Hilltops	1. Impact by large hail stones. Hail seldom causes loss of life. A. Those outdoors with no access to shelter.	1. Flying Debris *Non-secure outdoor items* A. Aviation B. Mobile home C. Motor Home D. Camp sites E. Being Caught Outdoors F. In a vehicle G. Insufficient shelter H. Windows
Mass Casualty Incident	No mass casualty incidents reported in ND. Lightning kills – averaging 80 to 93 deaths and 300 injuries in the US each year.	No mass casualty incidents reported in ND.	No mass casualty incidents reported in ND.

	Lightning	Hail	High Winds or Downbursts
Property Losses (points of vulnerability – high priority)	1. Property losses due to Fire (lightning as cause) 2. Computer equipment due to power surges 3. Downed power lines and trees	1. Shingles 2. Windows 3. Siding 4. Auto body damages 5. Trees/plants/crops	1. Mobile home 2. Motor Home 3. Windows/doors 4. Trees 5. Fences 6. Power lines 7. Roofs
Environmental			1. Debris 2. Hazardous Waste debris
COG/COOP	1. Computers and other electronic equipment 2. Loss of power	1. Could delay emergency response time.	1. Employee / family casualties 2. Key personnel – Orders of Succession
Critical Facilities	1. Computers and other electronic equipment 2. Loss of power	1. Windows	1. Windows 2. Garages 3. Doors 4. Large Span Roofs Structure – depending on design / materials
Critical Infrastructure	1. Loss of Power	1. Similar to snow event – blocked streets	2. Electricity: Substations & Overhead Power Lines 3. Streets Blocked 4. Communications
Schools	1. Computers and other electronic equipment 2. Loss of power	1. Windows	1. Portable Classrooms 2. Windows 3. Doors 4. Loss of roofing materials

	Lightning	Hail	High Winds or Downbursts
High Risk Facilities (chemical)	1. Computers and other electronic equipment 2. Loss of power		1. Windows 2. Garages/doors 3. Doors 4. Large Span Roofs
Specific Populations: Public Assembly,Vulnerable / Special Populations	1. Outdoor Activities – sporting events, water sports, etc.	1. Outdoor Activities – sporting events, water sports, etc.	1. Outdoor Recreation Areas 2. Public Assembly (high population densities) 3. Special Outdoor events
Economy (community wide)	Minor (THIRA rating)	Moderate (THIRA rating)	Moderate (THIRA rating)
OTHER:			Mobile HazMat (truck)

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Shortage or Outage of Critical Materials or Infrastructure – Hazard Profile

Description

A shortage or outage of critical materials or infrastructure occurs when the demand for a life sustaining product exceeds the supply. These shortages and outages may include a wide variety of resources including energy-related products, power transmission, communications infrastructure, medical products, food, and water.

The disruption of the critical material supply system may be caused by weather conditions (severe low temperatures, ice/winter storm high winds, space weather such as solar flares), other natural disasters such as drought, flooding, and tornadoes, lack of infrastructure maintenance, human error, global conflict, oil embargo, major work stoppage, cyber security or a national security emergency. Any disruption, regardless of the cause could have immediate adverse impacts as well as severely diminish existing supplies, thereby threatening the long term health, safety, and well-being of citizens.

Examples of shortages or outages of critical material or infrastructure include:

- Widespread and prolonged electric power failure that impacts both day-to-day and emergency capabilities.
- A lack of transportation fuels causing surface movement gridlock and disruption of commerce.
- Diminished supplies of heating fuels during the winter causing severe economic and health impacts.
- A lack of medical supplies especially vaccines, antibiotics, and anti-viral medications posing a public health and safety threat.
- Private hoarding, compounding a shortage problem.
- A lack of adequate food, water, and shelter.

The public has come to rely upon utility, communication, and fuel services for everyday life and basic survival. Communities/citizens throughout North Dakota depend on the typical utility and communication infrastructure such as water, sewer, electricity, propane, natural gas, communications, internet, and gasoline. Homes and businesses are heated with fuels such as natural gas, propane, oil, and electricity. Buildings heated by various fuels still rely on electricity to power their heating systems. Essentially, without electricity, most facilities are without heat, water, fuel, or other appliances during a long term outage. This problem becomes particularly significant in North Dakota during the cold winter months. Phone services are important for day-to-day business, but are most important for 911 communications in an emergency. Without phone service, emergency services can be severely delayed. In most cases, a long term utility outage would force many businesses to close until the services were restored. Gasoline shortages are also common during times of disaster.

The ability to restore services depends on the ability of repair crews (including mutual aid from other jurisdictions) to access the affected areas. Communities including Bismarck, also depend on the private utility industry capabilities regarding their business continuity of operations plans and mitigation plans on a local, regional, and national level. In the case of a quarantine or pandemic, repair crews may not be available to quickly restore services. The most common hazards that interrupt electric services are heavy snow, ice, and wind.

Space Weather

According to the NOAA Space Weather Prediction Center, Space Weather is the condition in space that affects Earth and its technological systems. Space Weather is a consequence of the behavior of the Sun, the nature of Earth's magnetic field and atmosphere, and our location in the solar system. The active elements of space weather are particles, electromagnetic energy, and magnetic field, rather than the weather contributors on earth of water, temperature, and air.

The Space Weather Prediction Center forecasts space weather to assist users in avoiding or mitigating severe space weather. These are storms that originate from the sun and occur in space near Earth or in the Earth's atmosphere. Most of the disruptions can be categorized into three types of events that can have environmental effects on Earth. They are: geomagnetic storms, solar radiation storms, and radio blackouts.

Source: 2014 NDDES Mitigation Plan

A "Worst Case" Scenario - Electromagnetic Pulse (EMP):

The use of a high-altitude nuclear detonation with the intention of causing an Electromagnetic Pulse to shut down critical infrastructure (electric utility) over a wide geographic area is potentially the worst case scenario in creating a shortage of critical materials. A highly effective EMP event could potentially cause a shortage of all critical materials previously discussed.

Below are excerpts from the May 8, 2014 Opening Statement remarks prepared for the Subcommittee on Cybersecurity, Infrastructure Protection, and Security Technologies Committee on Homeland Security.

"… EMP is simply a burst of electromagnetic radiation that results from certain types of high energy explosions or from a suddenly fluctuating magnetic field. A frightening point is that EMP can be generated by nuclear weapons, from naturally-occurring sources such as solar storms, or specialized non-nuclear EMP weapons. Nuclear weapon EMPs are most catastrophic when a nuclear weapon is detonated at high altitude, at approximately 30 kilometers (20 miles), above the intended target. The consequences of such an attack could be catastrophic; all electronics, power systems, and information systems could be shut down. This could then cascade into interdependent infrastructures such as water, gas, and telecommunications. While we understand this is an extreme case, we must always be prepared in case a rouge state decides to utilize this technology…"

Source: http://homeland.house.gov/sites/homeland.house.gov/files/documents/05-08-14-Perry-Open.pdf
http://homeland.house.gov/hearing/subcommittee-hearing-electromagnetic-pulse-emp-threat-critical-infrastructure

EMP Commission and Commission and Commission Report:
http://www.empcommission.org/
http://www.empcommission.org/docs/A2473-EMP_Commission-7MB.pdf

Risk Assessment – Shortage of Critical Materials or Infrastructure

Risk: the potential for damage, loss, or other impacts created by the interaction of hazards with community assets.

Risk Assessment: product or process that collects information and assigns values to risks for the purpose of informing priorities, developing or comparing courses of action, and informing decision making.

THIRA Ratings (Threat and Hazard Identification and Risk Assessment)

3 Day Power Outage Due to Winter Storm including high winds and record snowfall on top of freezing rain.

Frequency	Consequence			
	Human	Economic	Psychological	Government
Likely	Minor	None/Negligible	None/Negligible	Minor

One Week Power Loss and Loss of Interstate/Hwy Transportation - Due to Winter Storm - High Wind and excessive snowfall on top of freezing rain.

Frequency	Consequence			
	Human	Economic	Psychological	Government
Possible	Minor	Minor	Minor	Moderate

EMP (worst case scenario)

Frequency	Consequence			
	Human	Economic	Psychological	Government
Unlikely or "Unknown"	Catastrophic	Catastrophic	Catastrophic	Catastrophic

Previous Occurrences

Power outages of some magnitude are an annual event. The probability of a prolonged event is less certain but is more likely during other hazard events. The probability can also be broken down by service type. Electric power outages are the most common, but significant water, sewer, communications, heat, propane, internet, or fuel outages can also occur, with somewhat lower probability. Since 1970, three major material shortages and several extended power outages have occurred in the state.

North Dakota has experienced three separate major statewide incidents involving shortages of critical materials:
1970s Oil Embargo – International events caused the price of gasoline to rise significantly, and many Americans experienced long lines at gas stations and were rationed in the amount of gasoline they were able to buy. During the oil embargo, a —state of disaster emergency was declared to meet the dangers inherent from a critical fuel shortage to the citizens of North Dakota. As a result, the following steps were immediately implemented by all state agencies to conserve energy resources:
Provisions to eliminate duplication of travel were implemented.

- Fuel-efficient policies regarding the use of and purchase of state vehicles were implemented.
- Temperature control limits and regulations were set for all state buildings.
- Lighting controls and regulations were set for all state buildings.
- Energy conservation public information was coordinated among state agencies and targeted to all residents of North Dakota.

A fuel allocation program was established under federal authority whereby 3 percent of motor gasoline and 4 percent of middle distillate fuels brought into the state were —set aside to be reallocated to retailers who were experiencing temporary shortages.

- 1970s Anti-Freeze Shortage – The anti-freeze shortage occurred prior to and during the winter months when it is critical to protect cooling system liquids from freezing in automobile engines. Distributors were able to receive ample stocks, but state officials monitored the situation. Because of this situation, state officials monitor distribution of this product annually to ensure proper supply.
- 1980s Farm Fertilizer Shortage – During the fertilizer shortage, phosphate, one of three primary ingredients used in farm fertilizers, was in short supply. Fertilizer has become an absolute necessity to maintain agricultural production levels, which aid in stabilizing the state's economy. Agriculture officials monitor fertilizer supplies on a yearly basis to ensure that timely actions are implemented to avert a shortage.
- Yearly power outages – occur that the utility companies classify as major events. These events will vary in magnitude and duration, most of them have been weather related, ice, wind, tornado are the common causes, most occur between October 1 and June 1 however summer wind storms and tornados are also relatively common. Other causes for these events include accidents, vandalism, and terrorism.

Space Weather
There are no recorded space weather effects in North Dakota. The nearest storm affected Montreal, Canada on March 13, 1989 when a geomagnetic storm took out their commercial electric power for 9 hours.

According to the NERC's Geomagnetic Disturbance Reference Document, —there are 200 days over the 11-year solar cycle with strong-severe geomagnetic storms, and approximately 4 days of extreme conditions. It is important to know that these solar storms typically occur during _solar maximum. The Sun undergoes an 11-year cycle where the polarities of the north and south poles reverse. We usually see most of the solar storms during a 4-6 year period that we refer to as a solar maximum. Solar storm events severe enough to potentially impact the energy infrastructure are relatively rare. The chance of occurrence is also inconsistent from year to year, depending on where the Sun is at in its solar cycle. In general though, geomagnetic storms are considered to be High Impact, Low Frequency (HILF) events, meaning that they occur relatively rarely but can have serious impacts when they do happen.
Source: 2014 DES Mitigation Plan

Vulnerability Assessment

Vulnerability: Characteristics of community assets that make them susceptible to damage from a given hazard.

Note: Losses, Impact and Vulnerabilities are assumed to be cumulative from previous columns to the left using winter season as timeframe of occurrence.

Scenario	**3-Day Power Outage (ex: winter storm)**	**1 Week Power Outage & Interstate/Hwy Transportation Closure (ex: winter storm)**	**EMP (a worst case scenario)**
Probability	Likely	Possible	Unlikely, yet "unknown"
Speed of Onset	No warning for power outage. Adequate warning for storm is assumed.	No warning for power outage. Adequate warning for storm is assumed.	Warning time would depend on detection or recognition of event. A "no notice" event is possible.
Geographic Area	Regional & City-Wide Impact	Regional & City-Wide Impact	Regional / National Event
Duration	3 days	7 days	Months to Years for Recovery
Death / Injury 1. Primary Causes	1. Improper use of alternative heating sources. 2. Carbon Monoxide poisoning. 3. Injury due to cold temperatures and heavy snow. 4. Lack of back-up power for personal life personal supportive equipment.	1. Same as column to the left.	2. Starvation, disease, societal collapse.

Scenario	3-Day Power Outage (ex: winter storm)	1 Week Power Outage & Interstate/Hwy Transportation Closure (ex: winter storm)	EMP (a worst case scenario)
A. Highest vulnerability	A. Those more affected by colder temperatures and those with poorly insulated homes. B. Those with medical conditions residing at home.		A. Those who are not self-reliant for all necessities (food, water, heat, etc.) and those who require medicines or medical attention
	Some residents will have stand-by generators but the majority of residents do not.		
Mass Casualty Incident	1. No. Some injury and loss of life is possible, but avoidable through sheltering and other response efforts.	1. Possible, but avoidable through sheltering and other response efforts.	1. Yes, potentially a majority of the population. 2. Food, potable water, and medical supplies likely to be depleted.
	Families and individuals may need to rely on their own emergency supplies.		
Property Losses (points of vulnerability – high priority)	1. Frozen and burst water pipes. 2. Personal property sensitive to colder temperatures damaged.	1. Frozen and burst water pipes (extensive) 2. Personal property sensitive to colder temperatures damaged.	1. Power Grid and other Electric Utility property and equipment losses. 2. Equipment having electronic components being disabled or destroyed.
	Structures may be affected by sewer back-up if back-up generators would fail (lift stations)		
Environmental	1. Food spoilage.	1. Food spoilage.	1. Loss of Power would impact water and sewer services. 2. Waste management. 3. Availability of potable water for drinking, food processing, etc.
	Personal and commercial food supplies may spoil during extended power outages.		

Scenario	3-Day Power Outage (ex: winter storm)	1 Week Power Outage & Interstate/Hwy Transportation Closure (ex: winter storm)	EMP (a worst case scenario)
COG/COOP	1. Non-essential services discontinued. 2. Staffing challenges due to personal impacts.	1. Critical and essential functions maintained. 2. Other functions discontinued. 3. Staffing challenges due to personal impacts.	1. Community Safety and Security. 2. Limited or no communications with the public. 3. Most, if not all government services would be very difficult to sustain. 4. Emergency Services impacted by loss of utility and loss of phone and radio communications 5. Lack of fuel *(depleted based on impact to transportation and utilities)*
Critical Facilities	1. Grocery Stores closed. 2. Gas Stations – not able to pump gas.	1. Grocery Stores closed. 2. Gas Stations – not able to pump gas. 3. Hospitals, Nursing Homes, Assisted Living Centers 4. Prisons, Jails	1. Water and Wastewater. 2. All critical facilities due to lack of electricity, water, as well as impacts to communications and transportation infrastructure. 3. Grocery Stores – food supplies depleted. 4. Hospitals, Nursing Homes, Assisted Living Centers 5. Prisons, Jails
	See Appendices for existing generator capabilities within city-owned critical facilities.		
Critical Infrastructure	1. Heating/Cooling Systems down. Back-up power required. 2. Communications (phone / cell) impacted.	1. Transportation – deliveries delayed for one week. 2. Reduced inventory of food and medicines due to Interstate and Hwy road closures.	1. Power Grids may take months to years to repair. *2.* All critical infrastructure requiring electricity would be impacted including transportation, communications, water, wastewater, heating/cooling)
	According to the ND State Energy Assurance Plan (as of 2014), fuel storage in ND represents about 12 days-worth of consumption for gasoline and 13 days-worth of consumption for distillates (diesel).		

Scenario	3-Day Power Outage (ex: winter storm)	1 Week Power Outage & Interstate/Hwy Transportation Closure (ex: winter storm)	EMP (a worst case scenario)
Schools	1. School Closures – some may be used as shelters.	1. School Closures – some may be used as shelters.	1. Schools closed, potentially used for alternative emergency response purposes.
High Risk Facilities (chemical)	1. Facilities without back-up power may be impacted. Safety/security may be impacted without power. 2. Closed for business – economic impact.	1. Same as left column with higher level of impact.	2. All businesses would be closed or severely impacted. High risk facilities may pose additional risk due to limited (if any) emergency services. 3. Safety/Security may be compromised at high risk facilities when fuel for back-up power is depleted.
Specific Populations: Public Assembly, Vulnerable / Special Populations	1. Evacuation and sheltering would be necessary for those without back-up power at place of residence.	1. Evacuation and Sheltering would be necessary for those without back-up power at place of residence.	2. Life threatening risk in the very short term for those requiring medical attention, medicines, or use of electricity for life support. 3. Evacuation and relocation capabilities seriously compromised.
Economy (community wide)	None/Negligible (THIRA Rating)	Minor (THIRA Rating)	1. Catastrophic (THIRA Rating) 2. Potential for societal collapse.
	The economy depends heavily on utility and communication services. Electricity alone powers many systems used in day-to-day business. Businesses, such as restaurants, require electricity and water to operate. Without these services, many businesses could be shut down. Closed businesses and government offices essentially put the economy at a standstill until services are restored. Fuel shortages due to a power outage, low supplies, high prices, or transportation closures, could have lasting effects on everyone from the individual commuter to any business that ships inventory. Ultimately, the economy has a high dependence on utility or communications services. Source: 2014 DES Mitigation Plan		
OTHER:			1. It may take hours or days to confirm and then communicate the cause of the power outage to the public.
	Depending on the season of initial impact, the challenges would vary. For example, during the cold winter season, existing food supplies may perhaps be maintained longer (avoid spoilage) despite lack of power.		

According to the ND State Energy Assurance Plan (as of 2014), fuel storage in ND represents about 12 days-worth of consumption for gasoline and 13 days-worth of consumption for distillates (diesel).

A Transportation fuel shortage could occur from a disruption in the supply system due to any number of the following reasons:

- Electric power outage
- Labor strikes
- Embargo
- Natural Disaster
- National Security
- Planned refinery maintenance
- Supply disruptions

Coal Supply
Most of the power plants that rely on coal are mine-mouth facilities, and therefore not dependent on rail or other third-party transportation. However, the coal supply is vulnerable to labor reductions/strikes.

Natural Gas Supply
Since natural gas is not used in electric generation, there is no related vulnerability. However, since two fifths of North Dakota households use natural gas for heating, a complete interruption in the supply of natural gas could result in a significantly higher demand for electricity as a substitute heating source.

While North Dakota has significant supply and natural gas processing within the state, it is still vulnerable to disruptions due to the following factors:

- Pipeline disruption either intra or interstate.
- Labor shortages.
- Supply/Demand imbalance.
- Supply reduction for economic or political reasons.

<u>Development in Identified Hazard Areas</u>
New and future development may have significant impacts on the shortage or outage of critical materials or infrastructure hazard. Increased populations add to the challenges of managing a utility outage and a shortage or outage of critical materials.

Population Increases from 2000 to 2010

County	2000	2010	# change	% change: 2000 to 2010
Burleigh County	69,416	81,308	11,892	17.10%

Source: U.S. Census Bureau and the Center for Social Research at NDSU, http://www.ndhfa.org/Web_Images/NDSHNA_DetailedTables_FINAL.pdf

Home Heating Fuel Summary

County	Utility Gas	Bottled, tank, or LP gas	Electricity	Fuel oil, kerosene, etc.	Coal or coke	Wood	Solar Energy	Other Fuel	No Fuel Use	Housing Units
Burleigh	22,349	2,551	7,276	215	114	58	0	566	308	33,437

Source: American Community Survey, 2007-2011, House Heating Fuel (2014 DES Mitigation Plan)

Loss Estimates

Since infrastructure outage is generally a secondary or cascading impact of other hazards, it is not possible to quantify estimated potential losses specific to this hazard due to the variables associated with affected population, duration of outages, etc.

Although the limitless variables make it difficult to estimate future losses, FEMA has developed standard loss of use estimates in conjunction with their Benefit-Cost Analysis methodologies to estimate the cost of lost utilities on a per-person, per-use basis.

FEMA Standard Values for Loss of Service for Utilities and Roads/Bridges

Loss of Electric Power	Cost of Complete Loss of Service
Economic Impact	$126 per person per day
Loss of Potable Water Service	Cost of Complete Loss of Service
Economic Impact	$93 per person per day
Loss of Wastewater Service	Cost of Complete Loss of Service
Economic Impact	$41 per person per day
Loss of Road/Bridge Service	Cost of Complete Loss of Service
Vehicle Delay Detour Time	$38.15 per vehicle per hour
Vehicle Delay Mileage	$0.55 per mile (or current federal mileage rate)

Source: FEMA BCA Reference Guide, June 2009, Appendix C

Vulnerability Assessment – Electric Utility

Risk, Vulnerability, and Restoration Timeline – Electric Utility

The more "typical" minor power outage affecting isolated areas of Bismarck is most likely to be restored within an estimated two to three hours (usually less) based on local utility company capabilities.

Based on risk/vulnerability *(excluding the "electromagnetic pulse" hazard),* the City of Bismarck and its residents should prepare to be without power for between 24 hours and one week. Being without power for one week is not a likely scenario, however, there is potential for that to occur as a result of a catastrophic "perfect storm" impacting all input sources (ie: incoming transmission lines from the Garrison, Heskett, and WAPA). Power is estimated to be restored within two days short of "perfect storm" catastrophic events. Natural hazards having this potential impact include Ice Storms, Extreme High Wind event, or even multiple tornados.

Another natural hazard of potential significance is a "geomagnetic disturbance" (GMD) which is one type of solar storm. A GMD event could cause a power outage, again requiring an estimated 24 hours to one week to restore all power. A GMD incident created a power outage for all of Quebec in March 1989 for a period of nine hours. Today, because of the more sophisticated circuitry (less mechanical), the impact would likely be more significant and more time required for restoration by any affected utility company. There is some potential for a GMD to compromise back-up generators as well because of the generator's connection to the ground. A GMD event in ND may have a lower probability compared to Canada due to the lower level of iron in North Dakota's soil.

A local and national worst case scenario is the Electromagnetic Pulse (EMP) event, which is primarily a nuclear/terrorist hazard (high altitude detonation) that could create a widespread power outage within "line of sight" impacting multiple states, even a majority of the United States. Although deterrence and prevention are primarily addressed at the federal level, the utility industry and the scientific community are key in researching, identifying, and pursuing feasible opportunities for electric utility hardening. In terms of worst case scenario, an EMP event could leave our community without power for months to year(s). Although the utility companies take the lead in restoring power, an EMP event would require significant response and recovery efforts since this type of event shuts down electricity and all infrastructures depending on electricity including communications, transportation, etc.

Vulnerability Assessment - Space Weather

Space weather storms mainly disrupt technology. As our society becomes more dependent and sophisticated with our technologies, our vulnerability to space weather storms increases. The NOAA Space Weather Prediction Center has created Space Weather Scales as a way to communicate to the general public about the possible effects on people and technologies. The scales describe the environmental disturbances for three event types: geomagnetic storms, solar radiation storms, and radio blackouts. The scales have numbered levels (1-5) similar to hurricane, tornado, and earthquake severity ratings and they list the possible effects at each numeric level.

The table (next page) describes the G1-G5 severity scale disturbances in the geomagnetic field caused by gusts in the solar wind that blows to earth. The possible effects are on power systems, spacecraft operations (including satellites), and other operation systems.

NOAA Space Weather Scale for Geomagnetic Storms

http://www.swpc.noaa.gov/NOAAscales/index.html#G5

Category		Effect	Physical measure	Average Frequency (1 cycle = 11 years)
Scale	**Descriptor**	**Duration of event will influence severity of effects**		
Geomagnetic Storms			**Kp values***	**Number of storm events when Kp level was met; (number of storm days)**
G 5	**Extreme**	**Power systems:** widespread voltage control problems and protective system problems can occur; some grid systems may experience complete collapse or blackouts. Transformers may experience damage. **Spacecraft operations:** may experience extensive surface charging, problems with orientation, uplink/downlink and tracking satellites. **Other systems:** pipeline currents can reach hundreds of amps, HF (high frequency) radio propagation may be impossible in many areas for one to two days, satellite navigation may be degraded for days, low-frequency radio navigation can be out for hours, and aurora has been seen as low as Florida and southern Texas (typically 40° geomagnetic lat.)**.	Kp = 9	4 per cycle (4 days per cycle)
G 4	**Severe**	**Power systems:** possible widespread voltage control problems and some protective systems will mistakenly trip out key assets from the grid. **Spacecraft operations:** may experience surface charging and tracking problems, corrections may be needed for orientation problems. **Other systems:** induced pipeline currents affect preventive measures, HF radio propagation sporadic, satellite navigation degraded for hours, low-frequency radio navigation disrupted, and aurora has been seen as low as Alabama and northern California (typically 45° geomagnetic lat.)**.	Kp = 8, including a 9-	100 per cycle (60 days per cycle)
G 3	**Strong**	**Power systems:** voltage corrections may be required; false alarms triggered on some protection devices. **Spacecraft operations:** surface charging may occur on satellite components, drag may increase on low-Earth-orbit satellites, and corrections may be needed for orientation problems. **Other systems:** intermittent satellite navigation and low-frequency radio navigation problems may occur, HF radio may be intermittent, and aurora has been seen as low as Illinois and Oregon (typically 50° geomagnetic lat.)**.	Kp = 7	200 per cycle (130 days per cycle)
G 2	**Moderate**	**Power systems:** high-latitude power systems may experience voltage alarms; long-duration storms may cause transformer damage. **Spacecraft operations:** corrective actions to orientation may be required by ground control; possible changes in drag affect orbit predictions. **Other systems:** HF radio propagation can fade at higher latitudes, and aurora has been seen as low as New York and Idaho (typically 55° geomagnetic lat.)**.	Kp = 6	600 per cycle (360 days per cycle)
G 1	**Minor**	**Power systems:** weak power grid fluctuations can occur. **Spacecraft operations:** minor impact on satellite operations possible. **Other systems:** migratory animals are affected at this and higher levels; aurora is commonly visible at high latitudes (northern Michigan and Maine)**.	Kp = 5	1700 per cycle (900 days per cycle)

* The Kp-index used to generate these messages is derived from a real-time network of observatories the report data to SWPC in near real-time. In most cases the real-time estimate of the Kp index will be a good approximation to the official Kp indices that are issued twice per month by the German GeoForschungsZentrum (GFZ) (Research Center for Geosciences).

** For specific locations around the globe, use geomagnetic latitude to determine likely sightings

NOAA Space Weather Scale for Solar Radiation Storms

Category		Effect	Physical measure	Average Frequency (1 cycle = 11 years)
Scale	**Descriptor**	**Duration of event will influence severity of effects**		
Solar Radiation Storms			**Flux level of >= 10 MeV particles (ions)***	**Number of events when flux level was met (number of storm days**)**
S 5	**Extreme**	**Biological:** unavoidable high radiation hazard to astronauts on EVA (extra-vehicular activity); passengers and crew in high-flying aircraft at high latitudes may be exposed to radiation risk.*** **Satellite operations:** satellites may be rendered useless, memory impacts can cause loss of control, may cause serious noise in image data, star-trackers may be unable to locate sources; permanent damage to solar panels possible. **Other systems:** complete blackout of HF (high frequency) communications possible through the polar regions, and position errors make navigation operations extremely difficult.	10^5	Fewer than 1 per cycle
S 4	**Severe**	**Biological:** unavoidable radiation hazard to astronauts on EVA; passengers and crew in high-flying aircraft at high latitudes may be exposed to radiation risk.*** **Satellite operations:** may experience memory device problems and noise on imaging systems; star-tracker problems may cause orientation problems, and solar panel efficiency can be degraded. **Other systems:** blackout of HF radio communications through the polar regions and increased navigation errors over several days are likely.	10^4	3 per cycle
S 3	**Strong**	**Biological:** radiation hazard avoidance recommended for astronauts on EVA; passengers and crew in high-flying aircraft at high latitudes may be exposed to radiation risk.*** **Satellite operations:** single-event upsets, noise in imaging systems, and slight reduction of efficiency in solar panel are likely. **Other systems:** degraded HF radio propagation through the polar regions and navigation position errors likely.	10^3	10 per cycle
S 2	**Moderate**	**Biological:** passengers and crew in high-flying aircraft at high latitudes may be exposed to elevated radiation risk.*** **Satellite operations:** infrequent single-event upsets possible. **Other systems:** small effects on HF propagation through the polar regions and navigation at polar cap locations possibly affected.	10^2	25 per cycle
S 1	**Minor**	**Biological:** none. **Satellite operations:** none. **Other systems:** minor impacts on HF radio in the polar regions.	10	50 per cycle

* Flux levels are 5 minute averages. Flux in particles$\cdot s^{-1} \cdot ster^{-1} \cdot cm^{-2}$. Based on this measure, but other physical measures are also considered.
** These events can last more than one day.
*** High energy particle measurements (>100 MeV) are a better indicator of radiation risk to passenger and crews. Pregnant women are particularly susceptible.

NOAA Space Weather Scale for Radio Blackouts

Category		Effect	Physical measure	Average Frequency (1 cycle=11 years)
Scale	**Descriptor**	**Duration of event will influence severity of effects**		
Radio Blackouts			**GOES X-ray peak brightness by class and by flux***	**Number of events when flux level was met; (number of storm days)**
R 5	**Extreme**	**HF Radio:** Complete HF (high frequency**) radio blackout on the entire sunlit side of the Earth lasting for a number of hours. This results in no HF radio contact with mariners and en route aviators in this sector. **Navigation:** Low-frequency navigation signals used by maritime and general aviation systems experience outages on the sunlit side of the Earth for many hours, causing loss in positioning. Increased satellite navigation errors in positioning for several hours on the sunlit side of Earth, which may spread into the night side.	X20 (2×10^{-3})	Less than 1 per cycle
R 4	**Severe**	**HF Radio:** : HF radio communication blackout on most of the sunlit side of Earth for one to two hours. HF radio contact lost during this time. **Navigation:** Outages of low-frequency navigation signals cause increased error in positioning for one to two hours. Minor disruptions of satellite navigation possible on the sunlit side of Earth.	X10 (10^{-3})	8 per cycle (8 days per cycle)
R 3	**Strong**	**HF Radio:** Wide area blackout of HF radio communication, loss of radio contact for about an hour on sunlit side of Earth. **Navigation:** Low-frequency navigation signals degraded for about an hour.	X1 (10^{-4})	175 per cycle (140 days per cycle)
R 2	**Moderate**	**HF Radio:** Limited blackout of HF radio communication on sunlit side, loss of radio contact for tens of minutes. **Navigation:** Degradation of low-frequency navigation signals for tens of minutes.	M5 (5×10^{-5})	350 per cycle (300 days per cycle)
R 1	**Minor**	**HF Radio:** Weak or minor degradation of HF radio communication on sunlit side, occasional loss of radio contact. **Navigation:** Low-frequency navigation signals degraded for brief intervals.	M1 (10^{-5})	2000 per cycle (950 days per cycle)

* Flux, measured in the 0.1-0.8 nm range, in $W \cdot m^{-2}$. Based on this measure, but other physical measures are also considered.
** Other frequencies may also be affected by these conditions.

Vulnerability Assessment - Electromagnetic Pulse (EMP)

EMP Vulnerabilities

"….Today's microelectronics are the foundation of our modern civilization, but are over one million times more vulnerable to EMP than the far more primitive and robust electronics of the 1960s, that proved vulnerable during nuclear EMP tests of that era. Tests conducted by the EMP Commission confirmed empirically the theory that, as modern microelectronics become ever smaller and more efficient, and operate ever faster on lower voltages, they also become ever more vulnerable, and can be destroyed or disrupted by much lower EMP field strengths.

Microelectronics and electronic systems are everywhere, and run virtually everything in the modern world. All of the civilian critical infrastructures that sustain the economy of the United States, and the lives of 310 million Americans, depend, directly or indirectly, upon electricity and electronic systems.

Of special concern is the vulnerability to EMP of the Extra High-Voltage (EHV) transformers, that are indispensable to the operation of the electric grid. EHV transformers drive electric current over long distances, from the point of generation to consumers (from the Niagara Falls hydroelectric facility to New York City, for example). The electric grid cannot operate without EHV transformers--which could be destroyed by an EMP event. The United States no longer manufactures EHV transformers. They must be manufactured and imported from overseas, from Germany or South Korea, the only two nations in the world that manufacture such transformers for export. Each EHV transformer must be custom made for its unique role in the grid. A single EHV transformer typically requires 18 months to manufacture. The loss of large numbers of EHV transformers to an EMP event would plunge the United States into a protracted blackout lasting years, with perhaps no hope of eventual recovery, as the society and population probably could not survive for even one year without electricity.

Another key vulnerability to EMP are Supervisory Control And Data Acquisition systems (SCADAs). SCADAs essentially are small computers, numbering in the millions and ubiquitous everywhere in the critical infrastructures, that perform jobs previously performed by hundreds of thousands of human technicians during the 1960s and before, in the era prior to the microelectronics revolution. SCADAs do things like regulating the flow of electricity into a transformer, controlling the flow of gas through a pipeline, or running traffic control lights. SCADAs enable a few dozen people to run the critical infrastructures for an entire city, whereas previously hundreds or even thousands of technicians were necessary. Unfortunately, SCADAs are especially vulnerable to EMP.

EHV transformers and SCADAs are the most important vulnerabilities to EMP, but are by no means the only vulnerabilities. Each of the critical infrastructures has their own unique vulnerabilities to EMP…"
Source: Dr. Peter Vincent Pry, Congressional EMP Commission, Congressional Strategic Posture Commission, Executive Director of the Task Force on National and Homeland Security, Witness Statement [PDF]

Additional statements regarding the EMP Threat:
http://homeland.house.gov/hearing/subcommittee-hearing-electromagnetic-pulse-emp-threat-critical-infrastructure

- Hon. Trent Franks, A Representative in Congress from the State of Arizona, Witness Statement [PDF]
- Dr. Peter Vincent Pry, Congressional EMP Commission, Congressional Strategic Posture Commission, Executive Director of the Task Force on National and Homeland Security, Witness Statement [PDF]
- Dr. Michael J. Frankel, Senior Scientist, Penn State University, Applied Research Laboratory, Witness Statement [PDF]
- Dr. Chris Beck, Vice President, Policy and Strategic Initiatives, The Electric Infrastructure Security Council, Witness Statement [PDF]

Data Limitations

Brief power outages occur regularly in North Dakota but since long-term critical material or infrastructure outages or shortages are not a normal event, understanding the specific problems and concerns of this hazard is the greatest limitation.

Tornado – Hazard Profile

Description

A tornado is a violently rotating column of air extending from a thunderstorm to the ground. The term "tornado" was derived from the Latin word, "tornare" which means "to make round by turning." A tornado is initially a cloud within the thunderstorm, composed of condensed water vapor. A tornado forms when a change in wind direction and increase in wind speed with increasing height creates a horizontal spinning effect in the lower atmosphere. This area of rotation may be two to six miles wide, extending through much of the storm. Most tornadoes form within this area of strong rotation when the rising air within the thunderstorm updraft tilts the rotating air from horizontal to vertical. Tornadoes may appear nearly transparent until the circulating wind in the funnel reaches the ground and picks up debris that eventually darkens the whole funnel.

Tornadoes are nature's most violent windstorm. In an average year, the United States experiences an average of 1,200 tornadoes that result in an average of 70 to 80 deaths and 1,500 injuries. Most fatalities occur when people are struck by flying debris or do not leave mobile homes and automobiles. Tornadoes can vary greatly in shape, size, and wind speed. Most tornadoes, 88 percent, have wind speeds less than 110 mph and a lifetime of less than ten minutes. These weak tornadoes result in less than five percent of tornado deaths. The average tornado moves from southwest to northeast, but tornadoes have been known to move in any direction. The average forward speed is 30 mph, but may vary from nearly stationary to 70 mph. Approximately 11 percent of all tornadoes have wind speeds between 110 and 205 mph and result in nearly 30 percent of all tornado deaths. These strong tornadoes may last 20 minutes or longer. Less than one percent of all tornadoes have resulted in 70 percent of all tornado deaths. These violent tornadoes can be over a mile wide with documented rotating winds of more than 250 mph, and they can have lifetimes exceeding one hour and stay on the ground for over 50 miles.

Fujita Scales

A funnel cloud is the rotating column of air extending out of a cloud base, but not yet touching the ground. The funnel cloud does not become a tornado until it touches the ground. Once in contact with the surface, it can create great damage over a small area. In 1971, Dr. Theodore Fujita developed the Fujita tornado damage scale to categorize various levels of tornado damage. In fact, Dr. Fujita's first major case study on tornado damage was the 1957 Fargo tornado. (North Dakota State Water Commission, 2007)

In 2006, enhancements to this scale resulted in more accurate categorizations of damage and the associated wind speeds. The Enhanced Fujita (EF) scale was implemented in February 2007.

Both scales are shown in the table below:
Tornado Scales

Fujita Scale (through January 2007)		**Enhanced Fujita Scale** (Feb 2007 - current)	
Scale	**Estimated Wind Speed**	**Scale**	**Estimated Wind Speed**
F0	<73 mph	EF0	65-85 mph
F1	73-112 mph	EF1	86-110 mph
F2	113-157 mph	EF2	111-135 mph
F3	158-206 mph	EF3	136-165 mph
F4	207-260 mph	EF4	166-200 mph
F5	261-318 mph	EF5	>200 mph

Source: National Climatic Data Center, 2013.

F0

F1

F2

F3

F4

F5

Photos Source: Wikipedia

Risk

Risk: the potential for damage, loss, or other impacts created by the interaction of hazards with community assets.

Risk Assessment: product or process that collects information and assigns values to risks for the purpose of informing priorities, developing or comparing courses of action, and informing decision making.

THIRA Ratings – **Tornado EF0/EF1**

Frequency	Consequence			
	Human	Economic	Psychological	Government
Possible	Minor	Minor	None	Minor

THIRA Ratings – **Tornado EF2/EF3**

Frequency	Consequence			
	Human	Economic	Psychological	Government
Possible	Significant	Moderate	Minor	Moderate

THIRA Ratings – **Tornado EF4/EF5**

Frequency	Consequence			
	Human	Economic	Psychological	Government
Unlikely	Catastrophic	Catastrophic	Significant	Significant

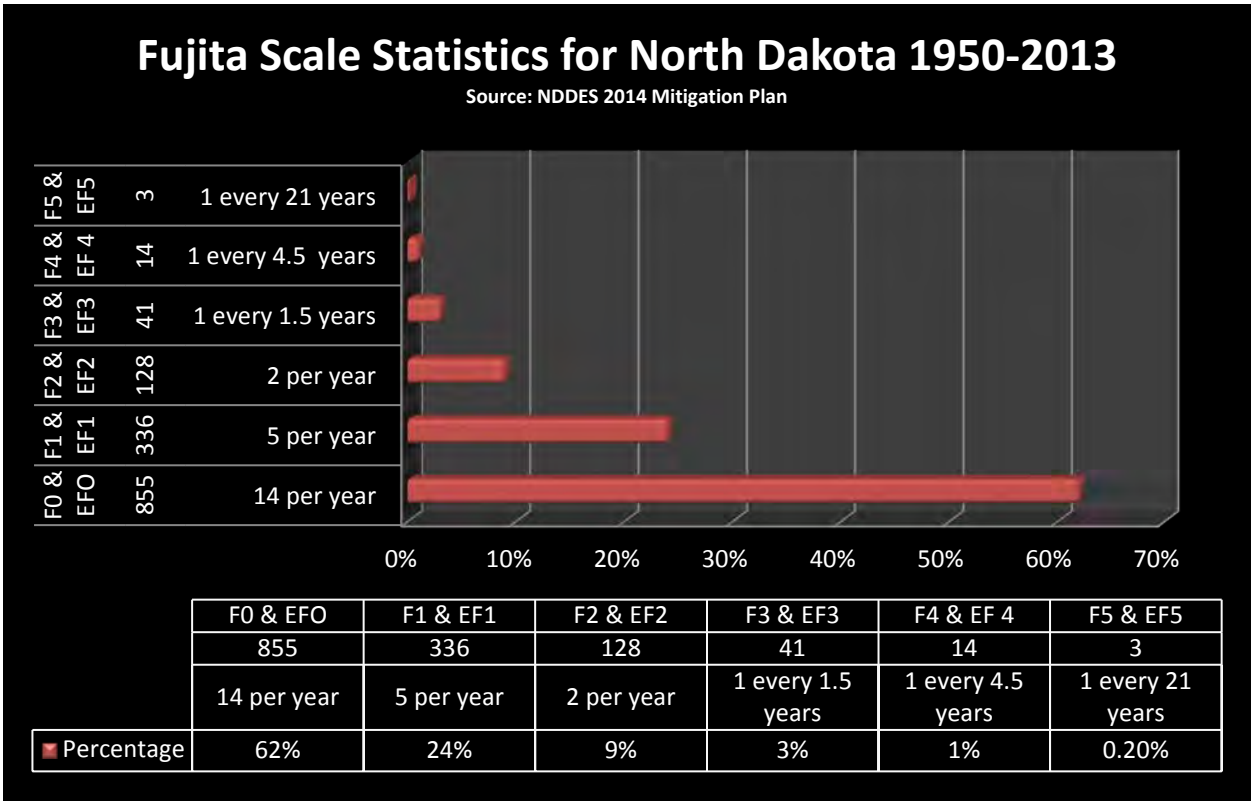
Estimated Annual Probability of a tornado of any magnitude Based on Historical Occurrences: *2%
*This estimate is for planning purposes only – and is based on the following limited and short term data and assumptions: There has been an average of one tornado per year in Burleigh County from 1996 to 2013 (not all tornados are reported). The ratio or target size of Bismarck compared to the geographic square miles of Burleigh County is 2%. It's assumed all of Burleigh County has equal chances.

When considering the statewide statistics regarding intensity of tornados since 1950, a majority of the estimated chance is for the weaker tornados (EF0 and EF1). See table below.

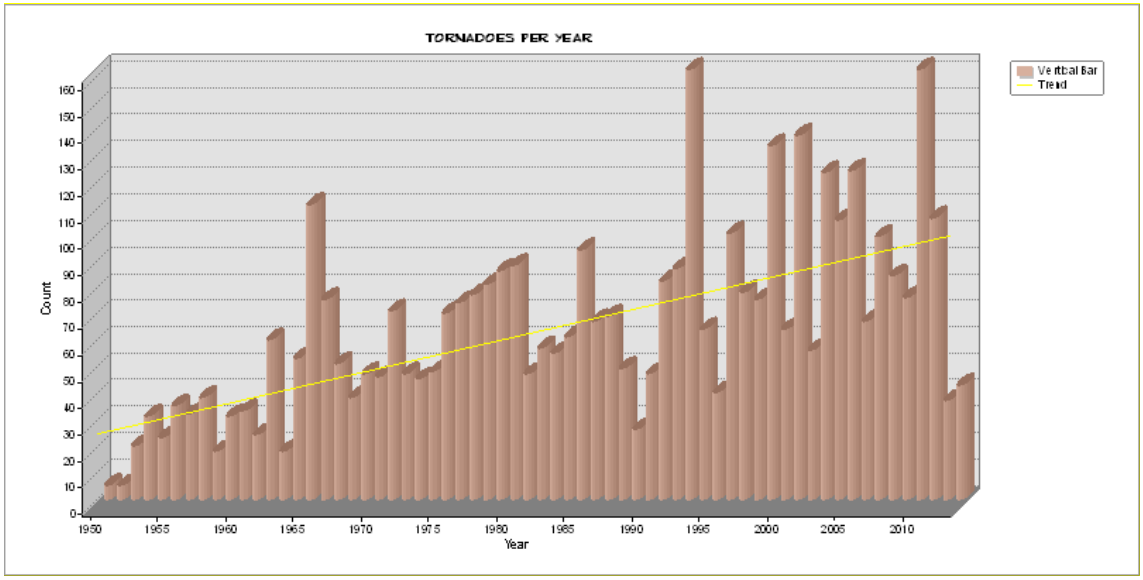
Fujita Scale Statistics for North Dakota Tornadoes 1950-2013

Magnitude	Number of Recorded Tornadoes	Average Frequency	Percentage
F0 & EFO	855	14 per year	62%
F1 & EF1	336	5 per year	24%
F2 & EF2	128	2 per year	9%
F3 & EF3	41	1 every 1.5 years	3%
F4 & EF 4	14	1 every 4.5 years	1%
F5 & EF5	3	1 every 21 years	0.2%

Source: NDDES 2014 Mitigation Plan

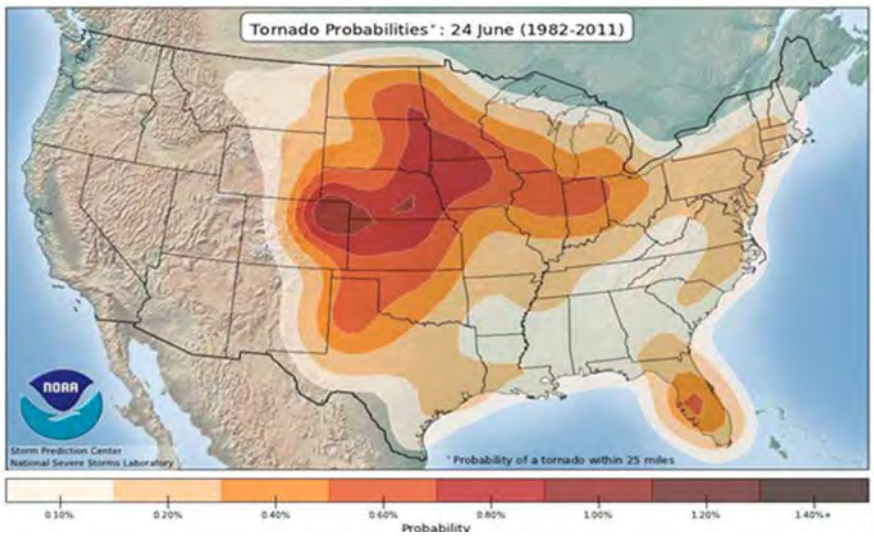


	F0 & EFO	F1 & EF1	F2 & EF2	F3 & EF3	F4 & EF 4	F5 & EF5
	855	336	128	41	14	3
	14 per year	5 per year	2 per year	1 every 1.5 years	1 every 4.5 years	1 every 21 years
Percentage	62%	24%	9%	3%	1%	0.20%

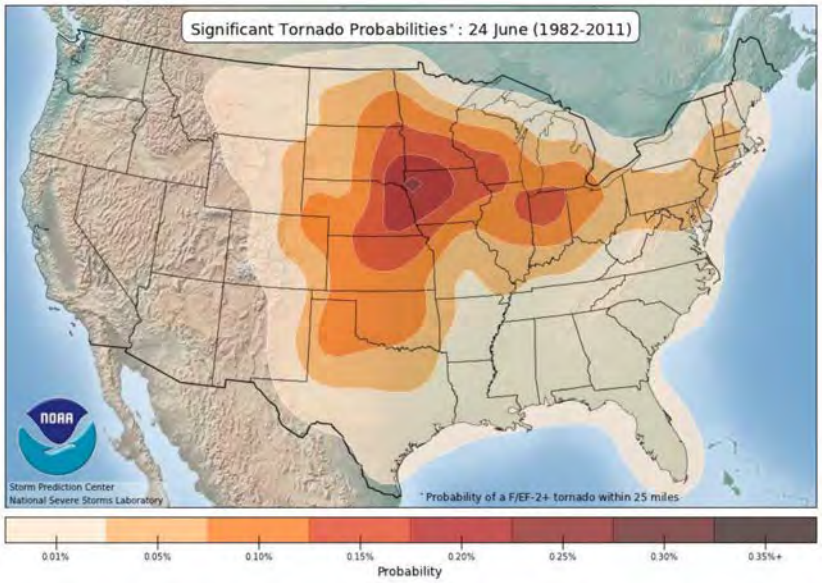


The chart above illustrates the number of tornadoes per year (within 300 miles of Bismarck).
Source: NWS Storm Prediction Center http://www.spc.noaa.gov/gis/svrgis/

"….With increased National Doppler radar coverage, increasing population, and greater attention to tornado reporting, there has been an increase in the number of tornado reports over the past several decades. This can create a misleading appearance of an increasing trend in tornado frequency….."
Source: http://www.ncdc.noaa.gov/climate-information/extreme-events/us-tornado-climatology/trends



0.6 % Probability of Tornado Event for Bismarck (on a per-day basis around June 24)

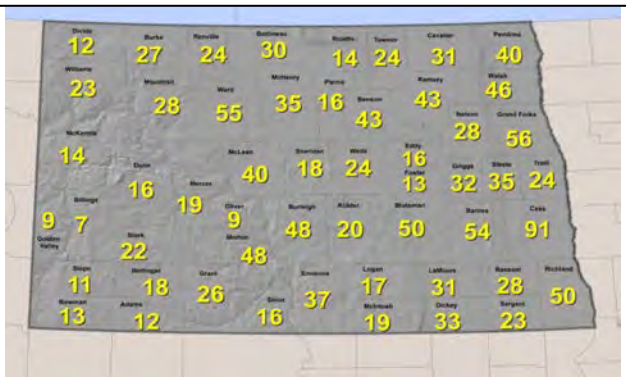
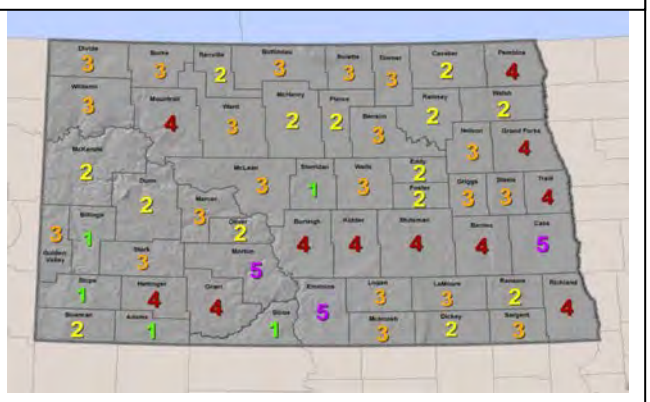


0.05 % Probability of Significant Tornado Event EF 2 or Greater on a per-day basis around June 24

Source: http://www.spc.noaa.gov/new/SVRclimo/climo.php?parm=sigTorn

The peak time of the year for tornadoes in North Dakota is from the end of May through the beginning of August, with most tornadoes in the state occurring between 3:00 p.m. and 11:00 p.m. in the months of June, July, and August; however, tornadoes have been reported as early as March 26 and as late as November 1.

Risk: Frequency - History

Tornadoes by County 1950-2013	Highest Rated Tornado 1950-2013
	

http://www.crh.noaa.gov/bis/?n=ndtorhistory
http://www.ncdc.noaa.gov/stormevents/

For a tornado to be counted in these statistics, it must be reported, and it is entirely possible for a tornado to occur in the state without anyone knowing it.

Note that these findings may be more indicative of the spotter networks in the state rather than the actual occurrence. The state also conducts cloud seeding operations in the western part of the state for hail suppression.

During the 63-year period from January 1950 to March 2013, 1,477 tornadoes were reported in North Dakota with an estimated $170,126,270 in property damage, $2,700,417 in average annualized property damage, 25 deaths, and 326 injuries. Most of the injuries occurred to people who were inside their homes, outside, or driving a vehicle. (National Climatic Data Center, 2013)

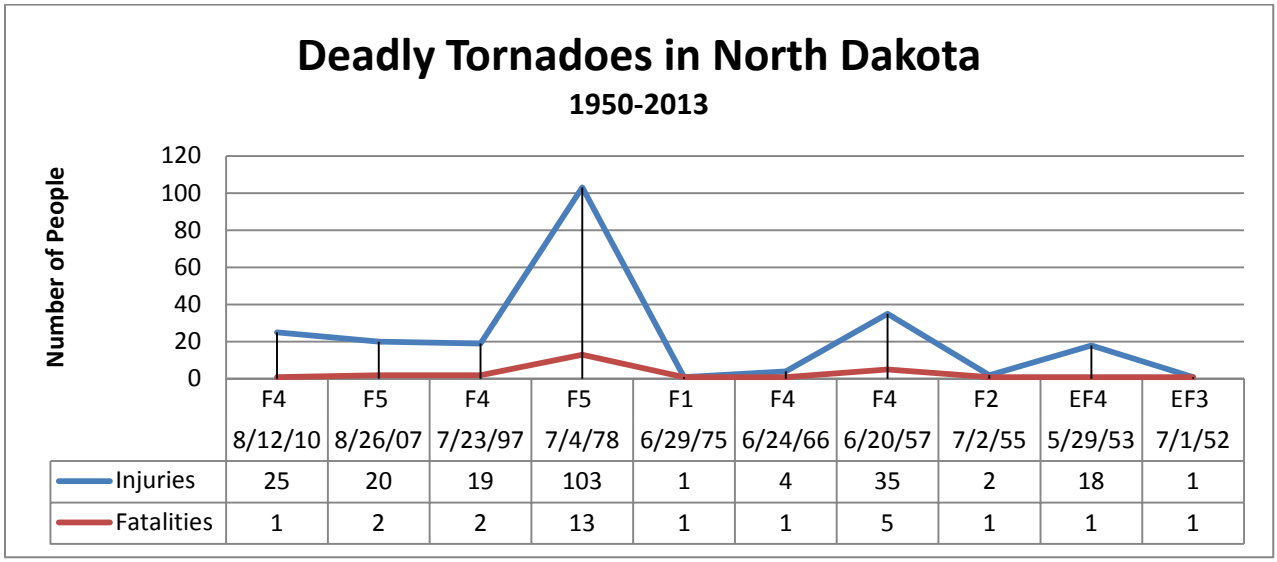
Based on the historical record, the following can be expected on average in North Dakota:
In an average year, 23 reported tornadoes resulting in about $2.7 million in combined property and crop damage and 5 injuries. Fatalities are possible, averaging one every other year over the past 63 years.

Reported tornado and severe thunderstorm events over the past several decades provide an acceptable framework for determining the magnitude of summer storms that can be expected and should be planned for. For tornadoes, even though only a few counties have experienced F5/EF5 tornadoes, all counties could experience tornadoes of this magnitude. The Federal Emergency Management Agency places the majority of North Dakota in Zone II (160 mph) for structural wind design; however, southeastern and south central North Dakota are in Zone III (200 mph). (Federal Emergency Management Agency, 2004)

Deadly Tornadoes in North Dakota 1950-2013

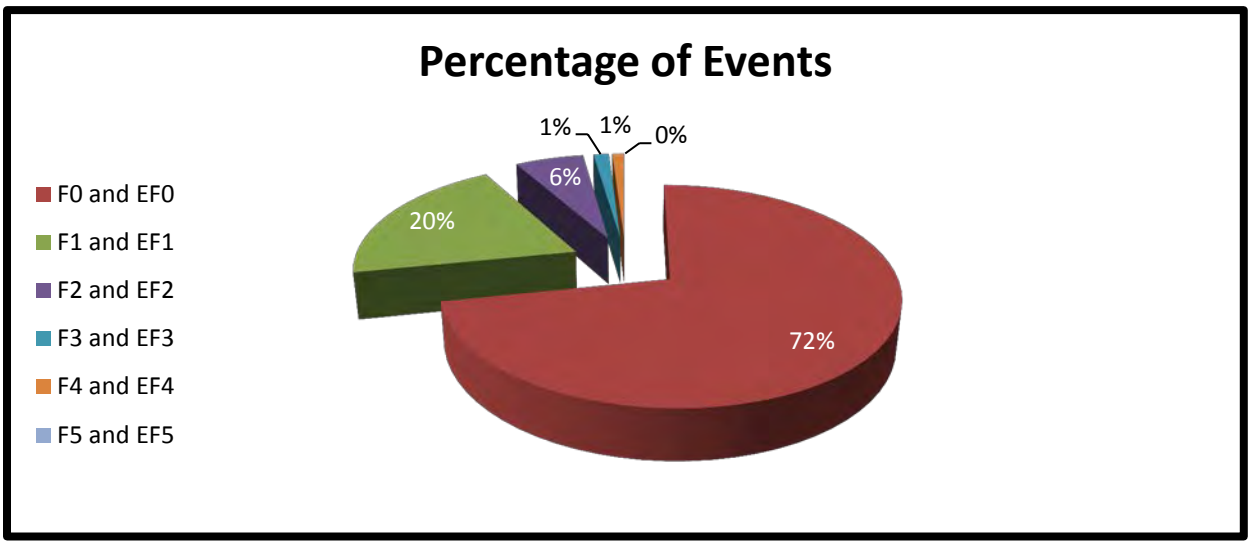
Location	Date	Magnitude	Fatalities	Injuries
Burleigh and Kidder Counties	July 1, 1952	F4	*2 fatalities (1 per county)	*26 injuries (total from both counties)
Morton County	May 29, 1953	F5	2 fatalities	20 injuries
Richland County	July 2, 1955	F4	2 fatalities	19 injuries
Cass County	June 20, 1957	F5	*10 fatalities	103 injuries
Cavalier County	June 24, 1966	F1	1 fatality	1 injury
Hettinger County	June 29, 1975	F4	1 fatality	4 injuries
Elgin, Grant County	July 4, 1978	F4	5 fatalities	35 injuries
12 miles South of Greene Renville County	July 23, 1997	F2	1 fatality	2 injuries
Northwood, Grand Forks County	August 26, 2007	EF4	1 fatality	18 injuries
10 miles north-northeast of Niobe, Ward County	August 12, 2010	EF3	1 fatality	1 injury

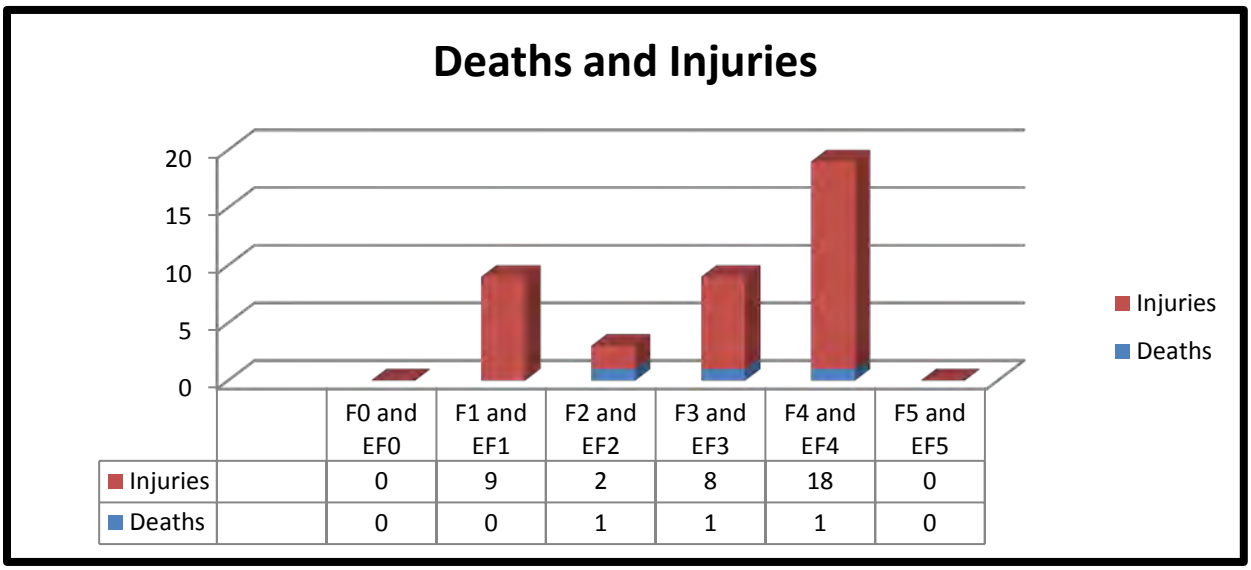
Source: 2014 NDDES Mitigation Plan *NWS corrections – local Bismarck Office.



ND Statewide Tornado Statistics
January 1, 1996 – November 30, 2013
http://www.ncdc.noaa.gov/stormevents/

Magnitude	# of Events	*Percent of Total Events*	Deaths	Injuries
F0 and EF0	489	*72%*	0	0
F1 and EF1	136	*20%*	0	9
F2 and EF2	40	*6%*	1	2
F3 and EF3	9	*1%*	1	8
F4 and EF4	7	*1%*	1	18
F5 and EF5	0	*0%*	0	0
Totals	**681**		**3**	**37**
Avg per year	38		0.16	1





Statewide Statistics:

- Average 23 tornadoes per year
- Earliest Tornado (calendar year): March 26, 2003 Stutsman County
- Latest Tornado (calendar year): November 1, 2000 Bismarck/Mandan area
- Most tornadoes in a year: 61 in 1999
- Least tornadoes in a year: 2 in 1950, 1951, and 1961
- Most tornadoes on a calendar day: 24 on June 11, 1976 with a total of 30 on June 11 and 12

http://www.crh.noaa.gov/bis/?n=ndtorhistory

Data Limitations (statewide):

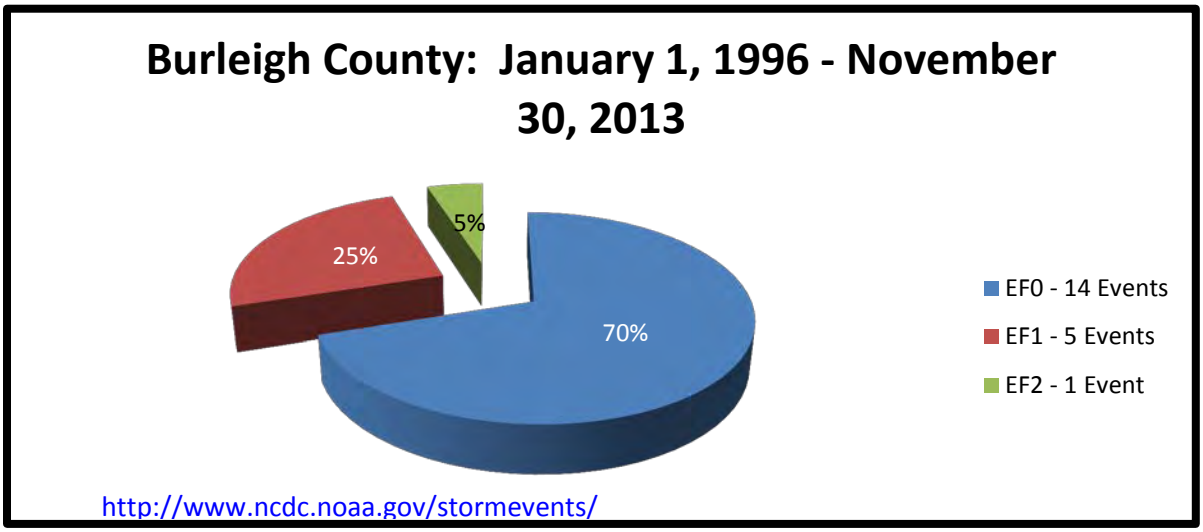
Summer storms can be such isolated events that the vulnerability to a particular area can be hard to determine. Weather data is often limited by the observations taken, and events in the National Climatic Data Center database are only recorded if reported to the National Weather Service. The addition of trained spotters to the area may improve data collection.

Burleigh County: January 1, 1996 - November 30, 2013

20 Tornado Events

Magnitude	Number of Events	%
EF0	14	70%
EF1	5	25%
EF2	1	5%

http://www.ncdc.noaa.gov/stormevents/



Burleigh County: January 1, 1996 - November 30, 2013 (**20 Tornado Events)**

*Location	Date	Start Time	End Time	Magnitude	Length (miles)	Width (yards)	Deaths	Injuries	Property Damage
REGAN	07/16/2011	16:35	16:46	EF1	4.05	50	0	0	10.00K
MENOKEN	08/11/2008	12:08	12:12	EF0	1.38	35	0	0	0.00K
BALDWIN	07/28/2008	20:25	20:31	EF0	3.72	40	0	0	0.00K
BALDWIN	07/10/2008	17:10	17:13	EF0	0.5	30	0	0	0.00K
STERLING	06/16/2007	23:57	23:59	EF0	1	30	0	0	0.00K
MOFFIT	06/16/2007	23:25	23:30	EF0	1	30	0	0	0.00K
BISMARCK ARPT	06/06/2005	23:02	23:07	F1	1	60	0	0	0.00K
BISMARCK	06/23/2002	18:55	18:55	F0	2	40	0	0	0.00K
DRISCOLL	05/30/2001	13:50	14:00	F0	0	30	0	0	0.00K
WILTON	11/01/2000	15:05	15:05	F0	2	40	0	0	0.00K
BISMARCK	11/01/2000	14:33	15:00	F2	5	100	0	0	55.00K
BISMARCK	11/01/2000	13:55	14:05	F1	3	50	0	2	0.00K
ARENA	06/25/1999	21:24	21:27	F1	2	30	0	0	0.00K
WING	06/06/1999	13:20	13:20	F0	0.5	10	0	0	0.00K
REGAN	06/06/1999	12:30	12:30	F0	0.5	15	0	0	20.00K
DRISCOLL	06/03/1999	16:50	16:50	F1	2	30	0	0	75.00K
DRISCOLL	06/03/1999	16:43	16:43	F0	4	15	0	0	0.00K
BISMARCK	06/18/1998	14:10	14:15	F0	0.2	33	0	0	0.00K
WILTON	05/13/1998	20:10	20:30	F0	6	100	0	0	0.00K
BISMARCK	08/05/1997	17:10	17:13	F0	0.2	10	0	0	0.00K

*Use Ctrl + Click on location name in table for more information.

<u>Exercise Scenario Impact Analysis – NOT a real event</u>

Approximately 7 miles long and ½ to ¾ mile wide at widest point

Estimated Population within impacted area: 8,170

Total Number of Buildings/Structures with a building value greater than zero: 2,815

Estimated Building Value (Bismarck) within tornado path: $761,652,100

Estimated Building Value (Bismarck/Burleigh): $763,114,300

Plus 217 exempt properties, building values not included in estimates above.

Infrastructure, facilities, and population impacted within the exercise scenario tornado path include: 2 nursing home facilities, 1 assisted living facility, 1 high school, 1 private college, 3 day care centers, 6 Tier II facilities (hazmat sites), 1 ambulance station, 7 hotels, 1 clinic, 1 apartment complex, 3 mobile home parks, the landfill, 1 railroad crossing, 1 water tower, 2 state critical facilities, 1 mall, 1 bus service company, 1 home improvement store, 1 supermarket, and 2 churches.

Magnitude of the event can vary greatly depending on the EF Scale applied to the scenario.

Deadly Tornadoes in Burleigh County

Location	Date	Magnitude	Casualties
Burleigh and Kidder Counties	July 1, 1952	F4 28 miles long 150 yards wide	1 fatality 25 injuries

November 1, 2000: Five tornadoes touched down in or near Bismarck area.
The latest tornado in the calendar year in North Dakota occurred on November 1, 2000. Around 1 PM, the first of several tornadoes touched down in the northern part of Bismarck and moved Northwest. There were several injuries and considerable damage in north Bismarck. *(Source: NWS)*

Source: 2010 State Hazard Mitigation Plan

Source: Pat Whitlock, KOTVS

*Bismarck Tribune article excerpt: "….*What many forecasters believe to be several first-ever November tornadoes in the state touched down on Wednesday, damaging some 50 homes, according to Maj. Patrick Richards of North Dakota emergency management. "There was also damage to vehicles," he said. "There were 90 mph winds." A high school student's jaw was broken on both sides when she was hit by flying debris, the only injury reported from the storm. House damages were mostly lost roofs or parts of garages, said Richards. Since the tornadoes occurred in the late afternoon, kids were held in school an extra hour and half. City officials ordered everyone off the streets, so parents were not allowed to pick up their children until the danger had passed. …."
(Source: November 3, 2000 Bismarck Tribune article "Rare late tornadoes hits ND" by Susan Kim)

June 18, 1965: EF0 Tornado touched down in SW Bismarck at 7:55 PM. One-tenth of a mile and only 10 yards wide near the intersection of Anderson Street and Garden Drive.
Source: NWS Storm Prediction Center http://www.spc.noaa.gov/gis/svrgis/ and on record at the Bismarck NWS office.

Vulnerability Assessment

Vulnerability: Characteristics of community assets that make them susceptible to damage from a given hazard.

Note: Loss / Impact and Vulnerabilities are assumed to be cumulative from previous columns to the left. Tornado intensity is determined AFTER the incident and is based on level of damage.

Tornado Intensity =	**EF 0 - EF 1** **"Weak"**	**EF 2 - EF 3** **"Strong"**	**EF 4 – EF 5** **"Violent"**
Probability	"Possible" *Highest Probability* *(and frequency)*	"Possible" *Lower Probability* *(and frequency)*	"Unlikely" *Lowest Probability* *(and frequency)*
Speed of Onset	15 minutes approximately	15 minutes approximately	15 minutes approximately
Geographic Area	300 yards wide 1 to 2 miles long is typical	1 mile wide is possible but wide rare (EF3) 1 to 2 miles long Is typical – can be longer	1 mile wide is possible but rare 1 to 2 miles long is typical – can be longer
Duration	5 minutes or less	5 to 15 minutes	In excess of 15 minutes
Death / Injury 1. Primary Causes A. Highest vulnerability	1. Flying Debris *Non-secure outdoor items* A. Mobile home occupancy B. Motor Home C. Camp sites D. Being Caught Outdoors E. In a vehicle F. Insufficient shelter G. Windows H. Smaller detached buildings	1. Flying Debris *Secured items* 2. Structure collapse *Average "stick" construction* A. Homes / buildings of average "stick" construction B. High population density within "average construction" structures	1. Flying Debris 2. Structure collapse *All structures* A. All Structures B. All structures with high population density

Tornado Intensity =	**EF 0 - EF 1** **"Weak"**	**EF 2 - EF 3** **"Strong"**	**EF 4 – EF 5** **"Violent"**
Mass Casualty Incident			Burleigh County July 1, 1952 1 Death 26 Injuries 28 miles long 150 yards wide Also, see Table "Deadly Tornados in ND"
Property Losses (points of vulnerability – high priority)	1. Mobile home 2. Motor Home 3. Windows/doors 4. Trees	1. Homes / buildings of average "stick" construction	1. All Structures
Environmental	1. Debris 2. Hazardous Waste debris	1. HazMat Releases 2. Oil Refinery - Mandan	1. HazMat Releases 2. Oil Refinery - Mandan
COG/COOP	1. Employee / family casualties 2. Key personnel – Orders of Succession	1. Employee / Family casualties 2. Key personnel – Orders of Succession	1. Employee / Family casualties 2. Key personnel – Orders of Succession 3. Property / Building(s) Destroyed 4. Equipment destroyed
Critical Facilities	1. Windows 2. Garages 3. Doors 4. Large Span Roofs Structure – depending on design / materials	1. Windows 2. Garages 3. Doors 4. Large Span Roofs Structure – depending on design / materials	1. Response agencies (includes 911) 2. City Buildings - Airport 3. Hospitals 4. Ambulance Service

Tornado Intensity =	**EF 0 - EF 1** **"Weak"**	**EF 2 - EF 3** **"Strong"**	**EF 4 – EF 5** **"Violent"**
Critical Infrastructure	1. Electricity - Substations & Overhead Power Lines 2. Streets Blocked 3. Communications	1. Electricity - Substations & Overhead Power Lines 2. Streets Blocked 3. Communications	1. Electricity - Substations & Overhead Power Lines 2. Streets Blocked 3. Communications
Schools	1. Portable Classrooms 2. Windows 3. Doors 4. Large Span roofs 5. Loss of roofing materials	High end EF 3: 1. All Schools structurally damaged 2. Loss of non-bearing walls 3. Loss of load bearing walls 4. Interior walls of 2nd floor or higher collapsed	1. Structures Destroyed Most Elementary Schools (BPS) do NOT have basements for sheltering
High Risk Facilities (chemical)	1. Windows 2. Garages/doors 3. Doors 4. Large Span Roofs	1. Windows 2. Garages/ doors 3. Doors 4. Large Span Roof	1. Water Treatment Plant 2. Waste Water Treatment Plant 3. All Haz Mat storage facilities
Specific Populations: Public Assembly, Vulnerable / Special Populations	1. Outdoor Recreation Areas 2. Public Assembly (high population densities) 3. Special Outdoor events	1. Outdoor Recreation Areas 2. Public Assembly (high population densities) 3. Special Outdoor Events	1. Outdoor Recreation Areas 2. Public Assembly (high population densities) 3. Special Outdoor Events
Economy (community wide)	Minor	Moderate	Catastrophic *Significant recovery challenges*
OTHER:	Mobile HazMat (truck)	Mobile Hazmat	Mobile Hazmat – including railroad

The Federal Emergency Management Agency places the majority of North Dakota in Zone II (160 mph) for structural wind design; however, southeastern and south central North Dakota are in Zone III (200 mph).
Source: Federal Emergency Management Agency, 2004 via 2014 ND DES Mitigation Plan

Generally, during tornado warnings, it's recommend that people move to a pre-designated shelter or a basement. If not available, interior rooms or hallways on the lowest floor away from windows or under a sturdy piece of furniture is recommended. Automobiles and mobile homes, even if tied down, are not safe places. North Dakota has approximately 23,471 mobile homes across the state. Given approximately 2.3 people per housing unit in the state, roughly 53,983 people are at enhanced risk from tornadoes and strong winds. Besides structure failure, wind-driven projectiles and shattered glass can injure or kill occupants. Source: NDDES 2014 Mitigation Plan.

Mobile Home Parks within Bismarck

NAME	PROPERTY ADDRESS	UNITS	POPULATION ESTIMATE
Capitol Park Village	1821 N 11th St	28	49
18th St/Thayer Av	1713 E Rosser Av	28	31
Bismarck Mobile Home Park	2406 E Thayer Av	34	78
Dakota Mobile Home Park	2520 E Broadway Av	51	89
Holiday Park	600 S 9th St	109	197
Airport Village	1437 University Dr	192	404
Century Centennial	2500 Centennial Rd	265	542
Century Park	4191 E Century Av	475	956
Colonial Estates	1501 E Bismarck Ex	282	599
Hay Creek Court	4005 NE 19th St	132	263
Parkview Estates	614 W Sweet Av	87	192
North Valley	4224 N 19th St	151	335
Skyway Park Village	1119 University Dr	397	689
Stardust Terrace	725 S 12th St	254	630
Tatley Meadows	2200 S Washington St	362	769
TOTAL		2,847	5,823

Mobile homes are regulated by HUD. The International Building Code requirements do not apply to mobile homes. Therefore, mobile homes are exempt from this particular International Building Code: Chapter 16 Structural Design - Section 1609 Wind Loads.

International Building Code - Chapter 16 Structural Design - Section 1609 Wind Loads:

1609.1 Applications states "Buildings, structures and parts thereof shall be designed to withstand the minimum wind loads prescribed herein. Decreases in wind loads shall not be made for the effect of shielding by other structures."

- 105 MPH (3 second gust) 33 feet above ground for Risk Category I Buildings and other Structures
- 115 MPH (3 second gust) 33 feet above ground for Risk Category II Buildings and other Structures
- 120 MPH (3 second gust) 33 feet above ground for Risk Category III and IV Buildings and other Structures

Source: http://publicecodes.cyberregs.com/icod/ibc/2012/icod_ibc_2012_16_par090.htm

The table below extracted from the 2012 International Building Code is used to identify the risk category of buildings and other structures.

structural system resulting from torsion due to eccentricity between the center of application of the lateral forces and the center of rigidity of the lateral force-resisting system.

Every structure shall be designed to resist the overturning effects caused by the lateral forces specified in this chapter. See Section 1609 for wind loads, Section 1610 for lateral soil loads and Section 1613 for earthquake loads.

1604.5 Risk category. Each building and structure shall be assigned a *risk category* in accordance with Table 1604.5. Where a referenced standard specifies an occupancy category, the *risk category* shall not be taken as lower than the occupancy category specified therein.

1604.5.1 Multiple occupancies. Where a building or structure is occupied by two or more occupancies not included in the same *risk category*, it shall be assigned the classification of the highest *risk category* corresponding to the various occupancies. Where buildings or structures have two or more portions that are structurally separated, each portion shall be separately classified. Where a separated portion of a building or structure provides required

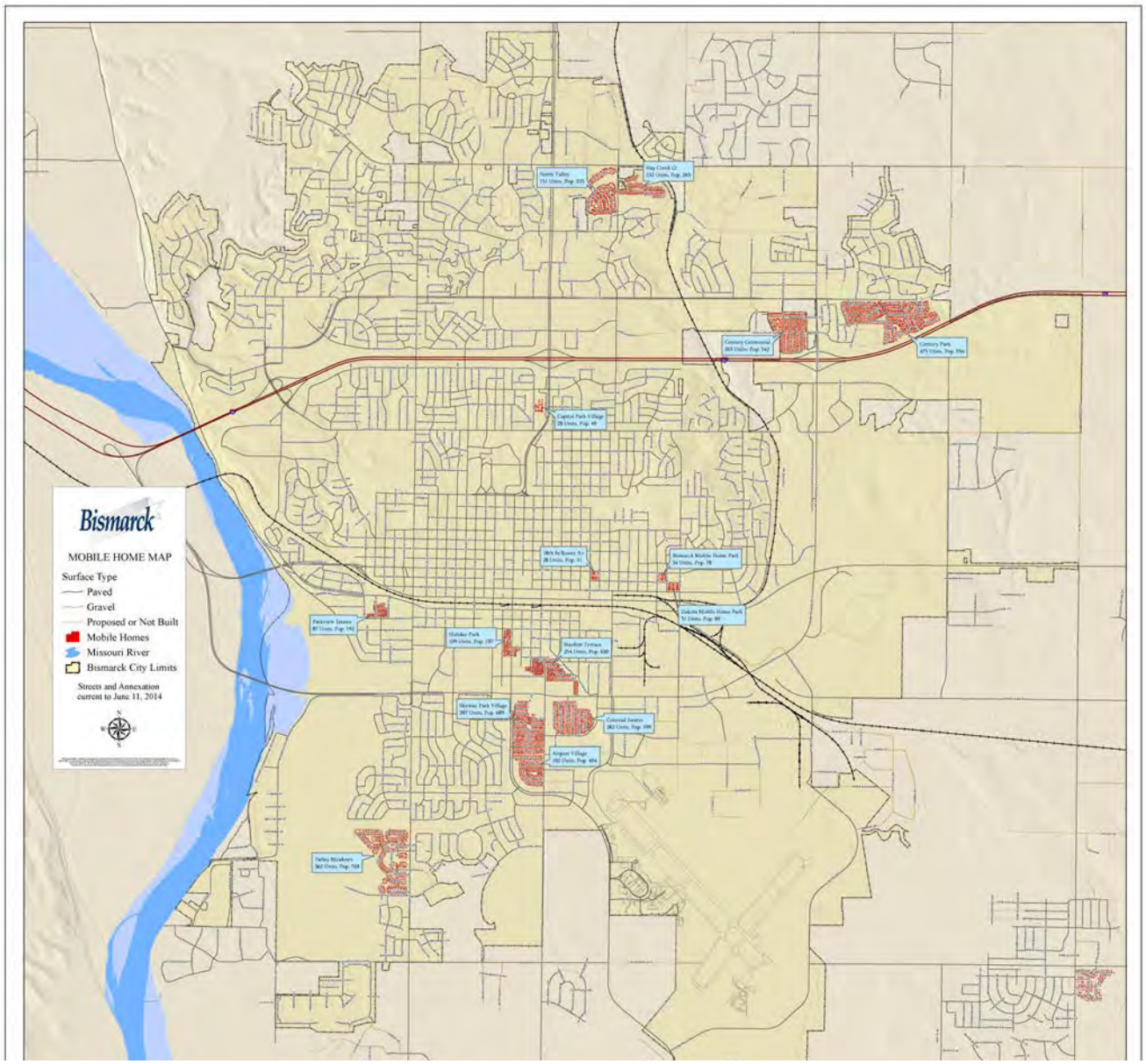
TABLE 1604.5
RISK CATEGORY OF BUILDINGS AND OTHER STRUCTURES

RISK CATEGORY	NATURE OF OCCUPANCY
I	Buildings and other structures that represent a low hazard to human life in the event of failure, including but not limited to: • Agricultural facilities. • Certain temporary facilities. • Minor storage facilities.
II	Buildings and other structures except those listed in Risk Categories I, III and IV
III	Buildings and other structures that represent a substantial hazard to human life in the event of failure, including but not limited to: • Buildings and other structures whose primary occupancy is public assembly with an occupant load greater than 300. • Buildings and other structures containing elementary school, secondary school or day care facilities with an occupa load greater than 250. • Buildings and other structures containing adult education facilities, such as colleges and universities, with an occupant load greater than 500. • Group I-2 occupancies with an occupant load of 50 or more resident care recipients but not having surgery or emergency treatment facilities. • Group I-3 occupancies. • Any other occupancy with an occupant load greater than 5,000[a]. • Power-generating stations, water treatment facilities for potable water, waste water treatment facilities and other public utility facilities not included in Risk Category IV. • Buildings and other structures not included in Risk Category IV containing quantities of toxic or explosive materials that: Exceed maximum allowable quantities per control area as given in Table 307.1(1) or 307.1(2) or per outdoor control area in accordance with the *International Fire Code*; and Are sufficient to pose a threat to the public if released [b].
IV	Buildings and other structures designated as essential facilities, including but not limited to: • Group I-2 occupancies having surgery or emergency treatment facilities. • Fire, rescue, ambulance and police stations and emergency vehicle garages. • Designated earthquake, hurricane or other emergency shelters. • Designated emergency preparedness, communications and operations centers and other facilities required for emergency response. • Power-generating stations and other public utility facilities required as emergency backup facilities for Risk Category IV structures. • Buildings and other structures containing quantities of highly toxic materials that: Exceed maximum allowable quantities per control area as given in Table 307.1(2) or per outdoor control area in accordance with the *International Fire Code*; and Are sufficient to pose a threat to the public if released [b]. • Aviation control towers, air traffic control centers and emergency aircraft hangars. • Buildings and other structures having critical national defense functions. • Water storage facilities and pump structures required to maintain water pressure for fire suppression.

a. For purposes of occupant load calculation, occupancies required by Table 1004.1.2 to use gross floor area calculations shall be permitted to use net floor areas to determine the total occupant load.

b. Where approved by the building official, the classification of buildings and other structures as Risk Category III or IV based on their quantities of toxic, highly toxic or explosive materials is permitted to be reduced to Risk Category II, provided it can be demonstrated by a hazard assessment in accordance with Section 1.5.3 of ASCE 7 that a release of the toxic, highly toxic or explosive materials is not sufficient to pose a threat to the public.

Bismarck Mobile Home Locations



EF0 – EF2 Vulnerabilities Summary *Based on **Damage Level Indicators** http://www.spc.noaa.gov/efscale/ef-scale.html				
***Type**	**Property Type**	**Expected Wind Speed**	**EF Scale**	**Description**
TS	Trees – Softwood	60	EF0	Small limbs broken (up to 1” diameter)
TH	Trees – Hardwood	60	EF0	Small limbs broken (up to 1” diameter)
TH	Trees – Hardwood	74	EF0	Large branches broken (up to 3” diameter)
MHSW	Single Wide Manufactured Mobile Home	74	EF0	Loss of shingles or partial uplift of one-piece metal roof covering
MHDW	Manufacture Home – Double Wide	78	EF0	Damaged porches or carports
FR12	One and Two-Family Residences	79	EF0	Loss of roof covering material (>20%), gutters and/or awning; loss of vinyl or metal siding
MHDW	Manufacture Home – Double Wide	83	EF0	Broken Windows
TS	Trees – Softwood	87	EF1	Uprooted
MHSW	Single Wide Manufactured Mobile Home	87	EF1	Unit slides off block piers but remains upright
MHDW	Manufacture Home – Double Wide	88	EF1	Uplift of roof deck and loss of significant roof covering material (>20%)
MHSW	Single Wide Manufactured Mobile Home	89	EF1	Complete uplift of roof; most walls remain standing
TH	Trees – Hardwood	91	EF1	Uprooted
MHDW	Manufacture Home – Double Wide	93	EF1	Complete uplift of roof; most walls remain standing
MHDW	Manufacture Home – Double Wide	94	EF1	Unit slides of CMU block piers
FR12	One and Two-Family Residences	96	EF1	Broken glass in doors and windows
MHDW	Manufacture Home – Double Wide	97	EF1	Removal of entire roof structure leaving most walls standing
FR12	One and Two-Family Residences	97	EF1	Uplift of rood deck and loss of significant roof covering material (>20%); collapse of chimney; garage doors collapse inward; failure of porch or carport.
MHSW	Single Wide Manufactured Mobile Home	98	EF1	Unit rolls on its side or upside down; remains essentially intact
TS	Trees – Softwood	104	EF1	Trunks Snapped
MHSW	**Single Wide Manufactured Mobile Home**	**105**	**EF1**	**Destruction of roof and walls, leaving floor and undercarriage in place**
MHSW	Single Wide Manufactured Mobile Home	109	EF1	Unit rolls or vaults; roof and walls separate from floor and undercarriage
TH	Trees – Hardwood	110	EF1	Trunks Snapped
SBO	Small Barns and Farm Outbuildings (sheds)	112	EF2	Total destruction of building

MHDW	**Manufacture Home – Double Wide**	**113**	**EF2**	**Complete destruction of roof and walls leaving undercarriage in place**
MHDW	Manufacture Home – Double Wide	114	EF2	Unit rolls, displaces or vaults
MHSW	Single Wide Manufactured Mobile Home	118	EF2	Undercarriage separates from unit; rolls, tumbles and is badly bent
FSP	Free Standing Light Poles, Luminary Poles, Flag Poles	118	EF2	Collapsed Pole
ETL	Electrical Transmission Lines	118	EF2	Broken wood poles
MBS	Metal Building Systems	118	EF2	Buckling of roof purlins
SRB	Small Retail Building	119	EF2	Uplift or collapse of entire roof structure
FR12	One and Two-Family Residences	121	EF2	Entire house shifts off foundation
MAM	Masonry Apartments or Motels	121	EF2	Uplift of pre-cast or cast-in-place concrete roof decking
FR12	One and Two-Family Residences	122	EF2	Large sections of roof structure removed; most walls remain standing
SM	Strip Mall	122	EF2	Uplift or collapse of entire roof structure
M	Motels	123	EF2	Uplift or collapse of roof structure leaving most walls standing
WHB	**Warehouse Building**	**124**	**EF2**	**Collapse of pre-cast concrete tilt-up panels**
SPB	Small Professional Building	124	EF2	Uplift or collapse of entire roof structure
ACT	Apartments, Condos, and Townhouses	124	EF2	Uplift of roof decking; significant loss of roof covering (>20%)
ES	**Elementary School**	**125**	**EF2**	**Uplift or collapse of roof structure**
JHSH	**Junior or Senior High School**	**125**	**EF2**	**Uplift or collapse of roof structure**
ASR	**Automobile Showroom**	**126**	**EF2**	**Exterior Walls Collapsed**
MHSW	**Single Wide Manufactured Mobile Home**	**127**	**EF2**	**Complete destruction of unit; debris blown away**
MHSW	Single Wide Manufactured Mobile Home	127	EF2	Undercarriage separates from floor, rolls and tumbles, badly bent
ASB	**Automobile Service Building**	**128**	**EF2**	**Collapse of load-bearing walls**
LSM	Large Shopping Mall	128	EF2	Roof structure uplifted or collapsed
MROB	Mid-Rise Building	129	EF2	Broken curtain wall panel anchors
HROB	High-Rise Building	129	EF2	Broken curtain wall panel anchors
TS	Trees – Softwood	131	EF2	Trees debarked with only stubs of largest branches remaining
IB	Institutional Building	131	EF2	Damaged curtain walls or other wall cladding
FR12	**One and Two-Family Residences**	**132**	**EF2**	**Exterior walls collapsed**
FST	**Free-Standing Towers**	**133**	**EF2**	**Collapsed cell-phone tower**
SSC	Service Station Canopy	133	EF2	Complete destruction of Canopy
LRB	Low-Rise Building	133	EF2	Uplift of lightweight roof structure
MHDW	**Manufacture Home – Double Wide**	**134**	**EF2**	**Complete destruction of unit; debris blows away**
LIRB	Big Box Stores – Large Isolated Retail Building	134	EF2	Uplift and removal of roof structure

Relative Vulnerability of Property and Structure Types *Based on **Damage Level Indicators** Expected Wind Speed and associated EF Scale **to cause destruction of property** http://www.spc.noaa.gov/efscale/ef-scale.html				
***Type**	**Property Type**	**Expected Wind Speed**	**EF Scale**	**Description**
TS	Trees – Softwood	87	EF1	Uprooted
TH	Trees – Hardwood	91	EF1	Uprooted
TS	Trees – Softwood	104	EF1	Trunks Snapped
TH	Trees – Hardwood	110	EF1	Trunks Snapped
SBO	Small Barns and Farm Outbuildings (sheds)	112	EF2	Total destruction of building
FSP	Free Standing Light Poles, Luminary Poles, Flag Poles	118	EF2	Collapsed Pole
MHSW	Single Wide Manufactured Mobile Home	127	EF 2	Complete destruction of unit; debris blown away
TS	Trees – Softwood	131	EF2	Trees debarked with only stubs of largest branches remaining
SSC	Service Station Canopy	133	EF2	Complete destruction of canopy
MHDW	Double Wide Manufactured Mobile Home	134	EF2	Complete destruction of unit; debris blown away
FST	Free Standing Tower	136	EF3	Collapsed micro-wave tower
ETL	Electrical Transmission Line	141	EF3	Collapsed metal truss towers
TH	Trees – Hardwood	143	EF3	Trees debarked with only stubs of largest branches remaining
ES	Elementary School (see additional entry below)	153	EF3	Collapse of load bearing walls
MBS	Metal Building System	155	EF3	Total destruction of building
SPB	Small Professional Building (single story, less than 5,000 sf)	157	EF3	Total destruction of entire building
ASB	Automotive Service Building	157	EF3	Complete Destruction of all or a large section of the building
ASR	Automobile Showroom	157	EF3	Complete Destruction of all or a large section of the building
WHB	Warehouse Buildings (non-metal buildings)	158	EF3	Total destruction of large section of building or entire building
SRB	Small retail building (ex: fast food restaurant)	167	EF4	Total destruction of entire building
SM	Strip Mall	171	EF4	Complete destruction of all or a large section of building

LIRB	"Big Box" Store. Large Isolated Retail Building	173	EF4	Complete Destruction of all or a large section of the building
ES	Elementary Schools	176	EF4	Total destruction of a large section of building or entire building
MAM	Masonry Apartments or Motels	180	EF4	Total destruction of large section of building
ACT	Apartments, Condos, and Townhouses (3 stories or less)	180	EF4	Almost total destruction of top two stories
ACT	Apartments, Condos, and Townhouses (3 stories or less)	>180	EF4	Total Destruction of entire building
LRB	Low Rise Building	188	EF4	Complete Destruction of all or a large section of the building
M	Motels (4 or fewer stories)	190	EF4	Total destruction of entire building
JHSH	Junior or Senior High School	192	EF4	Complete Destruction of all or a large section of the building
FR12	One and Two Family Residences	200	EF4	Destruction of engineered and/or well constructed residence; slab swept clean
LSM	Large Shopping Mall	204	EF5	Complete Destruction of all or a large section of the building
IB	Institutional building (ex: hospitals, university buildings)	210	EF5	Significant damage to building envelope
MROB	Mid-Rise building (5-20 stories)	210	EF5	Permanent structural deformation
HROB	High-Rise > 20 stories	228	EF5	Significant structural deformation

Single-Wide Mobile Homes

Damage Description	**Wind Speed Range (expected in parentheses)**
Threshold of visible damage	51-76 mph (61 mph)
Loss of shingles or partial uplift of one-piece metal roof covering	61-92 mph (74 mph)
Unit slides off block piers but remains upright	72-103 mph (87 mph)
Complete uplift of roof; most walls remain standing	73-112 mph (89 mph)
Unit rolls on its side or upside down; remains essentially intact	84-114 mph (98 mph)
Destruction of roof and walls leaving floor and undercarriage in place	87-123 mph (105 mph)
Unit rolls or vaults; roof and walls separate from floor and undercarriage	96-128 mph (109 mph)
Undercarriage separates from unit; rolls, tumbles and is badly bent	101-136 mph (118 mph)
Complete destruction of unit; debris blown away	110-148 mph (127 mph)

One and Two Family Residences

Damage Description	Wind Speed Range (expected in parentheses)
Threshold of visible damage	53-80 mph (65 mph)
Loss of roof covering material (<20%), gutters, and/or awning; loss of vinyl or metal siding	63-97 mph (79 mph)
Broken glass in doors and windows	79-114 mph (96 mph)
Uplift of roof deck and loss of significant roof covering material (>20%); collapse of chimney; garage doors collapse inward; failure of porch or carport	81-116 mph (97 mph)
Entire house shifts off foundation	103-141 mph (121 mph)
Large sections of roof structure removed, most walls remain standing	104-142 mph (122 mph)
Top floor exterior walls collapsed	113-153 mph (132 mph)
Most interior walls of top story collapsed	128-173 mph (148 mph)
Most walls collapsed in bottom floor, except small interior rooms	127-178 mph (152 mph)
Total destruction of entire building	142-198 mph (170 mph)

School Building (Junior or Senior High School)

Damage Description	Wind Speed Range (expected in parentheses)
Threshold of visible damage	55-83 mph (68 mph)
Loss of roof covering (<20%)	66-99 mph (79 mph)
Broken windows	71-106 mph (87 mph)
Exterior door failures	83-121 mph (101 mph)
Uplift of metal roof decking; significant loss of roofing material (>20%); loss of rooftop HVAC	85-119 mph (101 mph)
Damage to or loss of wall cladding	92-127 mph (108 mph)
Collapse of tall masonry walls at gym, cafeteria, or auditorium	94-136 mph (114 mph)
Uplift or collapse of light steel roof structure	108-148 mph (125 mph)
Collapse of exterior walls in top floor	121-153 mph (139 mph)
Most interior walls of top floor collapsed	133-186 mph (158 mph)
Total destruction of a large section of building envelope	163-224 mph (192 mph)

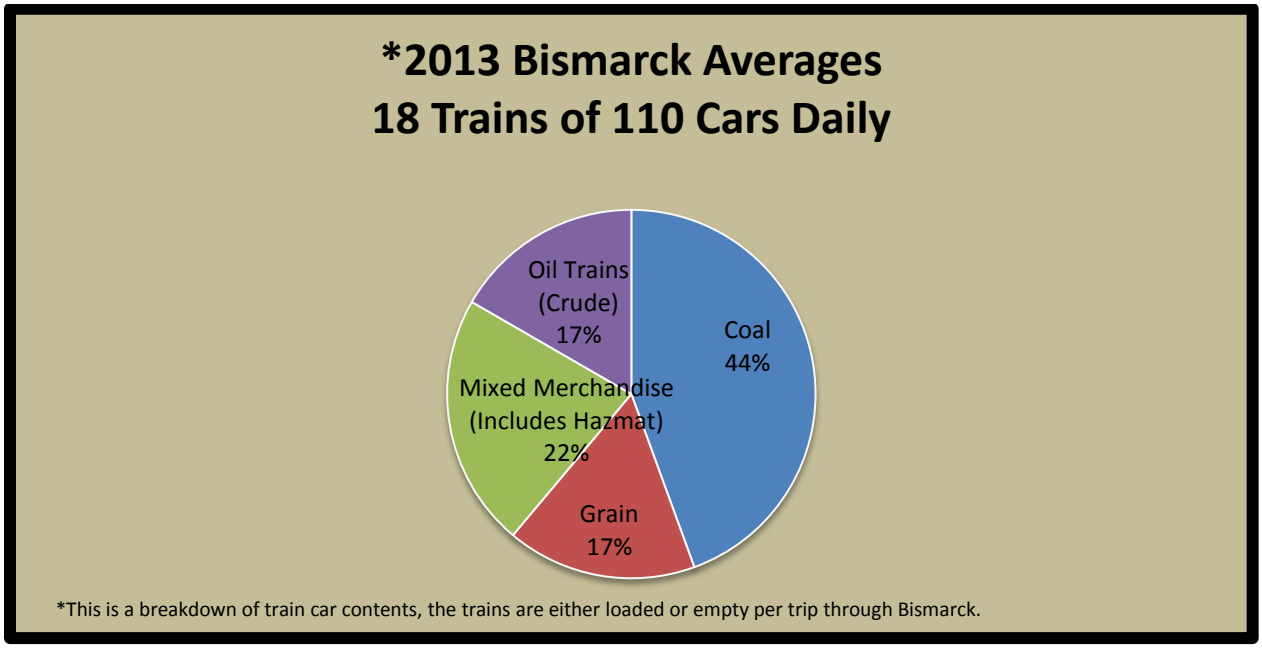
Source: Storm Prediction Center, 2007

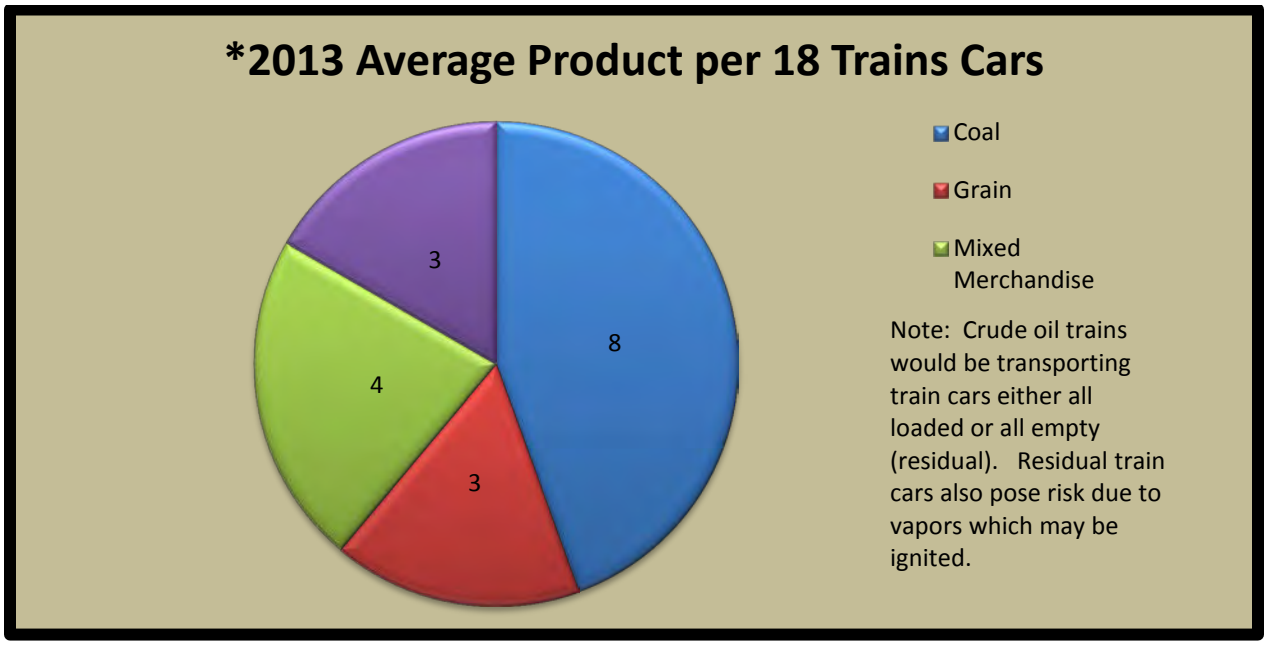
Train Derailment – Hazard Profile

Description

For purposes of this plan, a train derailment is a technological or human caused transportation incident that involves a derailment of one or more engines or train cars. Bismarck has experienced three train derailment incidents since 2002. This hazard profile is intended to illustrate the risk and vulnerabilities relating to both the east/west railroad line (BNSF) as well as the north/south railroad line (DMVW) through Bismarck. The magnitude or impact of a train derailment transportation incident will vary widely depending on the incident location, product involved, and the existence of cascading hazards such as fire, explosion, and/or hazardous materials release. A train derailment transportation incident has potential to be the cause of mass casualties. A mass casualty event can be defined as an incident resulting in a number of deaths and/or injuries that overwhelms local resources and capabilities. Although Bismarck does not have primary responsibility or authority to mitigate or prevent train derailments from occurring, Bismarck has developed this mitigation plan section to better identify vulnerabilities and identify mitigation opportunities or recommendations to share with stakeholders as well as those that might be pursued at the local level.

*Averages identified in the following two tables were provided to Bismarck Emergency Management by a BNSF representative, January 2014. These averages are provided for planning purposes only. Actual number of trains will vary.





Risk

Risk: the potential for damage, loss, or other impacts created by the interaction of hazards with community assets.

Risk Assessment: product or process that collects information and assigns values to risks for the purpose of informing priorities, developing or comparing courses of action, and informing decision making.

THIRA Ratings – **Train Derailment Involving Hazardous Materials Release or Fire**

Frequency	Consequence			
	Human	Economic	Psychological	Government
Possible	Significant	Significant	Significant	Moderate

Previous Occurrences and Causes

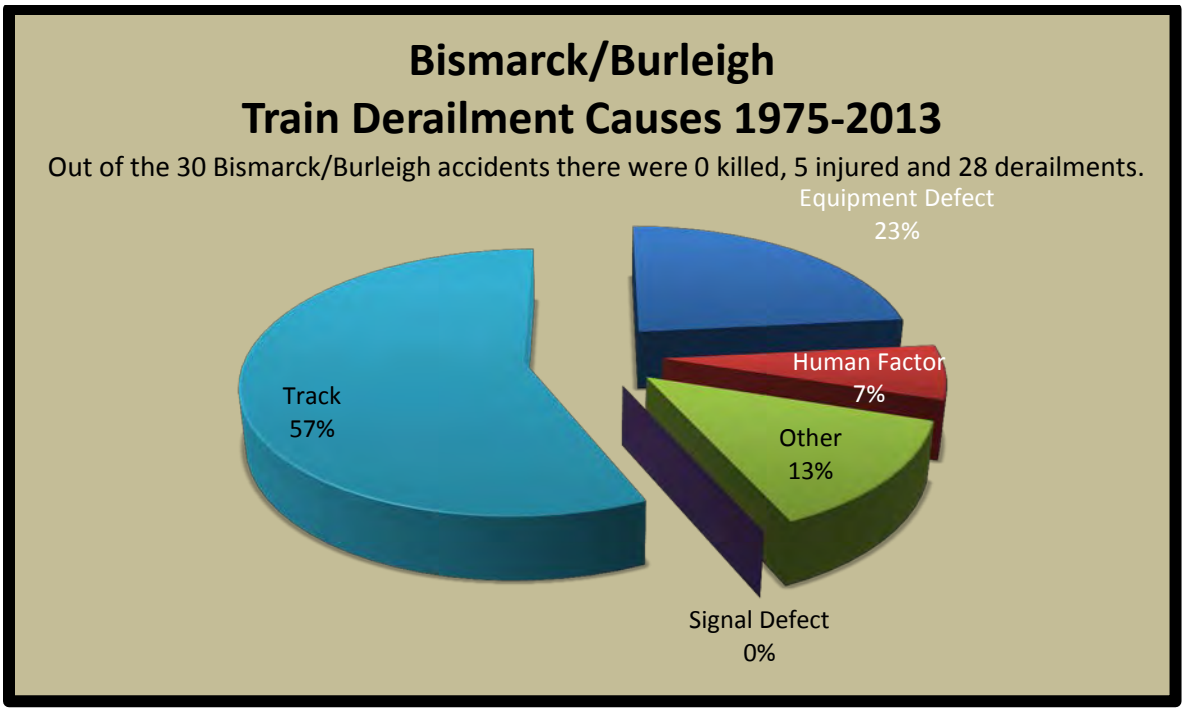
Bismarck/Burleigh Train Derailments
1975-2013 (39 years)

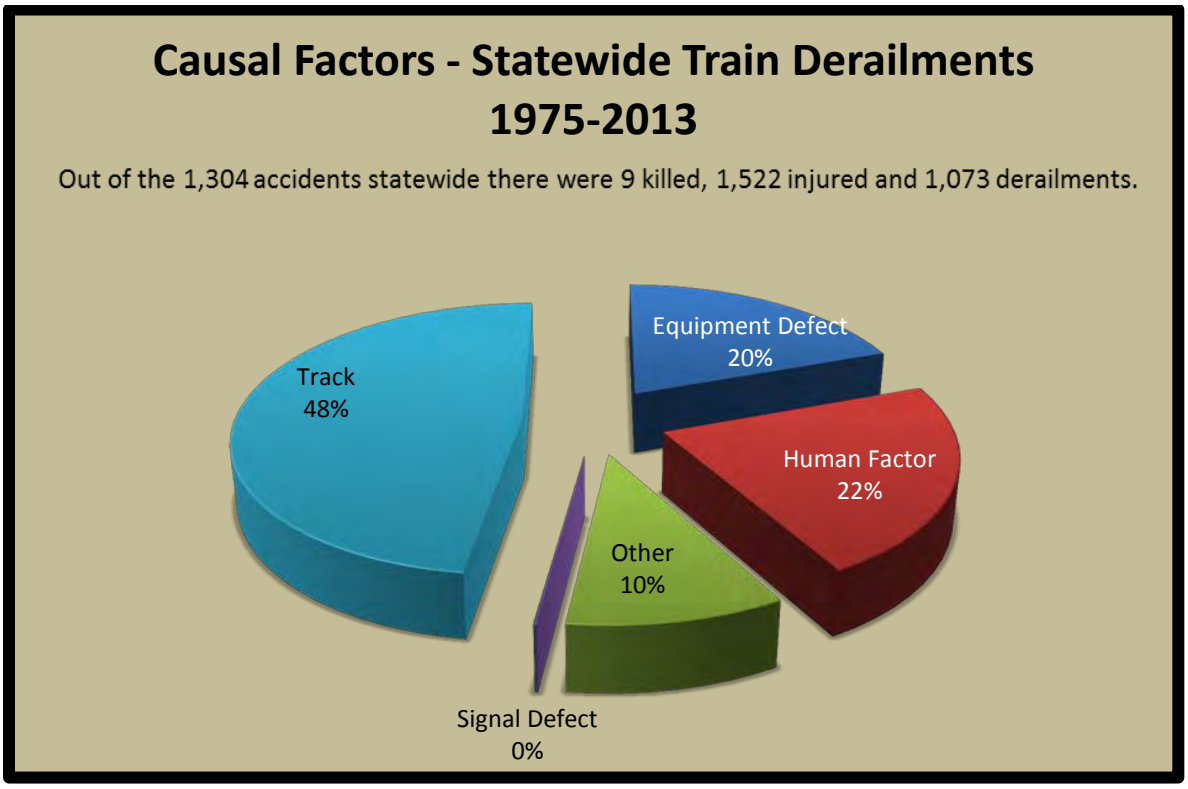
Unless otherwise specified, train derailment statistics within this plan section are derived by Bismarck Emergency Management from the Federal Railroad Administration website:
http://safetydata.fra.dot.gov/OfficeofSafety/Default.aspx

- **Total Number of Train Derailment Incident Reports from 1975-2013 for Burleigh County: 30**
- **Incidents In or Near Bismarck: 10 of 30**
- Incident Average: 1 per 16 months (Burleigh)
- Incident Average: 1 per 4 years (Bismarck)

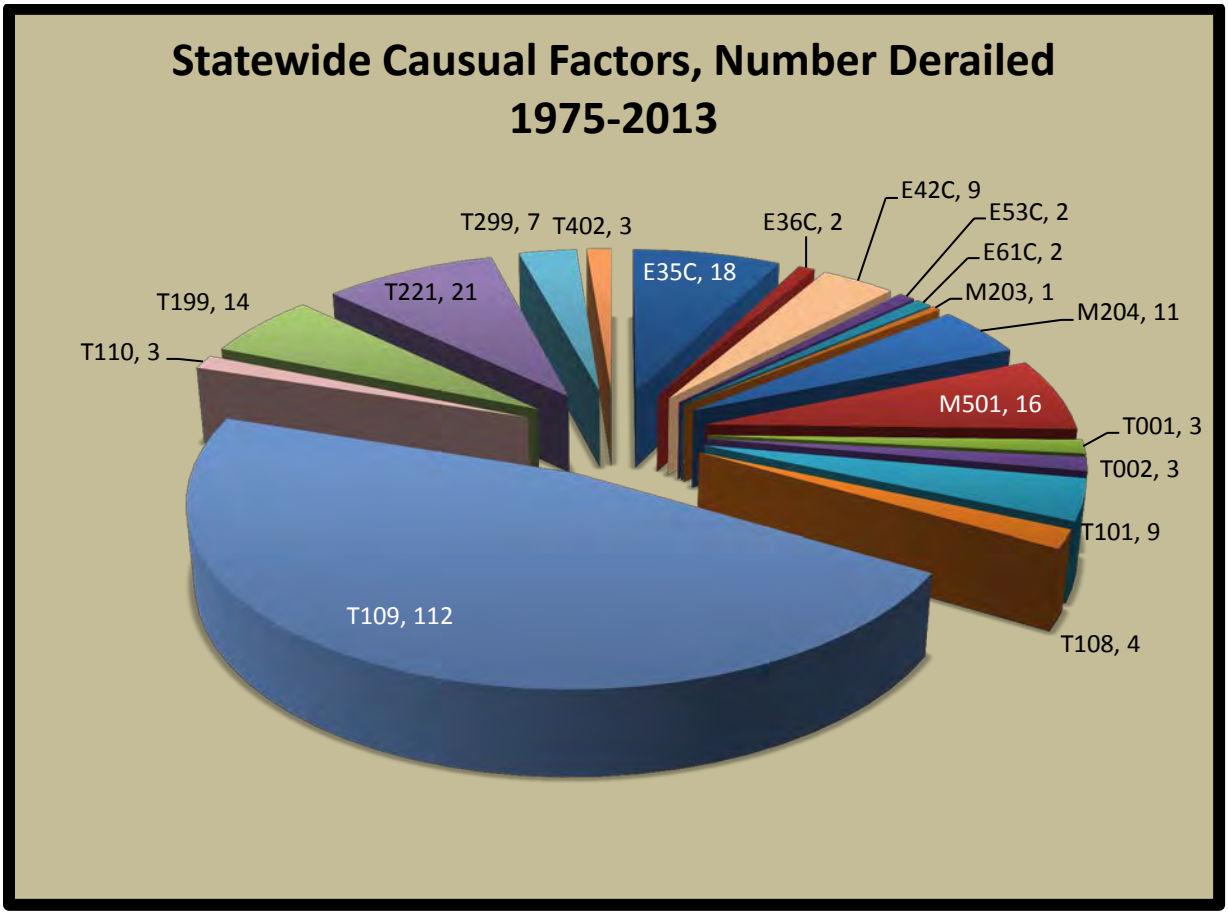
Incident Type Description:

Derailment: 28 of 30
Obstruction: 1 of 30
Explosion – Detonation: 1 of 30



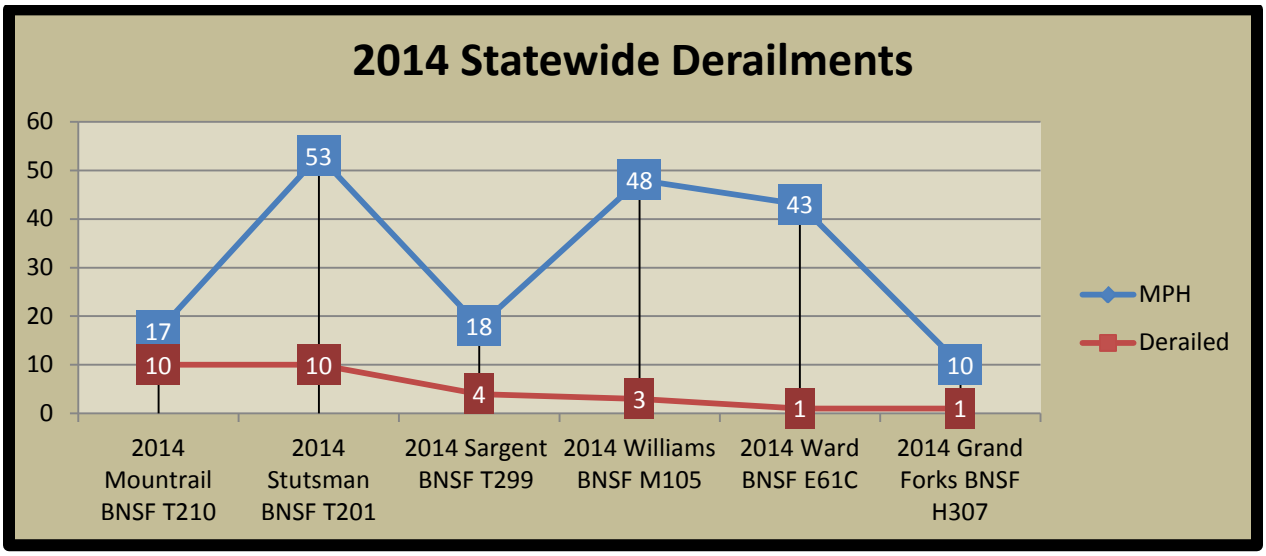


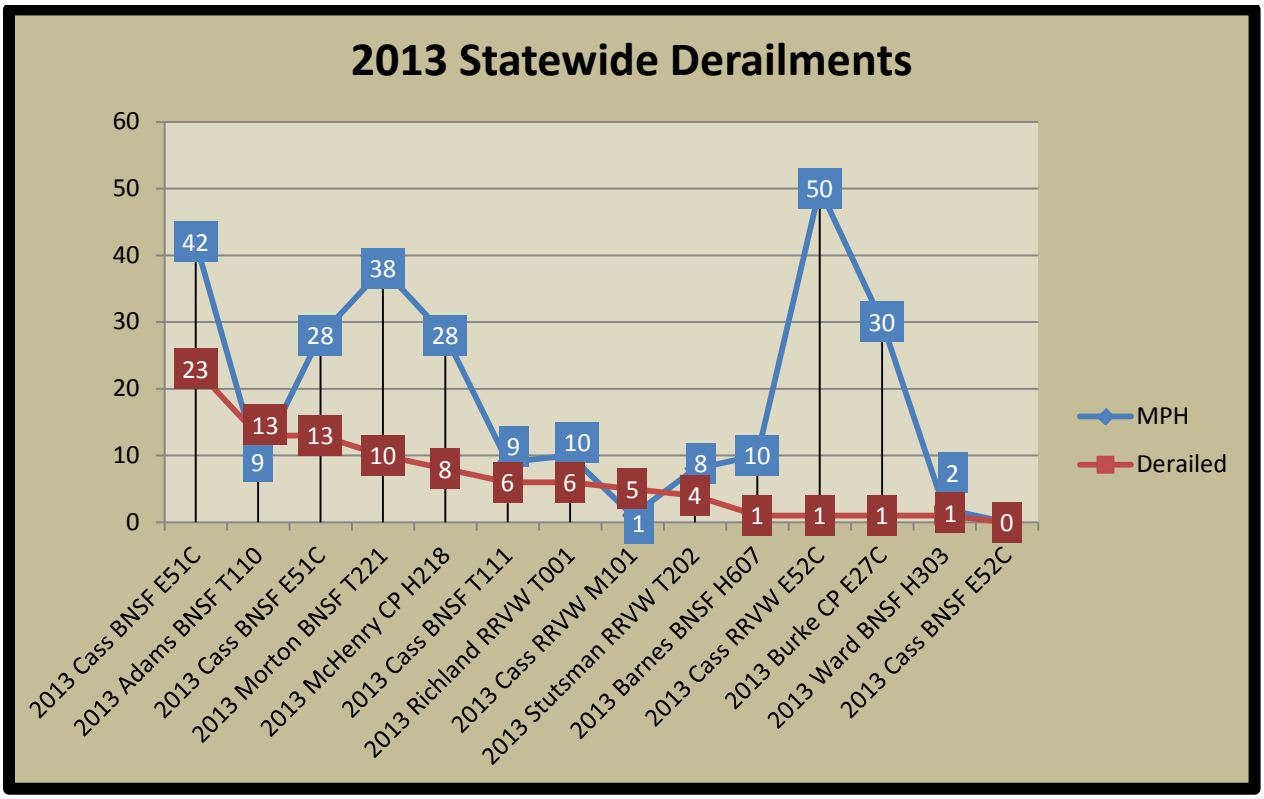
*Traffic accidents at railroad crossings that do not result in a train derailment are not included in the totals.

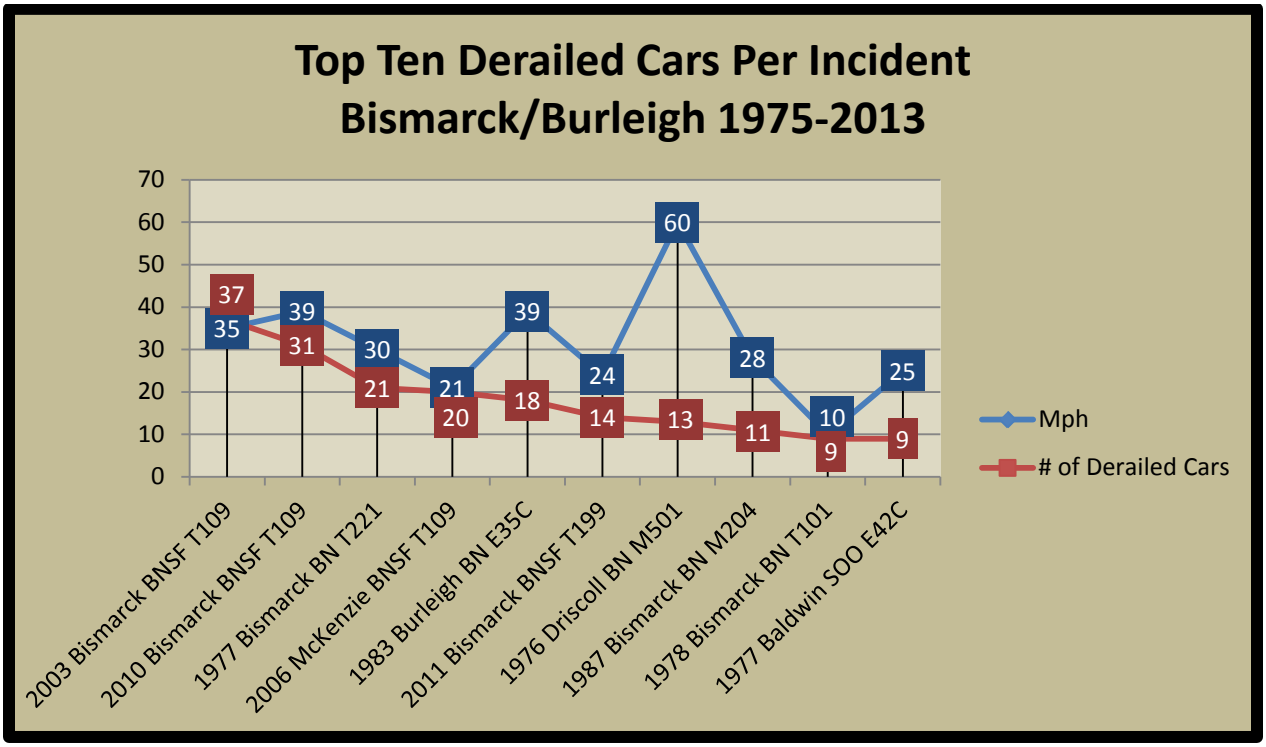


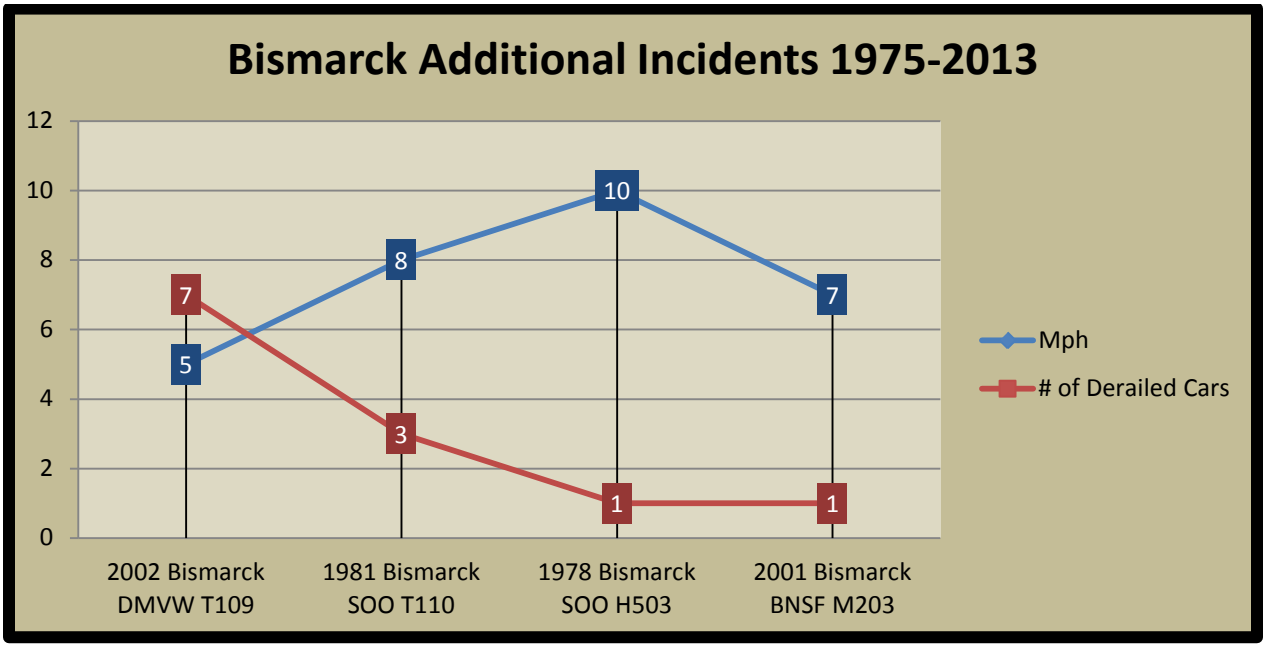
E35C Coupler carrier broken or defective
E36C Coupler shank broken or defective (includes defective alignment control)
E42C Side bearing(s) broken
E53C Journal (roller bearing) failure from overheating
E61C Broken rim
M203 Overloaded car
M204 Improperly loaded car
M501 Interference (other than vandalism) with railroad operations by no railroad employee
T001 Roadbed settled or soft
T002 Washout/rain/slide/flood/snow/ice damage to track
T101 Cross level of track irregular (at joints)
T108 Track alignment irregular (other than buckled/sunkink)
T109 Track alignment irregular (buckled/sunkink)
T110 Wide gage (due to defective or missing crossties)
T199 Other track geometry defects
T221 Broken Rail - Vertical split head
T299 Other rail and joint bar defects (Provide detailed description in narrative)
T402 Flangeway clogged

The following four charts illustrate the number of train cars derailed in relation to the speed. Although the charts demonstrate that fewer cars derail with lower speeds (in general), it's also demonstrated that lower speeds do not always result in fewer cars derailed, and higher speeds do not always result in more cars derailed.






Top Ten Derailed Cars Per Incident
Bismarck/Burleigh 1975-2013
70
60
50
40
30
20
10
0
35
37
39
31
30
21
21
20
39
18
24
14
60
13
28
11
10
9
25
9
2003 Bismarck BNSF T109
2010 Bismarck BNSF T109
1977 Bismarck BN T221
2006 McKenzie BNSF T109
1983 Burleigh BN E35C
2011 Bismarck BNSF T199
1976 Driscoll BN M501
1987 Bismarck BN M204
1978 Bismarck BN T101
1977 Baldwin SOO E42C
Mph
# of Derailed Cars


Bismarck Additional Incidents 1975-2013
12
10
8
6
4
2
0
5
7
8
3
10
1
7
1
2002 Bismarck DMVW T109
1981 Bismarck SOO T110
1978 Bismarck SOO H503
2001 Bismarck BNSF M203
Mph
# of Derailed Cars

Total Derailed Cars Per Incident Report – Top Ten Bismarck/Burleigh 1975-2013					
Derailed Cars +Derailed Loco	**Year**	**Cause**	**Speed Estimated Recorded**	**Location (In or Near)**	**Rail Line**
37	2003	T109 Track alignment irregular (buckled/sunkink)	35-R	Bismarck	BNSF
31	2010	T109 Track alignment irregular (buckled/sunkink)	39 - R	Bismarck	BNSF
19+2	1977	T221 Broken Rail - Vertical split head	30 – R	Bismarck	BN
20	2006	T109 Track alignment irregular (buckled/sunkink)	21 - R	McKenize	BNSF
18	1983	E35C Coupler carrier broken or defective	39 - E	Burleigh	BN
14	2011	T199 Other track geometry defects (Provide detailed description in narrative)	24-R	Bismarck	BNSF
13	1976	M501 Interference (other than vandalism) with railroad operations by non-railroad employee	60-E	Driscoll	BN
11	1987	M204 Improperly loaded car	28-E	Bismarck	BN
9	1977	E42C Side bearing(s) broken	25-R	Baldwin	SOO
9	1978	T101 Cross level of track irregular (at joints)	10-E	Bismarck	BN
Bismarck (In or Near) Additional Incidents					
7	2002	T109 Track alignment irregular (buckled/sunkink)	5-E	Bismarck	DMVW
3	1981	T110 Wide gage (due to defective or missing crossties)	8-R	Bismarck	SOO
1	1978	H503 Buffing or slack action excessive, train handling	10-E	Bismarck	SOO
1	2001	M203 Overloaded car	7-R	Bismarck	BNSF

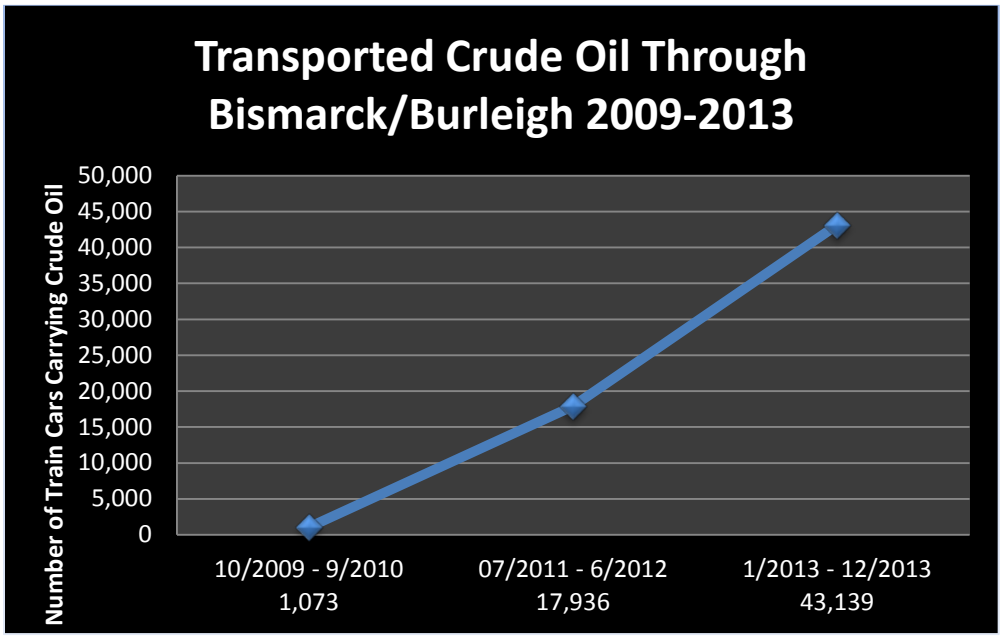
Deaths, Injuries, and Evacuations per Train Incident Reports Bismarck/Burleigh 1975-2013					
# of Deaths	**# of Injuries**	**People Evacuated**	**Year**	**Location**	**Railroad**
0	2	0	1995	Sterling	BN
0	1	0	1987	Regan	BN
0	1	0	1977	Bismarck	BN
0	1	0	1976	Driscoll	BN
No deaths or evacuations reported for Bismarck/Burleigh Incidents from 1975-2013.					

Two Incident Reports Involving Hazardous Materials 1975-2013					
# of Hazmat Cars Derailed Or Damaged	**Total # of Hazmat Cars**	**Total # of Cars**	**Incident Year**	**Location**	**Railroad**
0	3	81	1976	Driscoll	BN
0	1	17	1978	Bismarck	SOO

Product Involved – Train Derailments				
Incident Date	**Railroad**	**Location**	**Description**	**Product**
March 18, 2011	BNSF	East Main – near 100 block of South Airport Road. Blocked 26th street crossing	14 coal cars derailed – 13 destroyed. The train blocked several crossings including 26th Street and Airport Road.	Coal Cars - 14
July 10, 2010	BNSF	Near 93rd Street	Rail cars filled with coal derailed and were lying on the bank of the Apple Creek east of Bismarck.	Coal Cars - 30
July 5, 2003	BNSF	Near State Penitentiary in Bismarck	Coal was spilled against the trestle on the Expressway Bridge. No cars hit the bridge.	Coal Cars – 37 100 ton of coal each
September 5, 2002	DMVW	Intersection of Rosser and North 35th Street	Dakota Missouri Valley & Western Railroad authorities said they believe work on the tracks and 90-degree heat caused the rails to shift outward about four feet and the train to derail at 3:30 p.m. (source: Bismarck Tribune)	Fly Ash 7 Cars

Number of Train Cars Carrying Crude Oil:

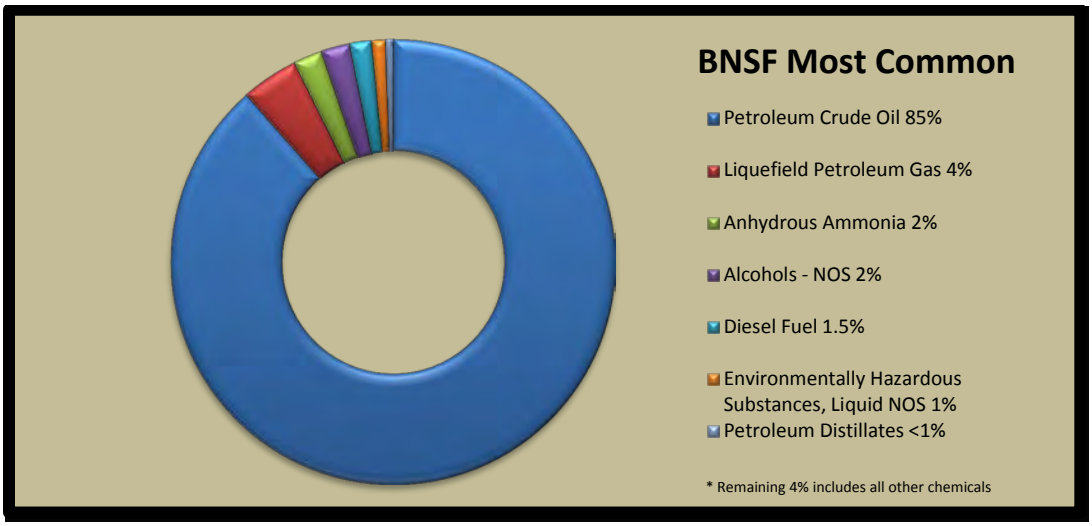
From Oct 2009 thru Sept 2010: 1,073
From July 2011 thru June 2012: 17,936 (this is the number that is contained in the HazMat flow study funded by the LEPC)
Year 2013 (Jan-Dec): 43,139



Source: Hazmat Flow Information provided by BNSF.

Most Common Hazardous Materials in 2013 Transport by BNSF (by Loaded Car Count):

- Petroleum Crude Oil – 85%
- Liquefied Petroleum Gas – 4%
- Anhydrous Ammonia – 2%
- Alcohols – NOS – 2%
- Diesel Fuel – 1.5%
- Environmentally Hazardous Substances, Liquid NOS – 1%
- Petroleum Distillates, NOS - <1%



Potential Magnitude

Actual Incidents may be used to estimate the potential magnitude of a significant train derailment incident involving fire, explosion, and/or hazardous materials.

Derailment of Canadian Pacific Railway Freight Train 292-16 and Subsequent Release of Anhydrous Ammonia.	
Minot, North Dakota January 18, 2002	NTSB Number: RAR-04-01 NTIS Number: PB2004-916301. Adopted March 9, 2004

Executive Summary:
At approximately 1:37 a.m. on January 18, 2002, eastbound Canadian Pacific Railway freight train 292-16, traveling about 41 mph, derailed 31 of its 112 cars about 1/2 mile west of the city limits of Minot, North Dakota. Five tank cars carrying anhydrous ammonia, a liquefied compressed gas, catastrophically ruptured, and a vapor plume covered the derailment site and surrounding area. The conductor and engineer were taken to the hospital for observation after they complained of breathing difficulties. About 11,600 people occupied the area affected by the vapor plume. One resident was fatally injured, and 60 to 65 residents of the neighborhood nearest the derailment site were rescued. As a result of the accident, 11 people sustained serious injuries, and 322 people, including the 2 train crewmembers, sustained minor injuries. Damages exceeded $2 million, and more than $8 million has been spent for environmental remediation.

Probable Cause
The National Transportation Safety Board determines that the probable cause of the derailment of Canadian Pacific Railway train 292-16 was an ineffective Canadian Pacific Railway inspection and maintenance program that did not identify and replace cracked joint bars before they completely fractured and led to the breaking of the rail at the joint. Contributing to the severity of the accident was the catastrophic failure of five tank cars and the instantaneous release of about 146,700 gallons of anhydrous ammonia.
The safety issues identified in this accident were as follows:

- Canadian Pacific Railway's programs and practices for the inspection and maintenance of joint bars in its continuous welded rail;
- The Federal Railroad Administration's oversight of continuous welded rail maintenance programs;
- Tank car crashworthiness, specifically the adequacy of non-normalized steels to resist tank fracture propagation.

The analysis also addresses the appropriateness of using shelter-in-place to protect the public from the release of hazardous material.

http://www.ntsb.gov/investigations/summary/RAR0401.html

Casselton Train Derailment – Preliminary Report	
Near Casselton, North Dakota December 30, 2013	**PRELIMINARY REPORT** (January 13, 2014) **RAILROAD DCA14MR004** *The information in this report is preliminary and will be supplemented or corrected during the course of the investigation.*

On December 30, 2013, about 1411 central standard time, a westbound BNSF Railway (BNSF) grain train, G-RYLRGT9-26A, derailed 13 cars at milepost 28.5 near Casselton, North Dakota. The grain train, operating on main track 1, consisted of two head-end locomotives, one rear distributed power locomotive, and 112 cars. One of the derailed cars, the 45th car from the head end, fouled main track 2. An eastbound BNSF petroleum crude oil unit train, U-FYNHAY4-05, operating on main track 2 collided with the derailed car that was fouling main track 2 and derailed the head-end locomotives and the first 21 cars of the train. The petroleum crude oil unit train consisted of two head-end locomotives, one rear distributed power locomotive, and 106 cars.
Local emergency officials coordinated a voluntary evacuation of about 1,400 people from Casselton. No injuries to the public were reported.

The grain train was traveling about 28 mph when it went into an emergency brake application. The petroleum crude oil unit train was traveling about 43 mph when the train crew initiated an emergency brake application. The train was traveling about 42 mph when the collision occurred. Damage was estimated at $6.1 million**.** The accident occurred in daylight with weather conditions of overcast skies, a temperature of -1° F, and wind from the north at 7 mph.
National Transportation Safety Board (NTSB) investigators have completed the on-scene work near Casselton. The investigation will continue at the NTSB headquarters in Washington, D.C. Preliminary results of the investigation include the following:
• Twenty-one cars from the petroleum crude oil unit train derailed along with the two lead locomotives. Twenty of the tank cars were carrying petroleum crude oil; one was a hopper car carrying sand.
• Of the 20 tank cars that derailed, 18 were breached (punctured).
• Initial estimates are that more than 400,000 gallons of crude oil was released.
• From January 1–3, 2014, investigators interviewed the train crews and first responders. Interview transcripts will be included in the public docket upon release.
• A broken axle and two wheels were shipped to the NTSB materials laboratory in Washington, D.C., for further evaluation and analysis.
• Locomotive event and video recorders were also sent to the NTSB materials laboratory in Washington, D.C., for further analysis.

http://www.ntsb.gov/doclib/reports/2014/Casselton_ND_Preliminary.pdf

Lac-Mégantic runaway train and derailment investigation summary

The accident

On the evening of July 5, 2013, at about 10:50 p.m., a Montreal, Maine & Atlantic Railway (MMA) train arrived at Nantes, Quebec, carrying 7.7 million liters of petroleum crude oil in 72 Class 111 tank cars. Originating in New Town, North Dakota, these were bound for Saint John, New Brunswick.

In keeping with the railway's practice, after arriving in Nantes, the locomotive engineer (engineer) parked the train on a descending grade on the main track. A replacement engineer was scheduled to continue the trip east in the morning.

The engineer applied hand brakes on all five locomotives and two other cars, and shut down all but the lead locomotive. Railway rules require hand brakes alone be capable of holding a train, and this must be verified by a test. That night, however, the locomotive air brakes were left on during the test, meaning the train was being held by a combination of hand brakes and air brakes. This gave the false impression that the hand brakes alone would hold the train.

The engineer then contacted the rail traffic controller in Farnham, Quebec, to advise that the train was secure. Next, the engineer contacted the rail traffic controller in Bangor, Maine, who controls movements for the crews east of Lac-Mégantic. During this conversation, the engineer indicated that the lead locomotive had experienced mechanical difficulties throughout the trip, and that excessive black and white smoke was coming from its smoke stack. Because they expected the smoke to settle, it was agreed to leave the train as it was and deal with the situation the next morning.

Shortly after the engineer left, the Nantes Fire Department responded to a 911 call reporting a fire on the train. After shutting off the locomotive's fuel supply, the firefighters moved the electrical breakers inside the cab to the off position, in keeping with railway instructions. They then met with an MMA employee, a track foreman who had been dispatched to the scene but who did not have a locomotive operations background.

Once the fire was extinguished, the firefighters and the track foreman discussed the train's condition with the rail traffic controller in Farnham, and departed soon afterward. With all the locomotives shut down, the air compressor no longer supplied air to the air brake system. As air leaked from the brake system, the main air reservoirs were slowly depleted, gradually reducing the effectiveness of the locomotive air brakes. Just before 1 a.m., the air pressure had dropped to a point at which the combination of locomotive air brakes and hand brakes could no longer hold the train, and it began to roll downhill toward Lac-Mégantic, just over seven miles away.

As it moved down the grade, the train picked up speed, reaching a top speed of 65 mph. It derailed near the center of the town at about 1:15 a.m.

Aftermath and emergency response

Almost all of the 63 derailed tank cars were damaged, and many had large breaches. About six million liters of petroleum crude oil was quickly released. The fire began almost immediately, and the ensuing blaze and explosions left 47 people dead. Another 2000 people were forced from their homes, and much of the downtown core was destroyed.

The pileup of tank cars, combined with the large volume of burning petroleum crude oil, made the firefighters' job extremely difficult. Despite the challenges of a large emergency, the response was well coordinated, and the fire departments effectively protected the site and ensured public safety after the derailment.

http://www.tsb.gc.ca/eng/rapports-reports/rail/2013/r13d0054/r13d0054-r-es.asp

Vulnerability Assessment

Vulnerability: Characteristics of community assets that make them susceptible to damage from a given hazard.

Vulnerabilities identified within the table are within ½ mile of the railroad. The properties and populations noted in the table are representative of the significant vulnerabilities within ½ mile radius of the railroad lines. Due to the extensive number of properties within a ½ mile, not all are listed.
Maps illustrating the ½ mile radius from the railroad lines follow the vulnerability table.

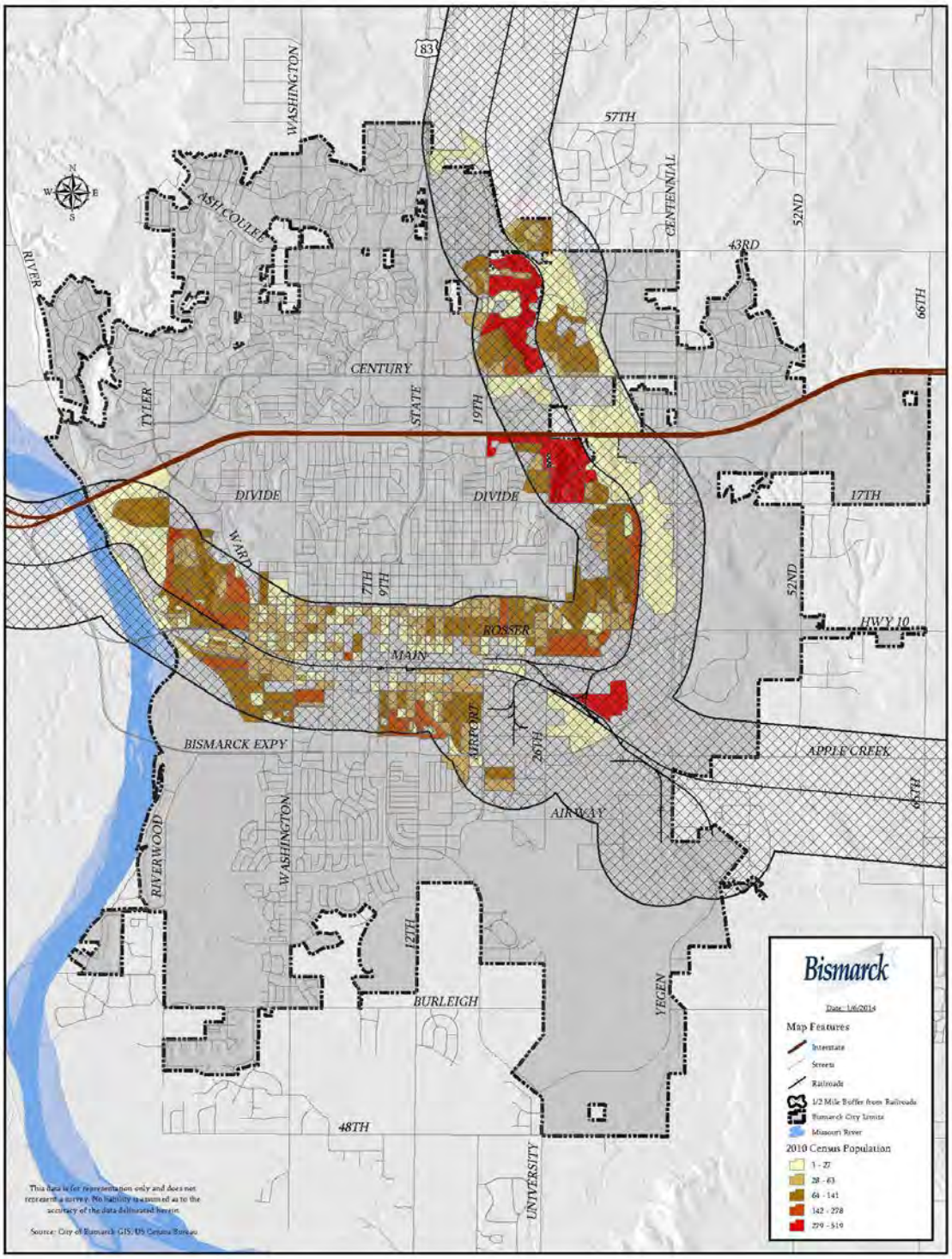
Scenario	**Train Derailment** **Fire/HazMat – Significant Event**
Probability	Possible
Speed of Onset	No Notice Event
Geographic Area	See maps included, this section.
Death / Injury 1. Primary Causes A. Highest vulnerability	 1. Fire 2. Explosion/projectiles 3. Inhalation Hazards A. Those within close proximity to the railroad lines (1/4 mile) B. Those within close proximity to the railroad lines (1/2 mile) C. Those downwind of hazmat release.
Mass Casualty Incident	Yes, potentially significant
Property Losses (points of vulnerability – high priority)	1. All Structures within ¼ to ½ mile radius of incident.
Environmental	1. Storm Water System – Hazardous Materials 2. Air, Water, Soil contamination depending on material involved 3. Missouri River 4. Hay Creek
COG/COOP	1. Public Health – Bismarck/Burleigh 2. City/County Building 3. Water Treatment Plant 4. Public Works and proximity of Praxair

Scenario	Train Derailment Fire/HazMat – Significant Event	
Critical Facilities	1. Public Health 2. City/County Office Building 3. Fraine Barracks – DES, NDNG 4. Water Treatment Plant 5. Waste Water Treatment Plant – via spill, drainage system 6. Metro Area Ambulance – South 7. Sanford Health 8. Sanford Health Powerhouse 9. St. Alexius Medical Center 10. St. Alexius Purchasing / Warehouse 11. Burleigh County Courthouse 12. Burleigh County Social Services 13. Public Works Department	14. ND State Penitentiary 15. US Postal Processing and Distribution 16. Post Office 17. ND State Lab 18. ND Department of Health Warehouse 19. MDU – Airport Road 20. MDU Operations – 4th Street 21. Civic Center 22. Bismarck Police Department 23. Metro Area Ambulance – North 24. Metro Area Ambulance - South 25. Bank of North Dakota
Critical Infrastructure	1. Western Area Power Substation 2. Clear Channel Radio 3. KFYR 4. BisMan Transit 5. Missouri River Train Bridge 6. Railroad Bridge over Main Avenue 7. Railroad Bridge over Washington Street 8. Main Avenue Bridge over Washington Street	9. Railroad Bridge over 7th Street 10. Railroad Bridget over 9th Street 11. Railroad Bridge over Bismarck Expressway 12. Railroad over Hay Creek (3 locations) 13. I-94 Bridge over Railroad
Schools	1. Bismarck State College 2. Roosevelt Elementary 3. Cathedral Elementary 4. Riverside Elementary 5. St. Mary's Elementary 6. Emmanuel Christian School 7. Rita Murphy Elementary 8. Stepping Stones Daycare 9. Shiloh Christian School 10. Child's Hope Learning Center	11. Discovery Daycare 12. Dakota Boys Ranch 13. Kidz First Daycare 14. Angel Academy 15. First Presbyterian Church Daycare 16. Highland Acres Elementary 17. Saxvik Elementary 18. South Central High School 19. Robert Miller Elementary
High Risk Facilities (chemical)	1. Water Treatment Plant 2. LaFarge 3. Ferrell Gas 4. Praxair (9th Street) 5. Praxair (near Public Works)	

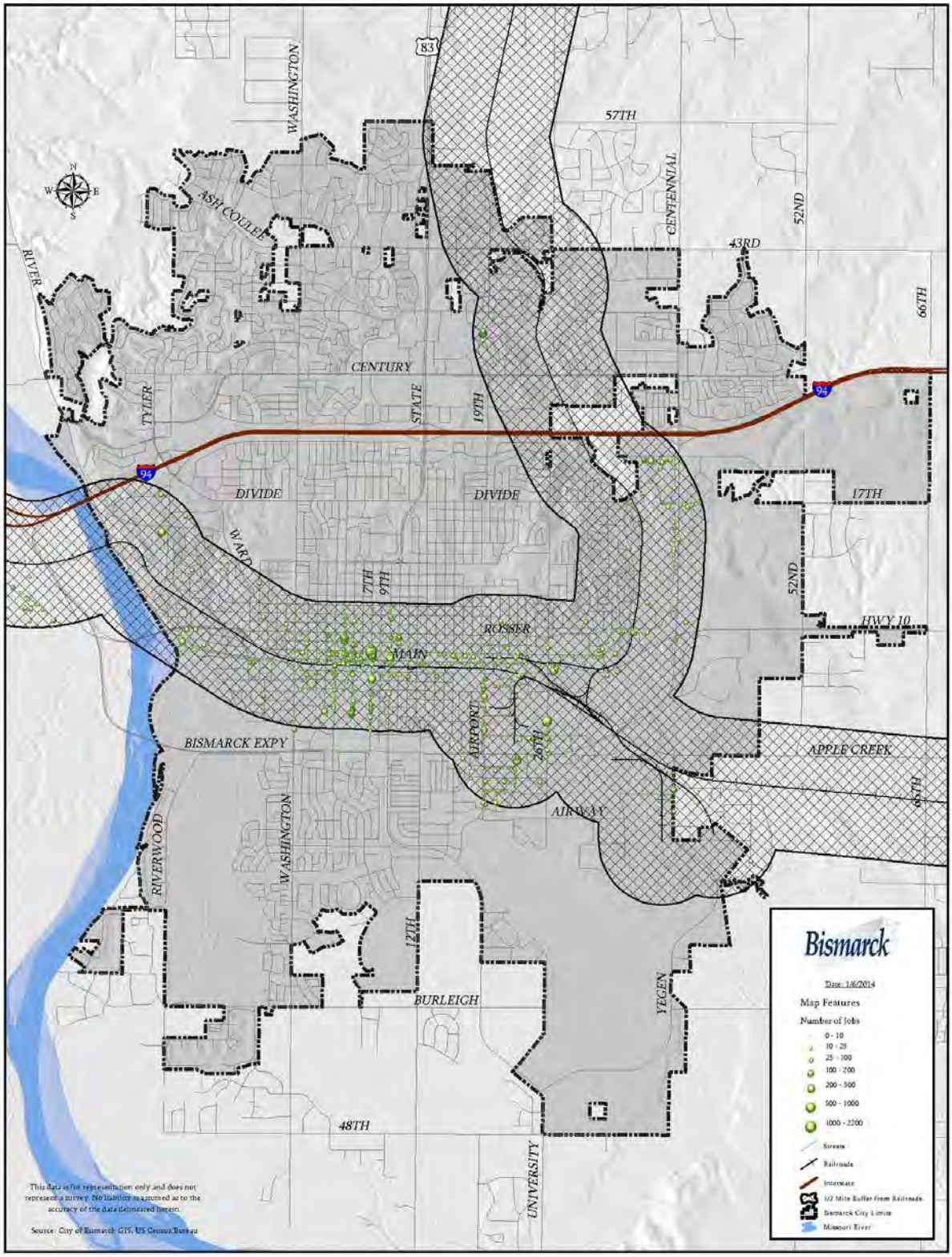
Scenario	Train Derailment Fire/HazMat – Significant Event
Specific Populations: Public Assembly, Vulnerable / Special Populations	1. Edgewood Vista 2. St. Vincent's Care Center 3. Marillac Manor 4. Dakota Boys Ranch 5. Elks Pool 6. Custer Home 7. Front Street Plaza 8. Patterson Place 9. The Terrace (Assisted Living) 10. Radisson Inn 11. Crescent Manor 12. Bismarck Community Bowl 13. Kirkwood Mall 14. Bismarck Transition Center 15. ND State Penitentiary 16. Front Street Plaza
Economy (community wide)	Significant impact
Other	

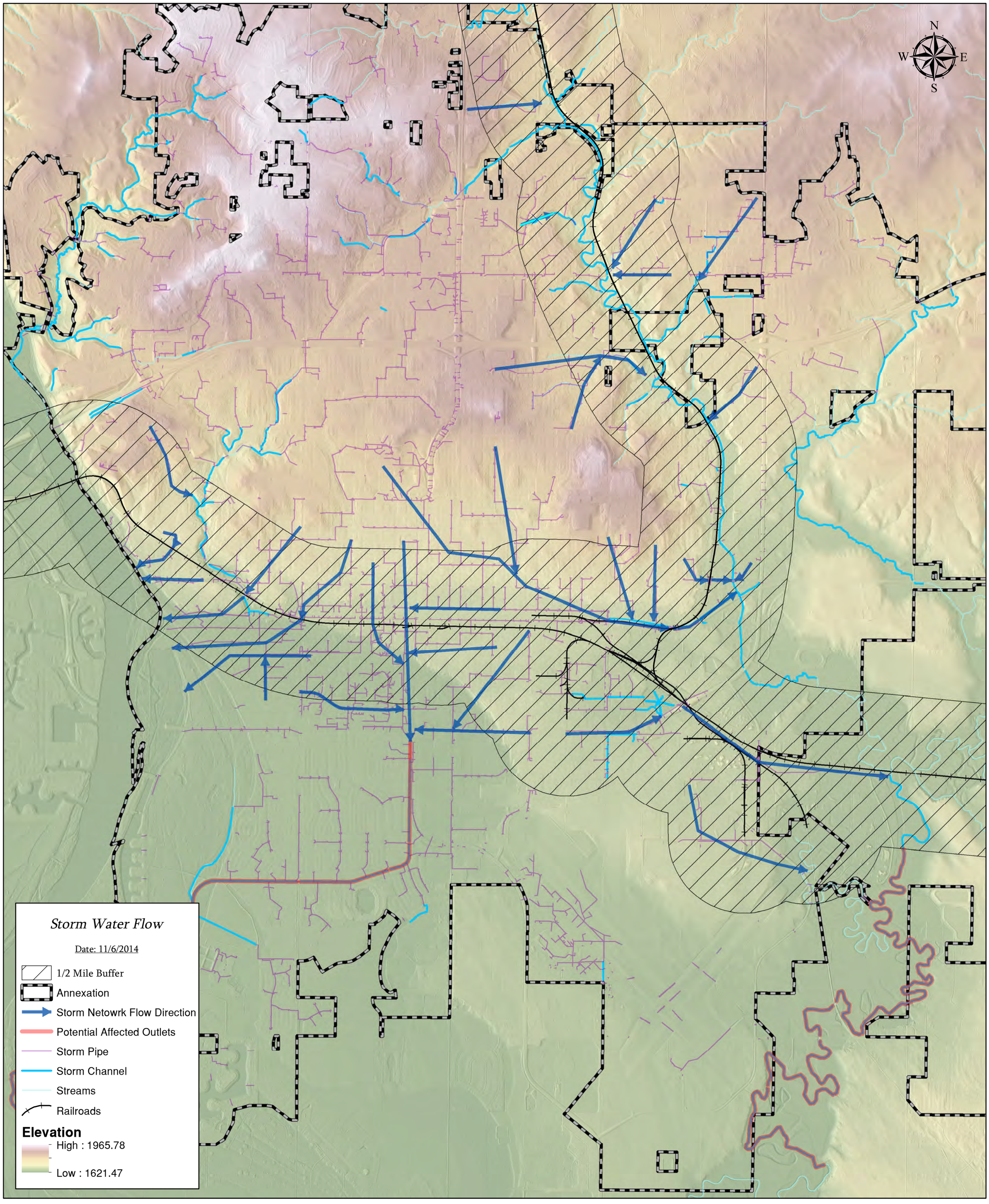
2011 Population and Property Estimates

- Total City of Bismarck population within ½ mile: 17,796
- Total Burleigh County Population within ½ mile of railroad: 25,125
- Buildings within ½ mile (Bismarck): 9,384



Year 2011 Employment Estimates 22,068 jobs within ½ mile radius of railroad.

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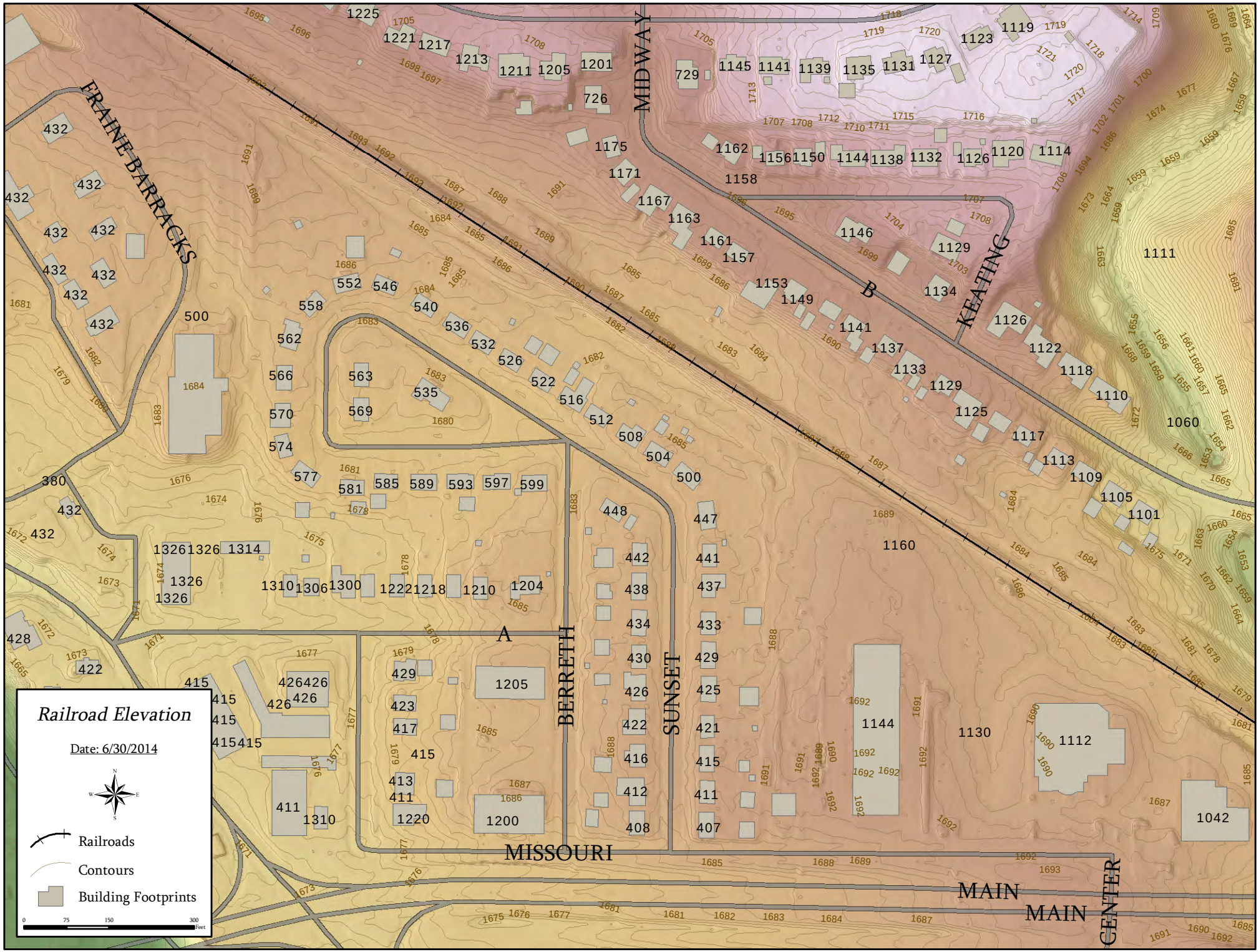
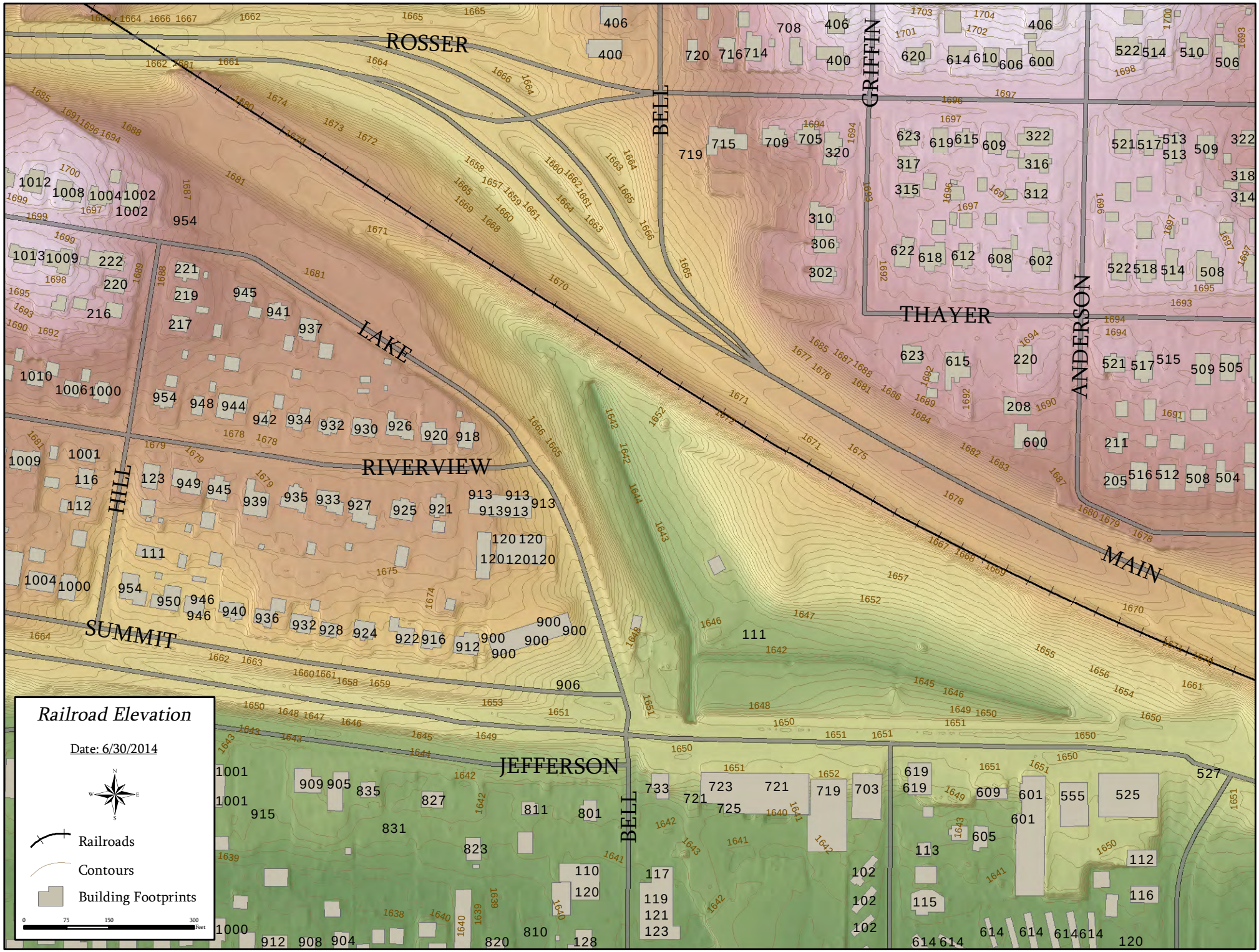
Storm Water Flow
Date: 11/6/2014
1/2 Mile Buffer
Annexation
Storm Netowrk Flow Direction
Potential Affected Outlets
Storm Pipe
Storm Channel
Streams
Railroads
Elevation
High : 1965.78
Low : 1621.47


Railroad Elevation
Date: 6/30/2014
Railroads
Contours
Building Footprints
FRAINE BARRACKS
MIDWAY
KEATING
B
A
BERRETH
SUNSET
MISSOURI
MAIN
MAIN
CENTER


ROSSER
BELL
GRIFFIN
THAYER
ANDERSON
LAKE
RIVERVIEW
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SUMMIT
MAIN
JEFFERSON
BELL
Railroad Elevation
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Railroads
Contours
Building Footprints
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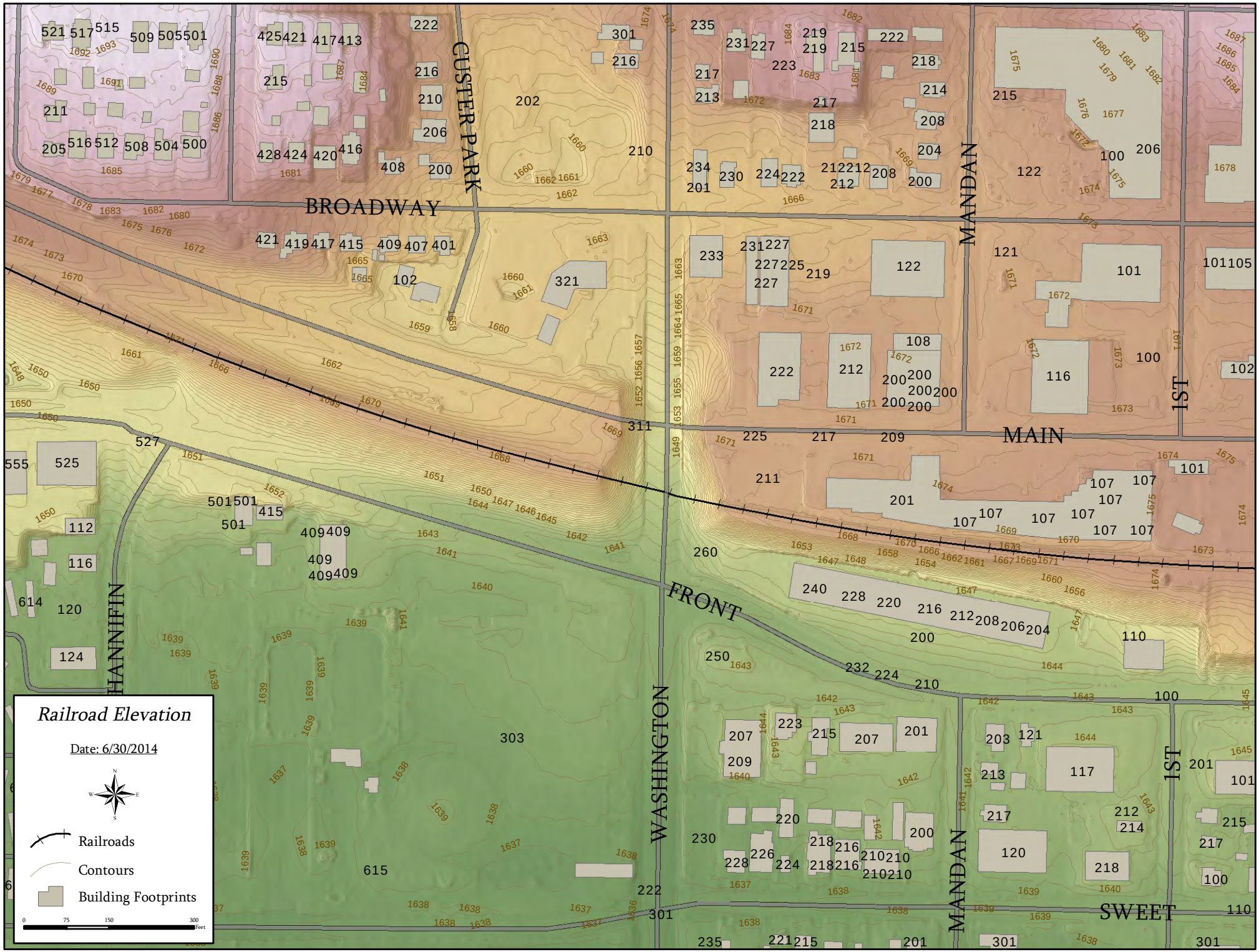
Railroad Elevation
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Railroads
Contours
Building Footprints
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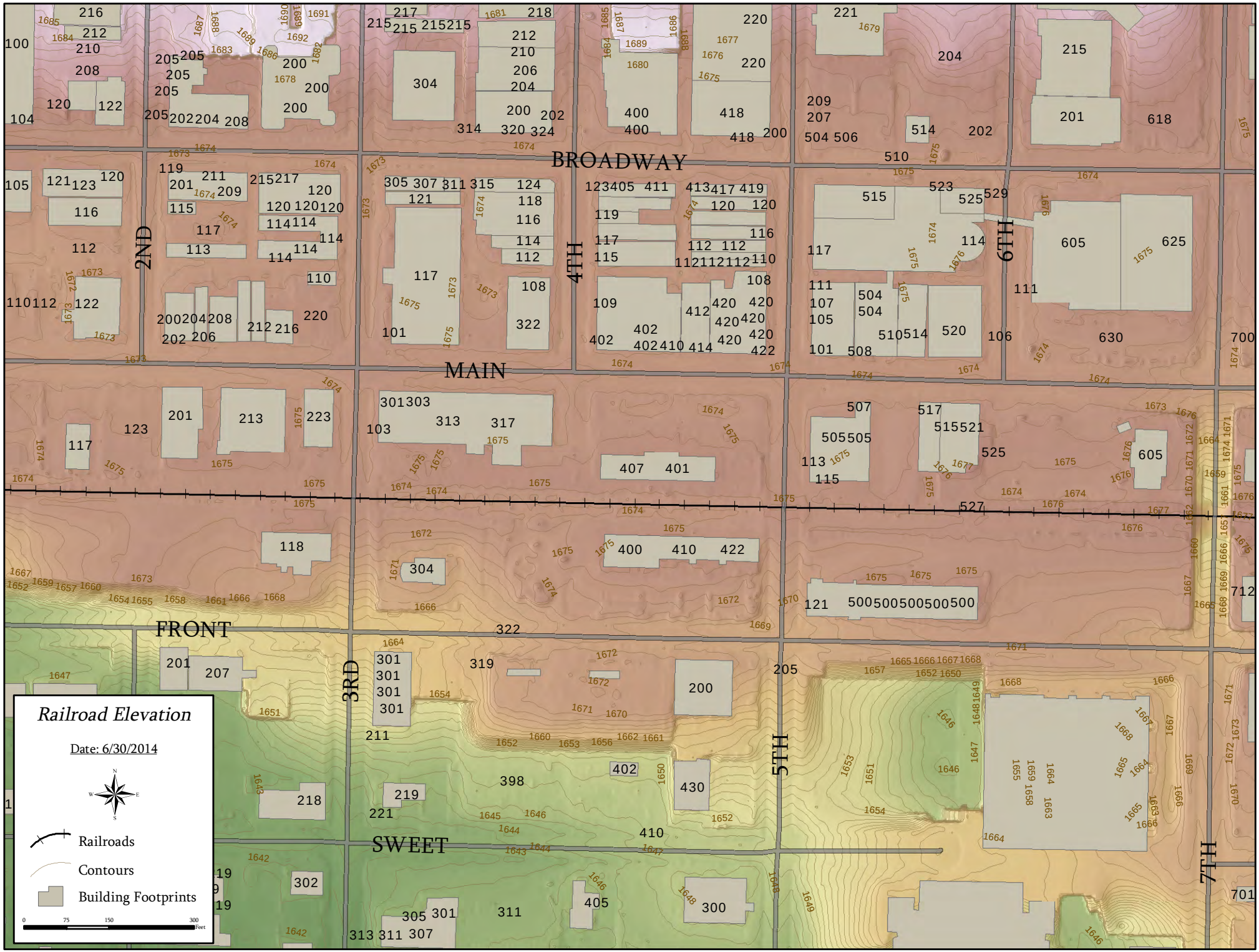
BROADWAY
CUSTER PARK
MANDAN
MAIN
1ST
FRONT
WASHINGTON
HANNIFIN
SWEET


Railroad Elevation
Date: 6/30/2014
Railroads
Contours
Building Footprints
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3RD
4TH
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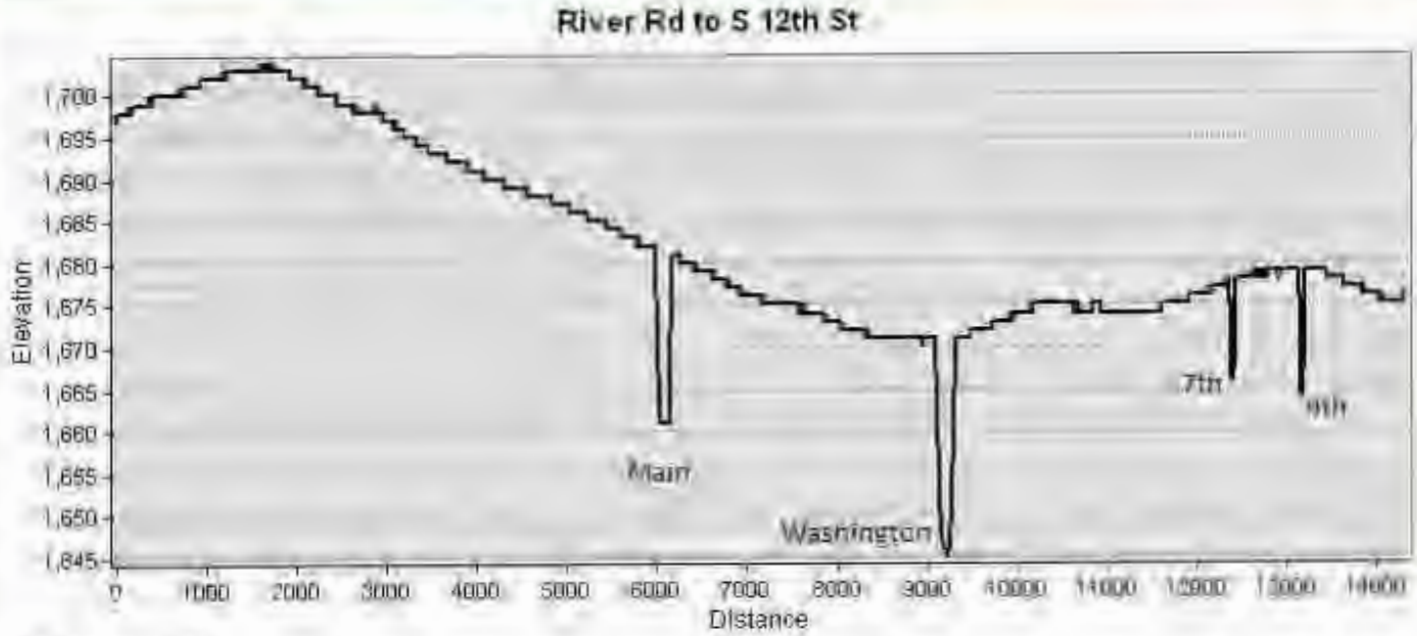
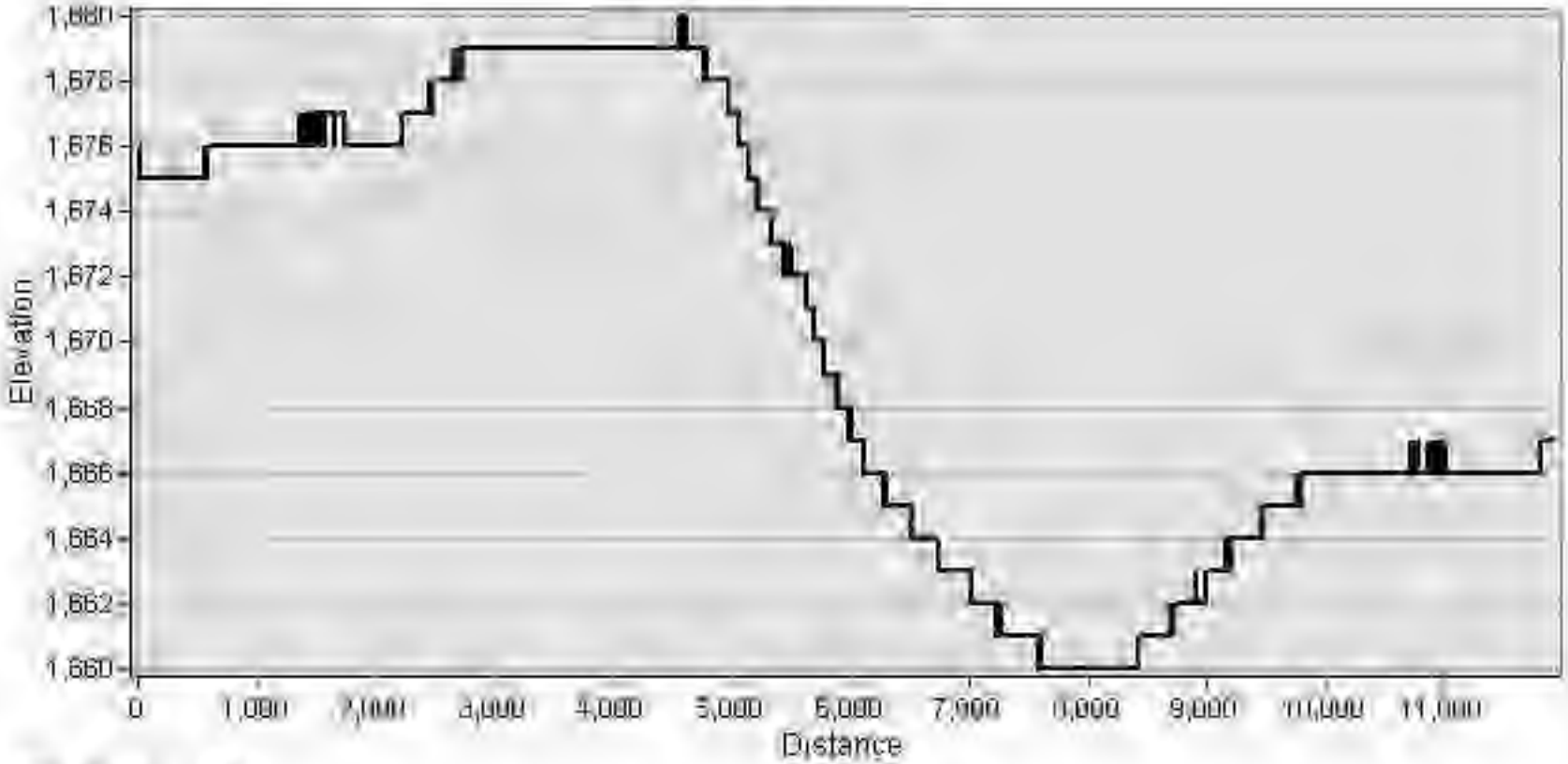
7TH

Profile Graph Title

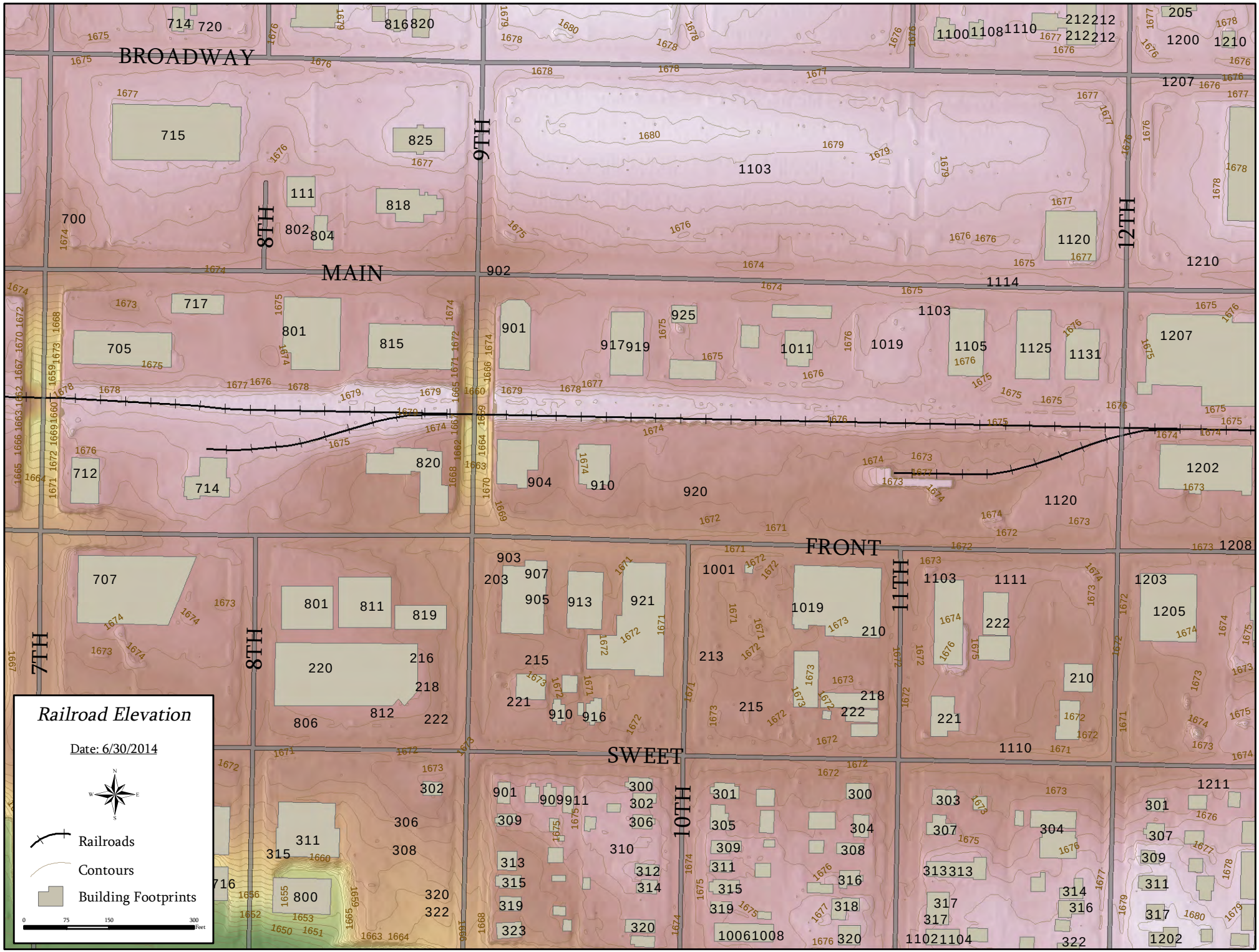


Profile Graph Subtitle

Railroad Elevation



19th St to Yegen Rd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Railroad Elevation
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Railroads
Contours
Building Footprints
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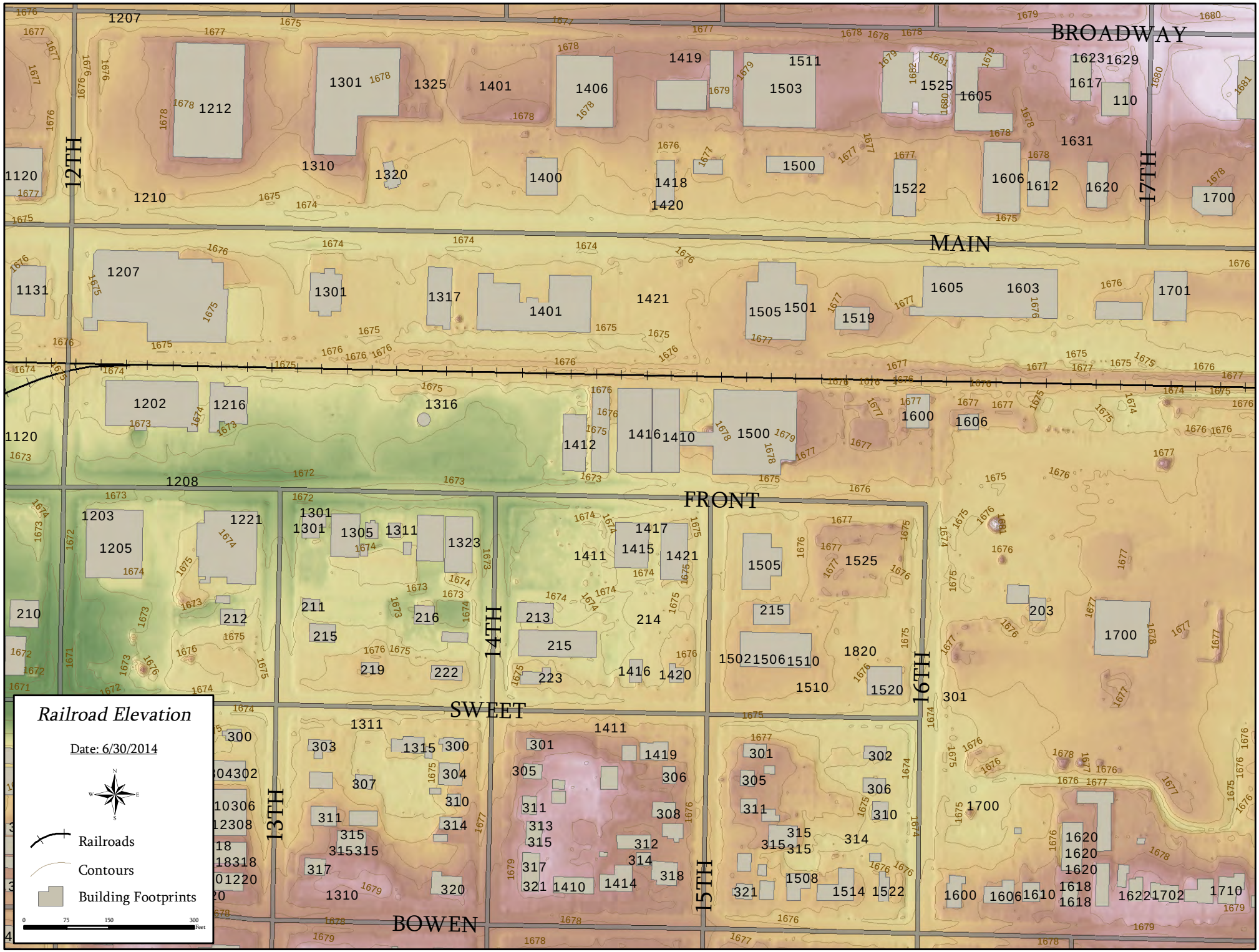
Railroad Elevation
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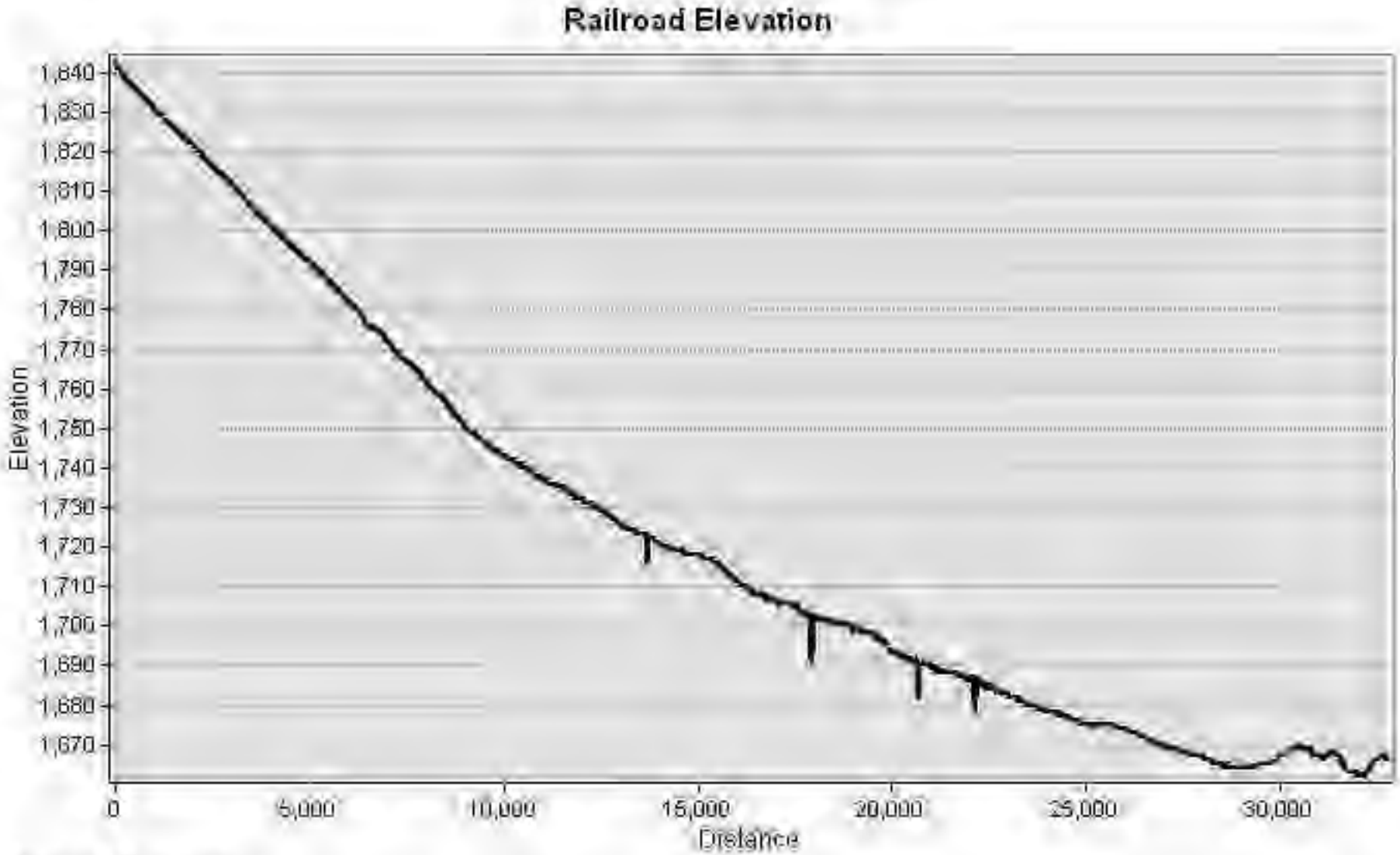

71st Av to Railroad Av

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Wildland Fire – Hazard Profile

Wildland Urban Interface (WUI)

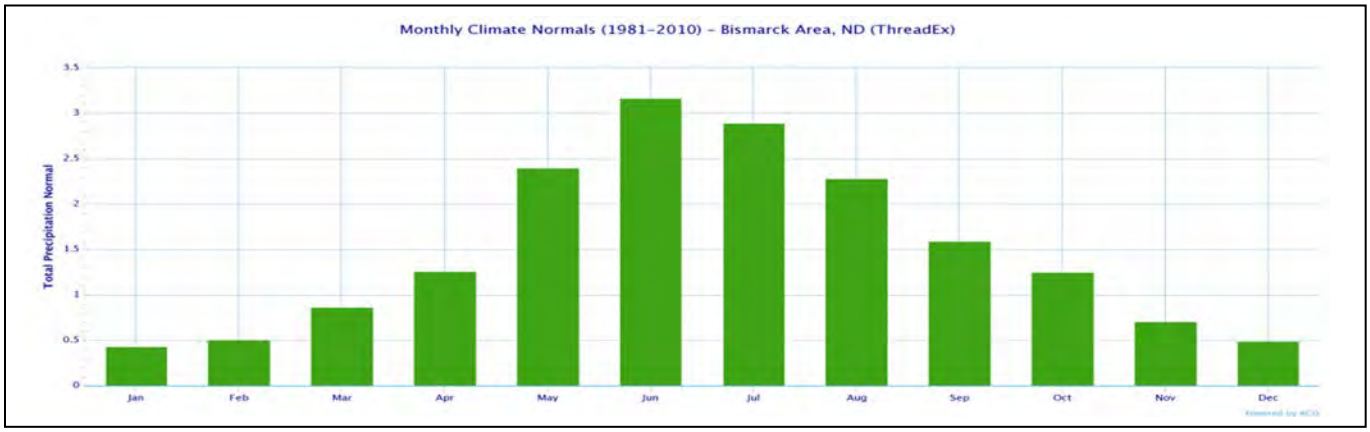
Description

The City of Bismarck has a relatively low potential of significant loss due to wildfire. There are areas in the NW part of the city that interface with larger prairie area where, depending on climatological conditions, including past rainfall, relative humidity and wind, a wildland fire may be able to gain some momentum. These areas are part of a "Wildland Urban Interface" (WUI), defined as areas where homes and other structures are built near or among lands prone to wildland fire. Homes and other structures that are located in these areas should practice wise fire mitigation plans such as those described in www.firewise.org.

Bismarck has a semi-arid climate with average annual precipitation of 17.85". Summer monthly rainfalls include; May: 2.4", June: 3.17", July: 2.89" and August: 2.28"

Monthly Climate Normals (1981-2010) - Bismarck Area, ND (ThreadEx)

Month	Total Precipitation Normal
January	0.43
February	0.51
March	0.87
April	1.26
May	2.40
June	3.17
July	2.89
August	2.28
September	1.59
October	1.25
November	0.71
December	0.49



Prevailing wind in Bismarck is from the WNW in all months other than May (SSE), July (SSE) and August (SSE). There are also some topographical interface areas, mostly in coulees and closer to the Missouri River, where fire may gain momentum as it moves from lower areas to higher areas.

Month	Bismarck		
	Mean Speed	Prevailing direction	Fastest Mile
January	10.2	WNW	54
February	10.2	WNW	54
March	11.4	WNW	65
April	12.8	WNW	63
May	12.5	SSE	66
June	11.3	WNW	66
July	9.8	SSE	72
August	10.0	E	72
September	10.5	WNW	66
October	10.4	WNW	61
November	10.6	WNW	67
December	9.8	WNW	61
Year	10.8	WNW	72
Yrs. of record	30	14	

While the City of Bismarck's risk of a wild-land fire in dry years can be relatively high; the damage potential is relatively low as our vegetation and topography do not readily allow a wild-land fire to gain momentum. The concern lessens even more when property owners have a yard that is cared for with short cut grass creating a buffer between a fire and a home

When compared to mountainous and heavily forested areas similar to Colorado, California and even the Black Hills of South Dakota, we have relatively flat lands providing less risk of a high magnitude event.

Even though our over-all vulnerability is low there are areas that may have more exposure potential than others; those areas would include the northwest portion of the city that is adjacent to undeveloped property and the southwest portion of the city that is adjacent to more heavily forested areas.

Property owners can make their property safer by practicing wise fire mitigation planning. A great resource is www.firewise.com

Risk

Risk: the potential for damage, loss, or other impacts created by the interaction of hazards with community assets.

Risk Assessment: product or process that collects information and assigns values to risks for the purpose of informing priorities, developing or comparing courses of action, and informing decision making.

THIRA Ratings – Wildland Fire (wildland urban interface)

Frequency	Consequence			
	Human	Economic	Psychological	Government
Very Likely	Minor	None/Negligible	None/Negligible	None/Negligible

HISTORY:

The City of Bismarck has not suffered loss of physical property as a result of wild-land fire; none-the-less the city is committed to protect all homes in the city limits from all hazards, including wild-land fires.

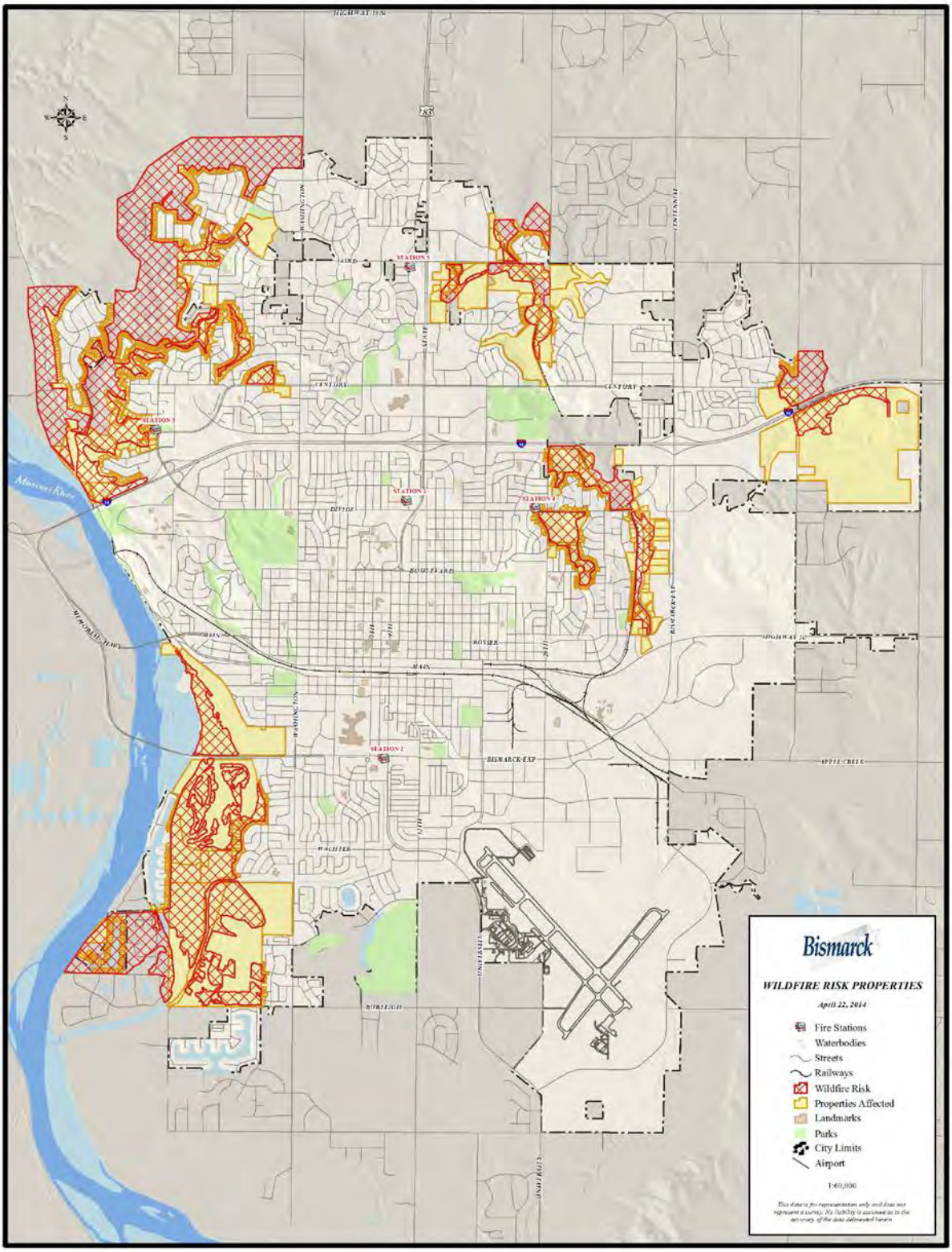
The Bismarck Fire Department has responded to 56 natural vegetation fires from January 1, 2010 through September 29, 2014.

Type	Number
Natural Vegetation Fire	8
Grass Fire	25
Brush, or brush and grass mixture fire	19
Cultivated vegetation, crop fire	1
Forest, woods or wildland fire	3
Total	**56**

The most significant wildfire with potential impact to Bismarck occurred on April 2, 2005:

- Incident Name: Wildland Fire
- Date: April 2, 2005
- Time: 1448
- Time Cleared: 1711
- Incident Location: 2800 South Washington (West of Tatley Meadows, north of the Waste Water Treatment Plant, south of drainage ditch and walking path)
- Fire was extinguished by Bismarck Fire and Mutual Aid (Bismarck Rural)

Bismarck Wildland Fire: Wildland Urban Interface Risk Areas



Vulnerability Assessment

Vulnerability: Characteristics of community assets that make them susceptible to damage from a given hazard.

Scenario	Wildland Fire – Wildland Urban Interface
Probability	**Very Likely** However, a high magnitude / high impact event is not likely.
Speed of Onset	No Notice Event
Geographic Area	See map – previous page.
Death / Injury 1. Primary Causes A. Highest vulnerability	 1. Asphyxiation. A. Those living adjacent to the wildland risk areas that do not evacuate, either by choice or as a result of not receiving notice of the event.
Mass Casualty Incident	Not likely. A high magnitude / high impact event is not likely. • Population within Wildland Fire Risk Area: Near Zero. Areas as mapped are open, vacant land or parks. • Population adjacent to wildland risk areas: Approximately 7,500
Property Losses	A high magnitude / high impact event is not likely. 1. Properties adjacent to wildland risk areas: Approximately 1,800 ○ based on a distance of 100 feet from within the wildfire risk areas 2. Total number of Structures in or adjacent to wildland risk areas: Approximately 2,200 3. Total building value adjacent to wildland fire risk area: Approximately 516,000,000. 4.
Environmental	1. Temporary air pollution from Wildland Fire itself 2. Erosion as a result of temporary loss of vegetation. 3. Potential loss of mature trees.

Scenario	Wildland Fire – Wildland Urban Interface
COG/COOP	1. Waste Water Treatment Plant
Critical Facilities	1. Capital Electric Coop 2. Wastewater Treatment Plant 3. ND Dept of Health Warehouse 4. St. Alexius Purchasing / Warehouse 5. Fire Station 4 – Northeast 6. American Red Cross
Critical Infrastructure (points of vulnerability – high priority)	1. Wastewater Treatment Plant 2. Sanitary Sewer Pump Station 3. Clear Channel Radio - KFYR/Y93 4. Bis-Man Transit 5. Taxi 9000 6. Capital Electric Coop 7. Public Works – Landfill
Schools	1. Horizon Middle School 2. Discovery Daycare
High Risk Facilities (chemical)	1. South Port Marina~ 125 feet from building 2. Public Works – Landfill ~ 100 feet to building 3. Wastewater Treatment Plant ~ 100 feet from outbuildings, 300 feet to large buildings 4. Cofells Plumbing and Heating ~ 200 feet to nearest building on property
Specific Populations: Public Assembly, Vulnerable / Special Populations	1. Dakota Boys Ranch 2. Dakota Zoo 3. Non-ambulatory population requiring evacuation assistance. 4. Holiday Inn 5. Door of Hope 6. Edgewood Vista 7. Missouri River Correctional Facility (Burleigh Co – just SW of city limits)
Economy (community wide)	None/Negligible
OTHER:	

Winter Storm – Hazard Profile

Including blizzards, heavy snow, ice storms, and extreme cold

Description

Winter storms take many forms and vary significantly in size, strength, intensity, duration, and impact. The composition of a storm varies with the temperature, wind, and amounts of precipitation. Important factors in winter storms include temperature, wind, wind chill, rain, sleet, snow, and blowing snow. Exceptional winter storms can and do cause problems for the communities, residents, and travelers. Examples of these types of storms include blizzards, ice storms, heavy snow events, and extended extreme cold temperatures. The combinations of cold temperatures, wind, snow, wind chills, ice, and reduced visibility can make these storms very deadly and costly.

The winter season can begin as early as September and last into May. The bulk of North Dakota's winter weather is from mid-November until early April. On average, there are around ten winter storms (ice storms, heavy snow events, winter storms, and blizzards) each year in North Dakota. Three to four of these storms reach blizzard intensity. As a result, North Dakota typically leads the nation in blizzard frequency. (National Climatic Data Center, 2010; National Weather Service, 2007)

Another hazard associated with Severe Winter Weather is prolonged periods of cold often associated with high winds, which produce life-threatening situations. This type of winter weather sometimes catches people unprepared, resulting in tragedy. Researchers have said that 70 percent of the fatalities related to ice and snow occur in automobiles and about 25 percent are related to people who have been caught off guard out in the storm. Ice storms with wind, or heavy snow without wind, have been extremely dangerous and costly to businesses, industries, state, tribal, and local governments, and citizens. Blizzards can last from less than 24 hours (in the fast moving storms) to more than four days (in the slower moving ones).

There are two major winter storm tracks that occur in the United States. The northern track produces the Alberta Low Pressure System, commonly called the "Alberta Clipper." This usually is a fast moving storm producing blizzard conditions for a relatively short period of time. Extremely low temperatures usually follow storms of this nature. Alberta Lows have traveled as fast as 90 mph and have not been known to become stationary systems. The southern track produces the Colorado Low Pressure System. These types of storms move more slowly and more erratically. The Colorado Low has traveled as fast as 60 mph, but has also been known to stop and become stationary for as long as 18 hours. Both of these types of storm systems can become very deadly.

Blizzards

Blizzards, as defined by the National Weather Service, are a combination of sustained winds or frequent gusts of 35 mph or greater and visibilities of less than a quarter mile from falling or blowing snow for 3 hours or more. A blizzard, by definition, does not indicate heavy amounts of snow, although they can happen together. The falling or blowing snow usually creates large drifts from the strong winds. The reduced visibilities make travel, even on foot, particularly treacherous. The strong winds may also support dangerous wind chills.

Blizzard conditions can also exist without a major storm system being near the state. Strong surface winds can blow already fallen snow, which is known as a "ground blizzard." Visibility can be reduced to near zero even though the sun is shining and the tops of power poles and trees are seen easily. These conditions are extremely variable in duration, from hours to even greater than a day. Ground blizzards are usually accompanied by very cold temperatures and wind chill conditions, making them as potentially deadly as a conventional blizzard.

The impact of a severe blizzard with low visibility, heavy snow, and cold temperatures can bring the entire region to a standstill. Utility and communication systems are often interrupted. Road systems are rendered impassable which causes school, workplace, and commercial shutdowns. This in turn magnifies the emergency and medical management needs of the community.

Heavy Snow

Other hazardous winter storms also exist that do not meet the criteria of a blizzard. Winter storms containing heavy amounts of snow, rapid snowfall rates, or enough wind to reduce visibilities and create hazardous road and outdoor conditions are an annual occurrence in the state. Six inches of snow or more in 12 hours or eight inches or more in 24 hours constitutes conditions that may significantly hamper travel or create hazardous conditions. The National Weather Service issues warnings for such events. Smaller amounts can also make travel hazardous, but in most cases, only results in minor inconveniences. Heavy wet snow before the leaves fall from the trees in autumn or after the trees have leafed out in the spring may cause problems with broken tree branches and power outages.

Ice Storms

Ice storms develop when a layer of warm (above freezing), moist air aloft coincides with a shallow cold (below freezing) pool of air at the surface. As snow falls into a warm layer of air, it melts to rain, and then freezes on contact when hitting the frozen ground or cold objects at the surface, creating a smooth layer of ice. This phenomenon is called freezing rain. Similarly, sleet occurs when the rain in the warm layer subsequently freezes into pellets while falling through a cold layer of air at or near the Earth's surface. Extended periods of freezing rain can lead to accumulations of ice on roadways, walkways, power lines, trees, and buildings. Almost any accumulation can make driving and walking hazardous. Thick accumulations can bring down trees and power lines.

Extreme Cold

Extended periods of cold temperatures frequently occur throughout the winter months in North Dakota. Heating systems generally compensate for the cold outside. Most people limit their time outdoors during extreme cold conditions, but common complaints usually include pipes freezing and cars refusing to start. When cold temperatures and wind combine, dangerous wind chills can develop.

Wind chill is how cold it feels when outside. Wind chill is based on the rate of heat loss on exposed skin from wind and cold. As the wind increases, it draws heat from the body, driving down skin temperature, and eventually, internal body temperature. Therefore, the wind makes it feel much colder than the actual temperature. For example, if the temperature is 0°F and the wind is blowing at 15 mph, the wind chill is -19°F. At this wind chill, exposed skin can freeze in 30 minutes. Wind chill does not affect inanimate objects. (National Weather Service, 2007)

Wind Chill Chart

Wind (mph)	Temperature (°F)																	
Calm	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
5	36	31	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40	-46	-52	-57	-63
10	34	27	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47	-53	-59	-66	-72
15	32	25	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51	-58	-64	-71	-77
20	30	24	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55	-61	-68	-74	-81
25	29	23	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58	-64	-71	-78	-84
30	28	22	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60	-67	-73	-80	-87
35	28	21	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62	-69	-76	-82	-89
40	27	20	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64	-71	-78	-84	-91
45	26	19	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79	-86	-93
50	26	19	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81	-88	-95
55	25	18	11	4	-3	-11	-18	-25	-32	-39	-46	-54	-61	-68	-75	-82	-89	-97
60	25	17	10	3	-4	-11	-19	-26	-33	-40	-48	-55	-62	-69	-76	-84	-91	-98

Frostbite Times: 30 minutes, 10 minutes, 5 minutes

$$\text{Wind Chill (°F)} = 35.74 + 0.6215T - 35.75(V^{0.16}) + 0.4275T(V^{0.16})$$

Where, T= Air Temperature (°F) V= Wind Speed (mph)

Effective 11/01/01

http://www.nws.noaa.gov/os/windchill/images/windchillchart3.pdf

Wind chill conditions become very relevant when human tissue is exposed to the outside air. This can occur when people become stranded in a blizzard and attempt to walk to safety and become lost. Lowering of the body core temperature leads to the condition known as "hypothermia." Hypothermia has often been called "the killer of the unprepared. It also claims the lives of many outdoor sports enthusiasts. This condition occurs when the body or "core temperature" is lowered. The blood is cooled, thereby reducing the amount of oxygen which is carried to the brain, thus dulling the senses. The victim becomes fatigued, delirious, and loses dexterity and control of arms and legs. If the body core temperature continues to drop and nears 85°F, the victim eventually slips into unconsciousness. If treatment is not started immediately, the result is arrest of the circulatory and respiratory systems and death.

Winter storms can often be associated with other hazards. The most common hazards thought of during winter weather events are transportation accidents. Roadways become hazardous quickly during snow, blowing snow, and ice events. Most accidents involve passenger vehicles; however, an accident involving a commercial vehicle transporting hazardous materials is also possible.

Strong winds and ice or snow accumulations can take down utility lines. A long-term utility outage becomes more significant during extended cold periods as sheltering and cold weather exposure becomes more challenging. In North Dakota, severe winter seasons often translate to severe flooding potential in the spring.

Large quantities of snow may fall during winter storms. Six inches or more in 12 hours or eight inches or more in 24 hours constitutes conditions that may significantly hamper travel or create hazardous conditions. The National Weather Service issues warnings for such events. Smaller amounts can also make travel hazardous, but in most cases, only results in minor inconveniences. Heavy wet snow before the leaves fall from the trees in autumn or after the trees have leafed out in the spring may cause problems with broken tree branches and power outages. In addition to Winter Storm Watches and Warnings, the National Weather Service issues the following products for heavy snow events:

Geographic Location

The winter storm hazards, such as blizzards, ice storms, heavy snow, and extreme cold, usually occur on a regional or even statewide scale. As the historical record indicates, winter storms are a formidable hazard for all parts of the state.

Risk

Risk: the potential for damage, loss, or other impacts created by the interaction of hazards with community assets.

Risk Assessment: product or process that collects information and assigns values to risks for the purpose of informing priorities, developing or comparing courses of action, and informing decision making.

THIRA Ratings – **Winter Storm (Severe Winter Weather)**

Frequency	Consequence			
	Human	Economic	Psychological	Government
Very Likely	Minor	Moderate	Significant	Minor

Previous Occurrences

See page 9.

Winter Storm Disaster Declarations – Burleigh County Since 1989			
Declaration	**Incident**	**Incident Period**	**Declaration Date**
DR-1901	Severe Winter Storm	April 1, 2010 to April 3, 2010	Major Disaster Declaration declared on April 21, 2010
DR-1157	Severe Winter Storms/Blizzards	January 3, 1997 to January 31, 1997	Major Disaster Declaration declared on January 12, 1997

http://www.fema.gov/disasters?field_state_tid=11&field_disaster_type_term_tid=6843&field_disaster_declaration_type_value=All&items_per_page=10&page=1

Vulnerability Assessment

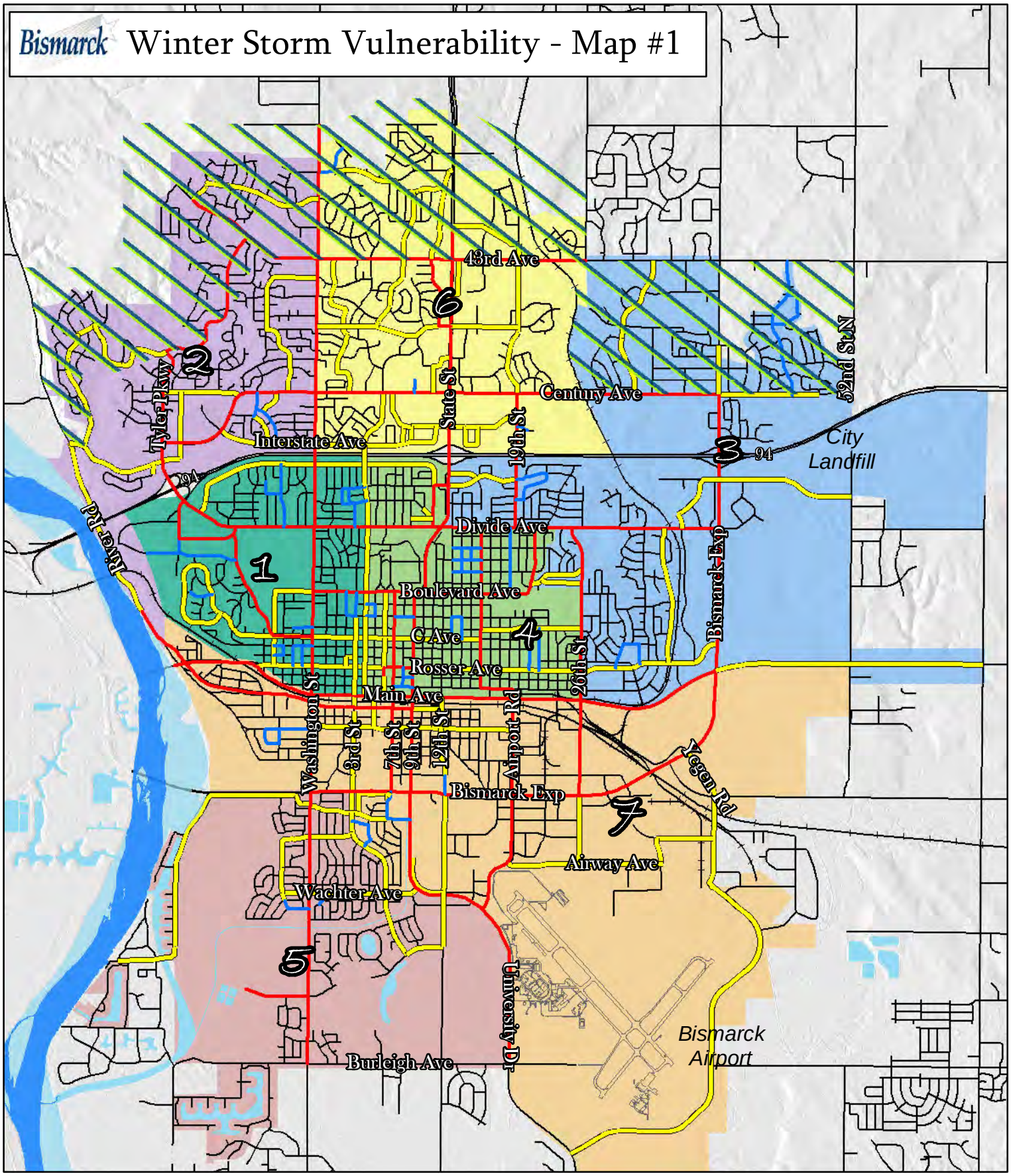
Vulnerability: Characteristics of community assets that make them susceptible to damage from a given hazard.

Scenario	Heavy Snow	Blizzard	Extreme Cold & Wind Chill	Ice Storm
Probability	High Probability (and frequency) *Refer to Characteristics and History*	High Probability (and frequency) *Refer to Characteristics and History*	High Probability (and frequency) *Refer to Characteristics and History*	Medium Probability (and frequency) *Refer to Characteristics and History*
Speed of Onset	12 to 24 hours warning	12 to 24 hours warning	12 to 24 hours warning	12 to 24 hours warning
Duration of impact	1 to 5 days (typically)	1 to 5 days (typically)	1 to 5 days (typically)	1 to 5 days (typically)
Geographic Area	Local to regional	Local to regional	Local to regional	Local to regional
Death / Injury 1. Primary Causes	1. Heart Attack (shoveling) 2. Traffic accidents – poor driving conditions 3. Carbon Monoxide – stranded vehicle	1. Traffic accidents – low visibility 2. Snow plow accidents	1. Exposure to weather elements 2. Alternate Heat source 3. Carbon Monoxide Poisoning	1. Traffic accidents 2. Power lines down – coming in contact with live wires 3. Slips/falls
A. Highest vulnerability	A. Elderly or others with heart health issues B. Stranded travelers	A. Travelers – high speed travel (highways)	A. Stranded travelers – attempting to find shelter B. Loss of power / heat C. Mechanical / vent failure – carbon monoxide	A. Travelers B. Proximity to overhead power lines C. Trees falling – pulling down power lines

Scenario	Heavy Snow	Blizzard	Extreme Cold & Wind Chill	Ice Storm
Mass Casualty Incident	Possible (traffic accidents)	Possible (traffic accidents)	Possible	Possible (traffic accidents)
Comments: No History of mass casualty events within Bismarck as a result of Winter Storms				
Property Losses (points of vulnerability – high priority)	1. Roof collapse *(large span roofs)*	1. Vehicles – *due to accidents*	1. Mechanical failures more likely 2. Batteries exposed to cold more likely to fail	1. Trees 2. Power lines and power poles 3. Vehicles *(due to accidents)*
Environmental			1. Pipeline breaks	
COG/COOP	1. Essential personnel not able to work 2. Transportation 3. Supplies – not able to deliver / receive	1. Ability to provide services is compromised 2. Transportation 3. Supplies – not able to deliver / receive 4. Safety – working outdoors	1. Water main breaks 2. Safety – working outdoors	1. Power outages 2. Safety of workers
Critical Facilities	1. Roof Collapse (large span roofs) 2. Lack of Access to critical facility	1. Access to critical facility compromised	1. Water main break 2. Power outage	1. Power outage 2. Backup generators in place and functional
Critical Infrastructure	1. Transportation *(Access)*	1. Transportation (visibility)	1. Backup generators – ensure heating capability	1. Power Outages 2. Backup generators – ensure heating capability

Scenario	Heavy Snow	Blizzard	Extreme Cold & Wind Chill	Ice Storm
Schools	1. School closures *(due to closed roads/access)* 2. Roof Collapse *(large span roofs)*	1. Bus Travel 2. Students walking to/from school	*1.* Exposure to extreme cold *(students not prepared)*	1. Power outages – school closure. 2. Potential contact with downed power lines *(students)*
High Risk Facilities (chemical)	1. Transporting hazardous materials 2. Roof Collapse	1. Transporting hazardous materials		1. Transporting hazardous materials 2. Power outage at facility 3. Backup generators in place and functional
Specific Populations: Public Assembly, Vulnerable / Special Populations	1. Roof collapse (gyms, auditoriums, etc.) 2. Medical attention / prescription needs 3. Travelers	1. Travelers 2. Medical attention / prescription needs	1. Travelers 2. Outdoor recreation	
Economy (community wide)	Affected –discontinued until storm lifts	Affected –discontinued until storm lifts	Affected - minimal business interaction	Affected – reduced business interaction – possible power outages – unsafe travel conditions
OTHER:	Mobile HazMat (transportation) Emergency Response time	Mobile Hazmat (transportation) Emergency Response time	Mobile Hazmat (transportation) Emergency Response time (outdoor work)	Mobile Hazmat (transportation) Emergency Response (travel / slippery conditions) Additional hazards – tree limbs, power lines, falling ice, slippery conditions
Traffic Accidents: As an example, the blizzard on December 30, 2010 affecting 16 counties (not affecting Burleigh) resulted in an estimated 100 car pile-up in eastern ND (Cass County). http://www.ncdc.noaa.gov/stormevents/eventdetails.jsp?id=275692				

Bismarck Winter Storm Vulnerability - Map #1



SNOW EMERGENCY ROUTES - PRIORITY 1

SCHOOL EMERGENCY ROUTES - PRIORITY 2

MAJOR ARTERIAL ROUTES - PRIORITY 3

RESIDENTIAL ROUTES - PRIORITY 4

*This map is for representation use only and does not represent a survey.

N

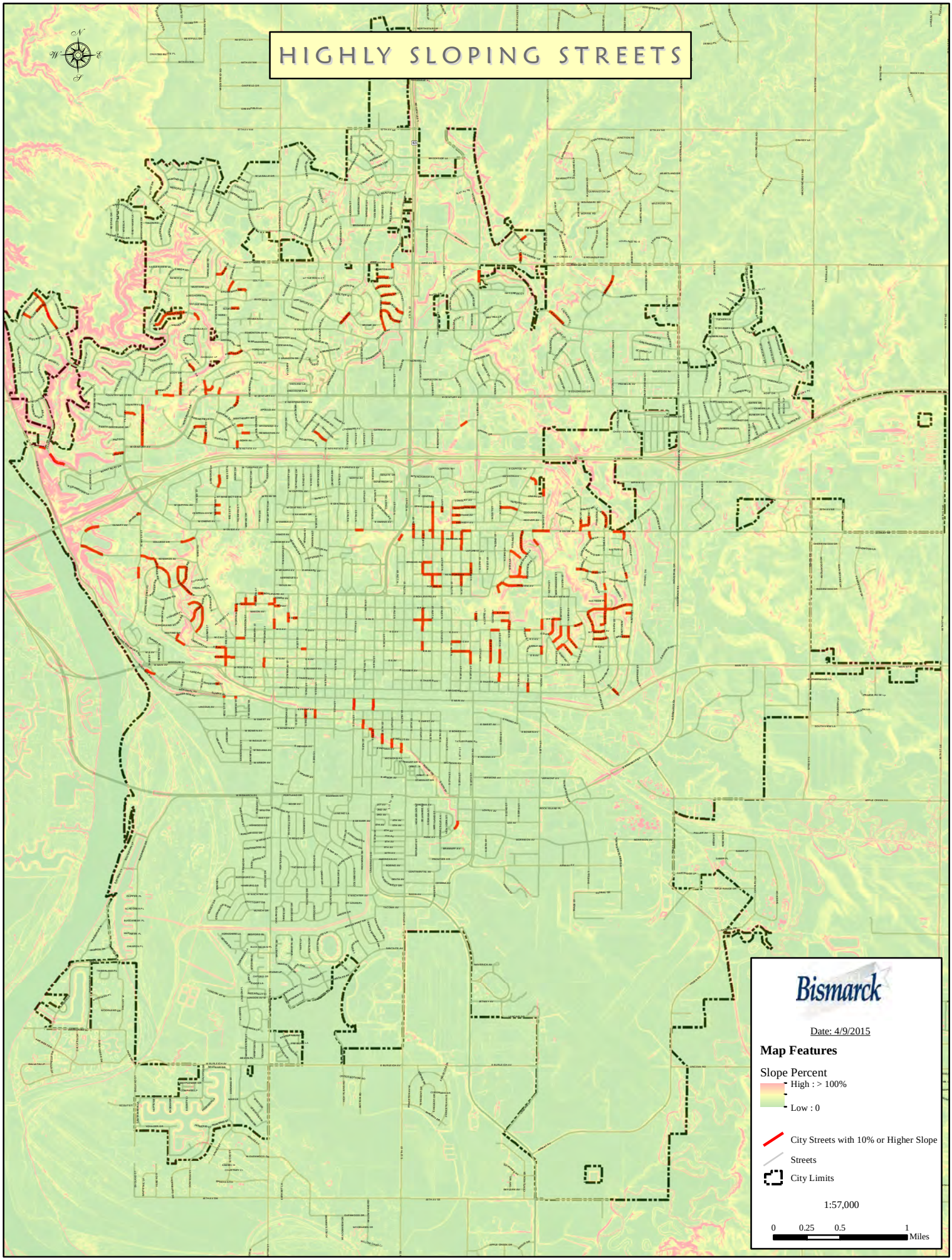
0 0.5 1 Miles

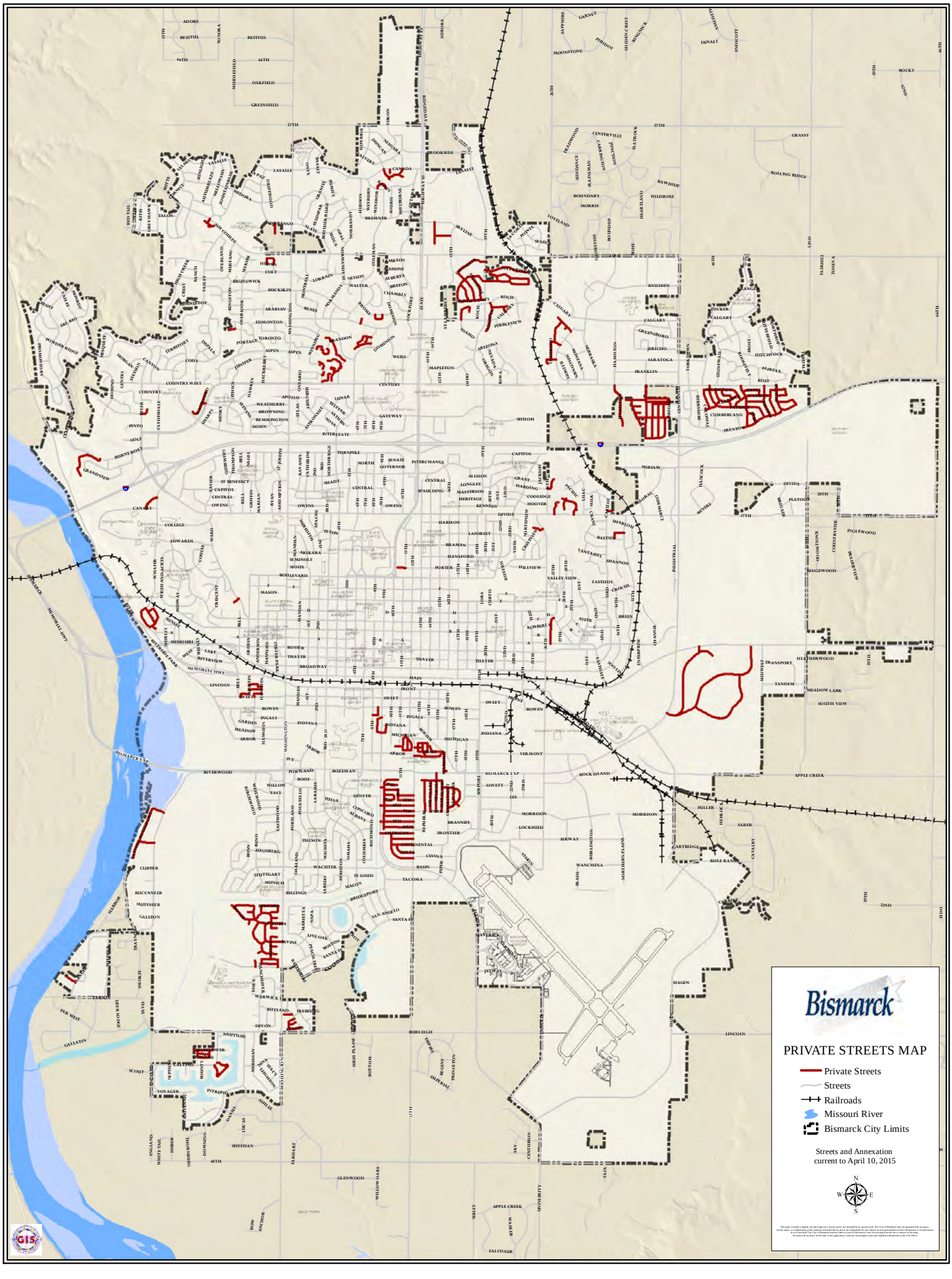
Areas of New Development - (prone to heavy snow drifting)

No liability is assumed as to the accuracy of the data delineated heron.

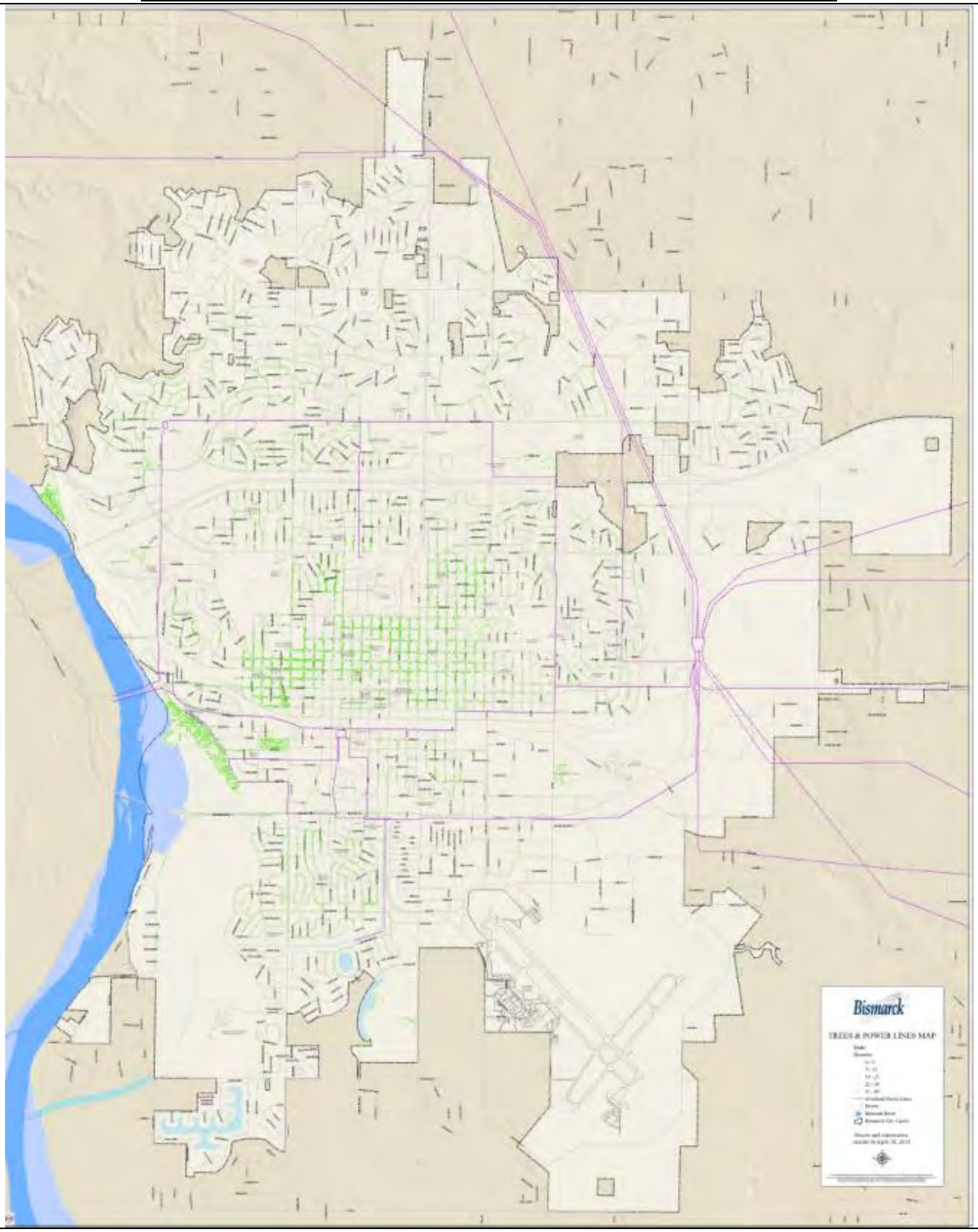
Map dated: April 2015

HIGHLY SLOPING STREETS




Bismarck
PRIVATE STREETS MAP
Private Streets
Streets
Railroads
Missouri River
Bismarck City Limits
Streets and Annexation
current to April 10, 2015
N
W
E
S
GIS

Overhead Power Lines and Overhead Powerline/Tree Intersection



History:

April 14-15, 2013: A total of 17.7 inches of snow fell beginning with a trace on April 13 (.1 inch) with a majority of the snow falling on Sunday April 14, 2013 (17.3 inches) and an additional. 3 inches on April 15. The snow had a high moisture content (wet/heavy) and made travel difficult to impossible.
A snow emergency declaration was issued by the city of Bismarck on April 14, 2013. Snow plows focused on clearing emergency routes only (red - priority 1 routes) on April 14th until noon on April 15 before snow plows were able to begin clearing second, third, and fourth level priority routes (residential). No travel was advised and the city of Bismarck closed its offices on Monday April 15 along with many other closings including ND State Government, Burleigh County, and Bismarck Public Schools.

NOAA Storm Event Database:
April 14, 2013 – Blizzard Event: Very heavy snow combined with winds gusting to 40 miles per hour to create a blizzard for much of the day on the 14th.

April 14-15: Winter Storm Event
Strong low pressure pushed across the Rockies April 13th, slowed down over the Dakotas April 14th, then moved east on April 15th. The peak of the storm occurred on Sunday when much of west and central North Dakota received heavy amounts of snow, with portions of the south central and southeast having a blizzard. A combination of favorable moisture feed and strong surface and mid-level dynamics brought historic snowfall to parts of west and central North Dakota. A moist conveyer belt extended from the eastern portions of Iowa and Illinois back northwest into North Dakota, situated along and north of an inverted surface trough stretched from southeast to northwest across South Dakota. Combined with strong diffluent flow aloft associated with the upper level low, snowfall rates approached two inches per hour across south central North Dakota on Sunday.
In addition to the heavy snow, strong surface winds developed across south central North Dakota west of the Missouri River and into the James River Valley. Wind gusts to 40 miles per hour combined with the heavy snow resulting in a blizzard. Storm total snowfall amounts ranged from 15 to 22 inches from the James River Valley into the Missouri River Valley. Lesser amounts were reported across the far west and north, with up to eight inches at Watford City, and around an inch near the Canadian border. The highest snowfall amounts were reported at Center and Flasher with 22 inches. A record snowfall for any calendar day of the year was set at Bismarck, with 15.5 inches falling on April 14th. The storm total in Bismarck was 17.7 inches. This also resulted in setting a new record April snowfall of 21.5 inches. Impacts from this storm were numerous. All roads across the southwest, south central, and southeast were under no travel advisories due to the heavy snow. Interstate 94 was closed from the Montana border to Jamestown, and Highway 83 was closed from Bismarck to Underwood. In addition, multiple school closings occurred on the 15th due to the heavy snow.

March 22-23, 2011: A storm total snowfall amount of 10.4 inches was reported near Bismarck.

April 2, 2010: Five to twelve inches of heavy wet snow and sleet fell across Burleigh County. The combination of strong winds and the wet snow resulted in damages to electrical utilities, causing power outages across the county. In some areas it took several days to restore power. Preliminary damage assessments estimated there was around two million dollars in damage from this storm for Burleigh County. Western portions of the county were hit the hardest.

January 22-23, 2010: A wintry mix of freezing rain, sleet, and snow spread north across the local area. Precipitation eventually changed over to all snow, with up to five inches of accumulations reported by early Saturday morning. Hazardous travel conditions and scattered power outages resulted.

January 5-6, 2010: Six to eight inches of snow fell across Burleigh County. The National Weather Service Office in Bismarck reported 7.1 inches of storm total snowfall. Strong northwest winds of 20 to 40 mph created areas of significant blowing and drifting snow, resulting in near blizzard conditions.

December 25, 2009: Winter Storm / Blizzard Conditions: Bismarck received 9.2 inches of snowfall on Christmas Day and a total of 13.8 inches from December 23 through 26. Most of North Dakota received heavy snow as a result of this storm. A no travel advisory was issued for the entire state on Christmas Day. Blowing snow caused reduced visibility, drifting, and dangerous driving conditions throughout the state. Road closures included I-29 from S.D. border to Canadian border (and from South Dakota to the Iowa border), I-94 from Montana border to Minnesota border, Hwy 83 from Bismarck to the Canadian border and Hwy 2 from Berthold to Devils Lake. Snow plows in Bismarck focused on clearing emergency routes and major arterials. Duration of the storm and impacts is at least 4 days (starting Dec 23 thru 26).

2008/2009 Winter Snowfall total: 100.3 inches (2nd place behind 1996-97 with 101.6 inches). Snow removal assistance (Federal Disaster Declaration) was received by Bismarck and many communities throughout the state.

March 23-24, 2009: A blizzard began later on the 23rd and continued into the 24th. Wind gusts to 47 mph on the 24th with a snow total of 8.1 inches (.2 on the 23rd and 7.9 on the 24th). This blizzard exacerbated the flooding/ice jam situation and caused delay in response/recovery efforts.

March 29 - 30, 2009: Heavy Snow/Blizzard - Strong northwest winds of 20 to 45 mph accompanied the snow and produced widespread blizzard conditions mainly south of Interstate 94 closer to the North Dakota and South Dakota border. Widespread 14 inch or greater storm total snowfall amounts were common across southwest and south central North Dakota during this event, with a few isolated reports greater than 20 inches. No travel advisories, road closures, including Interstate 94 from Bismarck to the Montana border, and school and business closures were common during this significant spring storm.

March 23, 2009: Blizzard: <u>This blizzard occurred at the onset of the Ice Jam Flooding that occurred in Bismarck/Burleigh spring of 2009.</u> A storm total snow amount of 8.1 inches was recorded at the Bismarck National Weather Service Forecast Office. The heavy snow combined with strong northwest winds resulted in widespread blizzard conditions. Storm total snow amounts ranged from 12 to 22.5 inches across southwest North Dakota, to five to 11 inches central. No travel advisories, road closures, power outages, and school and business closures were common during this significant spring storm.

January 11, 2009: Blizzard: Strong northwest winds of 25 to 35 mph, with gusts up to 45 mph, combined with falling snow and existing loose snow cover to create widespread and prolonged blizzard conditions across the county. Storm total snowfall accumulations by Monday morning ranged from two to five inches. The blizzard warning encompassed the entire National Weather Service Bismarck County Warning Area, 36 counties, all of which had a blizzard. Periods of light to moderate snow and blizzard conditions, very strong winds creating significant blowing and drifting snow and near zero visibilities, forced numerous road closures and the issuance of no travel advisories by law enforcement officials throughout the event.

January 8, 2009: Heavy Snow - A strong winter storm system brought moderate to heavy snow, areas of freezing rain, and considerable blowing and drifting snow to much of west and central North Dakota from early morning Thursday, January 8th, through Friday afternoon, January 9th. This significant storm resulted in numerous no travel advisories being issued by law enforcement throughout the event due to freezing precipitation, heavy snow accumulations, and blowing and drifting snow blocking roadways.

December 2008: Snowiest month on record (all months /years) with a total of 33.3 inches.

December 29, 2008: Heavy Snow - A fast moving surface low pressure system developed a band of moderate to heavy snow from northwest North Dakota, southeast through much of central North Dakota, Monday night, December 29th, and lasting through the early afternoon of Tuesday, December 30th. Storm total snow amounts ranged from three to four inches around the perimeter of the heavy snow band to around one foot within the center. In addition, occasional winds of 20 to 35v mph a produced considerable blowing and drifting snow and resulted in the issuance of no travel advisories over several counties Monday night into Tuesday morning.

December 20, 2008: Extreme Cold / Wind Chill - Cold Arctic air combined with winds of 15 to 25 mph to create wind chill temperatures of 40 below to near 50 below zero. - from Saturday the 20th, through Sunday morning the 21st.

December 14, 2008: Extreme Cold / Wind Chill - After a significant winter storm that brought a blizzard to western and central North Dakota moved out of the Northern Plains, wind chill continued to be a problem. Strong cold air advection combined with gusty northwest winds and resulted in wind chill temperatures of 40 to 55 below zero from Sunday night the 14th, through Monday morning the 15th.

December 13, 2008: Blizzard - A significant winter storm impacted all of western and central North Dakota beginning Saturday, December 13th, and lasting through much of Sunday, December 14th. A blizzard warning was posted well in advance of the storm, with the warning lead time more than a full day in advance. The blizzard warning encompassed the entire National Weather Service Bismarck County Warning Area, 36 counties, all of which verified. Heavy snow and blizzard conditions, significant snow combined with very strong winds and near zero visibility, forced numerous road closures and the issuance of no travel advisories throughout Saturday and Saturday night. A statewide no travel advisory was then issued early Sunday morning by the North Dakota Department of Transportation. Total snow amounts by Monday morning the 15th were as much as 13.8 inches at Williston. Bismarck had 12 inches.

November 6, 2008: Blizzard: - A significant and complex winter storm impacted much of western and central North Dakota beginning Wednesday, November 5th, and lasting into Friday, November 7th. Winter storm warnings and blizzard warnings were posted well in advance of the storm. Warning lead time averaged nearly 27 hours. The warnings encompassed the entire National Weather Service Bismarck County Warning Area, 36 counties, though not all counties had events or reached warning criteria. Counties in the Williston area and the Jamestown area were basically missed by the storm. Blizzard conditions, or significant snow with near blizzard conditions, forced many schools and businesses to close and stranded travelers. Numerous roads were closed or no travel was advised due to the conditions. Storm total snowfall ranged from one to three inches around Williston and Jamestown, to six to twelve inches southwest through central, to a maximum of twenty inches in McHenry County. The strong wind resulted in blowing and drifting snow and so amounts had to be estimated. Snow drifts were four to six feet deep.

January 29, 2008: Extreme Cold / Wind Chill - Wind chills of 40 to 45 below zero with wind speeds of 30 to 45 mph persisted for over 24 hours. The lowest wind chill recorded was 44 below zero at Bismarck.

March 30, 2007: Ice Storm - One quarter to one half inch of freezing rain fell across Burleigh County, creating ice covered and dangerous roadways. A few brief power outages occurred in the Bismarck area due to broken tree limbs falling onto power lines (newspaper). No travel was advised for various county, state, and federal highways as a result.

March 2, 2007: Blizzard - Winds of 30 to 45 mph were recorded across central North Dakota for much of Friday. These winds, in combination with recent snowfall of 5 to 12 inches, created widespread areas of significant blowing and drifting snow with near zero visibilities. Conditions were much worse in the open country than they were within urban areas, as numerous rural roadways became impassable due to large snow drifts. As a result, no travel was advised for much of central North Dakota, along with several highways being closed including Interstate 94 from Bismarck to Fargo.

February 28, 2007: Winter Storm - The heaviest snow (9 to 12 inches) fell over far south central and southeastern North Dakota. In addition to the heavy snow, light freezing rain and sleet also fell Wednesday afternoon and night over the central and eastern counties of the Bismarck County Warning Area.

January 24, 2007: Winter Storm - Low pressure over the central Rockies intensified into a major winter storm impacting North Dakota on the weekend of January 24th and 25th. A persistent snow event produced 6 to 12 inches of snow over most of western and central North Dakota. The heaviest band of snow fell from the northwest through central North Dakota where snowfall amounts ranged from 9 to 12 inches. The storm began as freezing rain and sleet over north central North Dakota before turning over to all snow. Gusty winds of 15 to 25 mph accompanied the storm resulting in considerable blowing and drifting snow and wind chills to 30 below zero. Travel throughout the region was impacted due to reduced visibilities and blocked roads.

January 4, 2007: Extreme Cold/ Wind Chill - Temperatures reached 20 to 30 below zero Sunday night and remained between 10 and 20 below zero on Monday. West winds of 10 to 25 mph combined with the subzero temperatures created wind chills ranging from 45 to 58 below zero over western and central North Dakota. The winds also created low visibilities in blowing snow in many areas of the region. Some roads were closed due to the blowing and drifting snow over parts of northern North Dakota. The frigid temperatures lead to power outages and water line breaks in several areas.

December 30, 2006: Heavy Snow - The highest snow totals, in excess of 10 inches, were from Bismarck, to Hazelton, Wishek, and Ashley, and through parts of Stutsman and Foster counties. These were the most significant snow amounts in these areas, from a single storm, in about seven winter seasons. There were many accidents and vehicles in ditches, at least 41 in the Bismarck area and more than 50 in the Jamestown area alone.

February 16, 2006: Wind Chill - Temperatures were in the 15 to 25 degree below zero range with wind speeds of 15 to 25 mph resulting in wind chills mainly in the 40s below.

January 20, 2006: Winter Weather - Around two inches of snow fell over Morton and Burleigh counties this morning. It was enough to cause slippery roads and traffic induced snow fog. Numerous accidents were reported in the two counties.

December 29, 2005: Winter Weather - Snow amounts totaled three to five inches over the area and a snow advisory was in effect. Several accidents were reported in Mandan, Morton County, and about 40 accidents were reported in Bismarck, Burleigh County. Two people were injured (indirect) in one of the Bismarck accidents.

January 13, 2005: Extreme Cold / Wind Chill - An arctic high pressure system dropped southeast out of central Canada on the evening of the 13th of January. The system brought bitter cold temperatures to western and central North Dakota the night of the 13th. The air temperatures overnight dropped between 20 to 35 below zero with daytime temperatures ranging 10 to 20 below zero. The subzero temperatures lasted through the morning of the 15th. Northwest winds up to 20 mph accompanied the cold air producing extreme wind chills of 40 to 60 below zero across the region.

March 10, 2004: Blizzard - The high wind event of March 10th brought afternoon and evening snow showers to central North Dakota. The snow combined with the high wind reduced visibilities to less and one quarter mile (1/4 mile) and in some areas visibilities lowered to near zero at times causing blizzard conditions. The North Dakota Highway Patrol and Department of Transportation closed down portions of highway 83 between Minot and Bismarck due to the extremely hazardous conditions caused by the snow and blowing snow. No travel was advised for the secondary roads in central North Dakota due to the snow, blowing snow and reduced visibilities.

February 10, 2004: Blizzard - The winter storm warning for western and central North Dakota was upgraded to a blizzard warning in the afternoon of the 10th. Strong winds of 50 mph combined with snow had reduced visibilities to zero at times by the late afternoon hours and remained at or near zero through the night.

January 27, 2004: Extreme Cold/Wind Chill - Ambient temperatures ranging 20 to 35 below zero combined with northwest winds to 30 mph resulted in widespread wind chill factors of 40 to 65 below zero.

December 17, 2002: Winter Storm - In the far west and far south central North Dakota 3 to 5 inch snowfall was common. After a relatively mild autumn, it was the first major arrival of winter weather to affect the region.

December 15, 2000: Blizzard - A strong low pressure system moved rapidly across southern Canada ushering frigid arctic air and strong northwest winds across western and central North Dakota. Wind gust to 60 mph were common throughout the region. The frigid arctic air kept daytime temperatures 5 to 10 below zero. The cold temperatures coupled with the high winds brought dangerous wind chills to 75 below zero. Snowfall was light, around an inch total, however existing snow on the ground created near zero visibilities in blowing and drifting snow for an extended period of time. This prompted the closing of many roads throughout western and central North Dakota.

November 7, 2000: Winter Storm – Heavy snow fell across western and central North Dakota with accumulations of 6 to 18 inches reported.

March 8, 2000: Winter Storm - Snow amounts ranged between 3 to 6 inches with the heaviest falling over south central North Dakota. Winds during the storm ranged between 40 to 50 mph which created dangerous winter conditions.

February 26, 2000: Winter Storm - A wide band of heavy wet snow fell from south central North Dakota through portions of extreme north central North Dakota along the Canadian border. Scattered areas of 8 to 12 inches of wet snow fell over this area with numerous reports of 3 to 6 inches within this band. Winds with this storm generally ranged between 30 to 45 mph which caused some blowing and drifting snow.

April 3, 1999: Winter Storm - The storm brought an area of heavy snow over western and central North Dakota. Snowfall ranged from 4 to 8 inches. The heaviest snow fell over the north central area.

April 1, 1999: Blizzard - Gusty northwest winds caused low visibilities in blowing and drifting snow over a wide area of western and central North Dakota. Six to fifteen inches of snow fell over the warned area.

January 1, 1999: Winter Storm - Heavy snow fell with 6 to 8 inches of snowfall during the day. Northwest winds to 40 mph brought bitter cold wind chills to 65 below zero and low visibilities in blowing snow west of the surface trough. Two fatalities were contributed to the storm. In south-central North Dakota at Bismarck a man (age unknown) died from a heart attack while shoveling snow. In north-central North Dakota near Rolette poor visibility stranded a vehicle which an elderly woman left to seek help and died from exposure to the cold. She came within 75 feet of a farm house but was unable to see it.

November 18, 1998: Winter Storm - Snowfall ranged 6 to 15 inches over central and east central North Dakota. The heaviest band of snow of 12 to 14 inches fell over the central and north-central counties.

November 9, 1998: Heavy Snow - A band of heavy wet snow extended from the southwest through much of central North Dakota ending early in the afternoon on the 10th. Amounts ranged from 6 to 9 inches in the southwest and south central to 9 to 13 inches north central.

April 4, 1997: Blizzard - Warm weather the first three days of April lead much of North Dakota to believe that spring had arrived with temperatures in the 60s and 70s. Mother Nature had other plans. A very strong area of low pressure moved out of the Colorado area into the northern plains. Warm moist air ahead of the low collided with cold air coming down from Canada. The result was the worst blizzard of the season for North Dakota, bringing much of the state to a complete halt. The precipitation began to fall during the afternoon of the 4th (Friday), as rain in the east and freezing rain or sleet in the west. By Friday evening the freezing rain and sleet had changed over to all snow in the west. By Saturday afternoon the heavy snow moved into the central part of the state, reaching the eastern part of North Dakota later that night. Snow accumulations were on average 1.5 to 2 inches an hour with 50 to 60 mph winds as well. The blizzard ended in the west on the morning of the 6th (Sunday), but continued into the evening across the east. **The additional snow at Bismarck brought the season snowfall total to 101.4 inches, which set an all-time record.** The old record was 91.8 inches. Many power poles fell from the weight of the ice and snow combined with the strong winds. It's estimated that over 300 wooden poles had to be replaced, with one power company reporting about 100 steel towers damaged or destroyed with over 200 miles of transmission line down. An estimated 75,000 homes were without power for some time over the weekend, with a few houses having to wait 4-5 days before power was fully restored. The state's electrical grid was in such patch work condition that the governor requested that people conserve as much energy as possible for rear of overtaxing the system and creating a widespread brownout. National Guard helicopters were used to help power companies assess the damage done to power poles and lines. With the widespread power outages, many people had to resort to burning wood or running gas powered generators to keep their homes warm. This lead to a few reports of carbon monoxide poisoning. Numerous vehicles were stranded in and out of towns, as well as people. I-94, I-29, and all other major highways in the state were closed for the weekend. **On the 7th(Monday), President Clinton declared North Dakota a disaster area for the 2nd time this winter**, freeing up grants and making low interest loans possible.

March 12, 1997: Winter Storm - The snow was mainly confined in a band from the northwest part of the state to the south-central (7 inches at Bismarck). I-94 was again closed from Bismarck to Fargo.

January 9, 1997: Blizzard - The second blizzard in less than 1 week brought North Dakota to a virtual standstill. This blizzard didn't bring as much snow as the first storm, but the winds gusted from the northwest as high at 40 mph and they lasted for 3 days. Snowfall amounts from this storm varied from 1-2 inches in the southwest to 2-4 inches in the central. But the strong winds combined with this snow as well as the snow from the blizzard a few days earlier created widespread whiteout conditions that lasted for 3 days. There were reports of people getting stranded in vehicles for up to 40 hours. Those that stayed with the vehicle survived, but those that didn't either perished or suffered 2nd and 3rd degree burns over 70-90 percent of their body. As the storm was winding down on the 11th and 12th, bitter cold air moved in, and with the strong northwest winds still blowing, wind chills plummeted to 85-90 below with actual air temperatures 20-30 below. In Elgin (Grant Co), the water tower froze and broke open due to the cold temperatures. With the amount of suffering and hardship going on, Gov. Schafer of North Dakota declared the state a disaster area. <u>This was followed on the 12th with President Clinton approving the 1st ever request to declare a major statewide disaster.</u> The National Guard was called in to help with snow removal as many communities had already spent their snow removal money before this storm.

January 4, 1997: Blizzard - The first blizzard of 1997 hit east-central North Dakota on the morning of the 4th. The blizzard was preceded by freezing rain that lasted most of the day before switching over to snow. The snow became so heavy that the highway department pulled the plows off of the roads the evening of the 4th and all day on the 5th. It was during the evening of the 4th that the northwest winds began to blow. Winds of 25 to 35 mph were common. Although the snow was not as heavy in the western part of North Dakota, the freezing rain made travel very hazardous. This would turn out to be the first of 4 major snow events that would hit western and central North Dakota during January.

December 25, 1996: Extreme Cold - The blizzard of the 16th-18th left in its wake very cold air. Williston set a new state record low of 32 below the morning of the 25th, and Bismarck set a new record low high temperature for the date, with the mercury struggling to 10 below for a high. Lows across the state that morning varied from 20 to 30 below with highs from 10 to 20 below.

December 16, 1996: Blizzard - A strong low pressure center moved southeast out of Canada into the northern plains bringing with it blizzard conditions. The blizzard lasted for 3 days in North Dakota. The blizzard began in the western part of the state the morning of Monday, December 16 and didn't exit the eastern part of the state until the evening of Wednesday, December 18th. This was the first 3 day blizzard since the winter of 1980-81. Snowfall amounts varied from around 2 inches in the Dickinson area...3-4 inches in Williston and Bismarck to 6-8 inches in the Jamestown area. The light snow combined with north winds gusting to 50 mph to produce massive blowing and drifting of snow. Temperatures also plummeted down to 20 below creating wind chills from 40 to 60 below. Visibilities were so poor that the ND Highway dept. pulled the plows off roads the evening of the 16th and didn't allow them to return to the roads until the afternoon of the 18th. Snow drifts as high as 10 feet were common. <u>All of I-29 in North Dakota and I-94 from Bismarck to Fargo were closed, stranding hundreds of travelers.</u>

November 23, 1996: Winter Storm - For the 2nd time is less than 1 week, more snow fell on parts of western and central North Dakota. Again, the lack of wind made the storm more bearable than what it could have been. Bismarck received almost 9 inches of snow. Bitter cold air also accompanied the storm system.

November 19, 1996: Winter Storm - Another winter storm hit North Dakota bringing more unwanted snow to the state. Although there wasn't enough wind associated with the storm system to qualify the storm as a blizzard, the 10 to 20 mph winds were enough to create some blowing and drifting snow in open areas. Bismarck received from 6-8 inches of snow.

November 5, 1996: Winter Storm - Although at first the storm appeared to be warm enough to only produce rain, once snow began to fall on the morning of the 5th, dynamic cooling lead to an all snow event across south-central and east central North Dakota. Snowfall totals include 6 inches at Bismarck.

March 23, 1996: Winter Storm - An early spring snow storm moved up out of the 4-corners region of the country to bring another round of severe winter weather to the northern plains. Snowfall totals include Bismarck with 13 inches. I-94 in Morton county was reported to have 6 foot snow drifts blocking lanes...and I-94 was closed from Saturday morning to Monday morning. Many travelers ended up being stranded for the weekend in North Dakota. Due to the warm weather received a few days before...roadways were warm. When the storm began...strong northeast to east winds blew the snow across the road...leaving the roadway wet. When the temperature began to fall, roadways became extremely icy. There were numerous reports of vehicles in the ditch, and a few roll-overs were also reported.

February 26, 1996: Blizzard - A strong low pressure system moving east out of the central Rockies brought another blizzard to North Dakota. Winds of 20-30 mph combined with the snow to produce white-out conditions. Snowfall totals include 11 inches at Bismarck, 10 inches at Grand Forks, 6.5 inches at Fargo, and 4-5 inches at Dickinson and Jamestown.

February 1, 1996: Extreme Cold / Wind Chill - Dangerously cold weather once again hit North Dakota. Many places reported lows from 35 to 45 below. Daytime highs faired no better, as Bismarck reached a high of 26 below. Northwest winds up to 30 mph created wind chills to **100 below**. Electric companies reported peak loads, while natural gas companies had trouble keeping gas flowing through pipelines. Numerous schools closed and many water main breaks occurred. There were also shortages of #1 diesel fuel.

January 29, 1996: Extreme Cold / Wind Chill - A 57 year old Bismarck man died from a heart attack while operating a snow blower. The day before the man died, the Bismarck area received 5 inches of snow. On the day he died, high temperatures were in the teens below zero with wind chills from 40 to 60 below.

January 17, 1996: Blizzard - A strong low pressure center located over the central plains combined with strong arctic high pressure moving south out of Canada to bring blizzard conditions to North Dakota. Snowfall amounts range from 8 inches at Williston in the northwest to 20 inches at Wahpeton in the southeast. Fargo and Bismarck set new records for 24 hr. snowfall, receiving 18 and 7.9 inches respectively. Winds gusting to 55 mph created 3 to 5 foot drifts in the central, while drifts up to 10 feet were found in the east. Law enforcement officials advised no travel and closed I-29 in North Dakota, I-94 from Bismarck to Fargo, and US Highway 2 from Grand Forks to Devils Lake. Many people who did not heed the travel warnings got stranded for several hours on the interstate and state highways. Fortunately no deaths were reported. With temperatures dropping to 10 to 20 degrees below zero, wind chills varied from 60 to 80 below zero, snow removal was hampered with hydraulic and cooling systems freezing on snow plows.

February 9, 1995: Blowing Snow - Strong northerly winds combined with recently fallen snow created near zero visibilities in parts of northwest, central, and eastern North Dakota. Along with the blowing snow were wind chills 40 to 60 below zero. Several counties advised no travel, many schools were cancelled; parts of Interstate 29 and parts of Interstate 94 were closed for the second time in as many days. Among the many problems caused by the weather was a serious accident at 1730 CST on the 10th, 15 miles west of Mandan on Interstate 94. Zero visibility caused several vehicles to slow or stop on the interstate. Other cars, 23 in all, continued travel causing a chain reaction of accidents resulting in 1 death and 13 injuries. In addition to the injuries from the accident, several rescue workers suffered frostbite in their rescue efforts.

November 26, 1994: Heavy Snow - Six to ten inches of snow fell in central North Dakota. In addition to the snow, freezing drizzle fell in the south central. The North Dakota Highway Patrol advised no travel in much of the central part of the state.

April 25, 1994: Heavy Snow / Blizzard - A late season winter storm came a few days after temperatures of 80 degrees. Parts of southern North Dakota received almost a foot of heavy wet snow. Some thunder occurred with the snowfall. Winds of 25 to 45 mph caused blizzard conditions at times, and snow drifts three feet high. This late storm brought record seasonal snowfall to many parts of the state. Snowfall for the winter season topped 100 inches in some places. The storm closed schools and businesses, and shut down travel.

March 22, 1994: Heavy Snow - Up to 14 inches of heavy wet snow fell over much of southern North Dakota. The snow began in southwest and south-central North Dakota the night of the 22nd, persisted throughout the day on the 23rd, then ended that evening. In southeast North Dakota, the snow began later on the 23rd and lasted late into the night. The heaviest snowfall occurred in the southwest and south-central sections, near the South Dakota border. Twelve inches of snow was reported in Bowman, in the southwest corner of the state. About eight inches of snow fell in the cities of Bismarck and Fargo.

November 22, 1993: Heavy Snow - A slow moving and enormous storm over North America brought record single-storm snowfall to much of North Dakota. Over two feet of snow fell over a large part of central and southeast North Dakota, and most of North Dakota had over a foot of snow from this storm. The greatest snowfall amount was reported at Oakes, in Dickey County in southeast North Dakota, 31 inches. At the National Weather Service office in Bismarck, 28.3 inches of snow was measured during the 108-hour snow event. This amount set a new single-storm record for snow in Bismarck. The snow began the evening of the 22nd and did not end until the morning of the 27th. Except for about six hours during the day on the 26th, the snow was continuous through this period. The snowfall was intermittent over most of North Dakota during this lengthy event. Fortunately, the wind was only 10 to 25 MPH during this storm, so it was well below blizzard conditions and blowing and drifting of snow was not a problem. The storm occurred during the week of Thanksgiving, so many travelers were stranded. The prolonged snowfall kept snow removal crews working around the clock, and a few motorists crashed into the snowplows. Out in the rural areas, some farm buildings collapsed in the heavy snow.

October 27, 1991 – Snow and ice storm
October 23, 1991 – Snow storm
December 19, 1990 – Extreme cold
November 7, 1986 – Blizzard, heavy snow, and ice storm
April 13, 1986 – Blizzard, heavy snow, ice storm
February 1, 1986 – Fog and freezing drizzle
December 23, 1983 – Extreme cold
March 4, 1983 – Severe storm with snow
January 5, 1980 – Blizzard
April 11, 1979 – Heavy snow
March 18, 1979 – Winter storm with $1,724 in property damage
February 22, 1979 – Winter storm with $943 in property damage
February 14, 1979 – Winter storm
January 24, 1978 – Blizzard
December 16, 1977 – Ice storm and wind with $94,340 in property damage
December 6, 1977 – Winter storm with one fatality
November 18, 1977 – Blizzard, wind, and snow
January 1, 1976 – Snow and blizzard
December 30, 1975 – Snowstorm
March 26, 1975 – Blizzard
January 10, 1975 – Blizzard
July 4, 1972 – Frost
June 20, 1972 – Frost
February 23, 1969 – Severe snow and ice storm with $943 in property damage
January 22, 1969 – Blizzard
December 22, 1968 – Snow and blizzard
April 29, 1967 – Ice storm
April 16, 1967 – Ice storm and blizzard with $1,667 in property damage
February 23, 1967 – Blizzard
April 25, 1966 – Rain, freezing rain, and heavy snow
March 2, 1966 – Blizzard
December 15, 1964 – Blizzard
December 6, 1963 – Blizzard
April 23, 1961 – Blizzard
March 28, 1960 – Blizzard with heavy snow
March 16, 1960 – Glaze with 3 injuries
January 1, 1960 – Cold wave and blizzard

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Plan Maintenance

Hazard mitigation planning is an on-going process. Bismarck Emergency Management will coordinate with stakeholders to ensure this plan remains effective and relevant for the city of Bismarck.

This plan section establishes the method and schedule for monitoring, evaluating, and updating the Hazard Mitigation Plan during a five-year plan-update cycle. This section also identifies how Bismarck will maintain community involvement in the plan.

Plan Monitoring
The plan will be monitored jointly by Bismarck Emergency Management and all city departments which are assigned to complete mitigation actions or conduct on-going mitigation projects. At a minimum, the plan is reviewed after each disaster, or in the absence of such, annually. Emergency Management and all departments will monitor progress of their assigned mitigation projects and maintain their own list of projects completed to be noted in future plan updates.

The plan will be reviewed annually throughout the 5-year planning cycle for updates based on any actual incidents or additional mitigation planning needs identified as a result of on-going input from the public, city departments, or stakeholders.

Plan Evaluation and Updating
Evaluation and updating of the plan will be coordinated by Bismarck Emergency Management in cooperation with the city departments and applicable stakeholders. Significant disaster or emergency incidents will be evaluated for mitigation recommendations that should be added to the plan. New stakeholders and interested parties will be identified and invited to participate in the implementation and update process.

Public Participation
The Bismarck Multi-Hazard Mitigation Plan will be posted to the Bismarck Emergency Management website. The website will invite and provide opportunity for on-going public input regarding the mitigation plan. Bismarck Emergency Management will also promote awareness of the mitigation plan and make it available for public review during various public forums including public education emergency preparedness presentations and site or community group-specific settings.

Schedule of Plan Review and Updates			
Plan Section/Content	**Post-Disaster**	**Annually**	**Every 5 Years**
Adoption Documentation			X
Executive Summary and Introduction Sections			X
Mitigation Strategy	X		X
Hazard Vulnerability & Mitigation Actions Summary	X		X
Mitigation Implementation Action Plan	X	X	X
Mitigation Actions – Prioritizing	X		X
Integration of Plans/Programs & Mitigation Capabilities Inventory			X
Community Profile			X
Community Assets		X	X
Risk Assessment Summary			X
Hazard Identification	X		X
Hazard Profiles	X	Update per incidents	X
Planning Process	X	X	X
Plan Maintenance		X	X

Planning Process & Public Input

The City of Bismarck recognizes that the planning process is as important as the plan document. Involvement in the planning process enhances understanding and awareness of the hazards, the associated risks and vulnerabilities, as well as mitigation opportunities to minimize potential impact. The Bismarck Multi-Hazard Mitigation Plan is a combined effort among various stakeholders including local, state, federal government entities as well as public and private sector and citizens. The various planning meetings were facilitated by the city emergency manager.

This section illustrates the planning process to include significant involvement by community stakeholders and opportunity for public input. Once approved, the Bismarck Multi-Hazard Mitigation Plan will be made available on the city's website and open to the public for comment and recommendations at any time.

Mitigation Planning Meetings Summary	
Meeting Title	**Date**
Kick-Off Meeting: Mitigation Plan Development Coordination Meeting	January 6, 2014
Stakeholder Meeting: Bismarck Mitigation Plan	January 30, 2014
Public Input Invite: advertising public input meeting and opportunity for public input via Bismarck and Burleigh websites.	February 20, 2014
Public Input Meeting: Bismarck Public Library	February 24, 2014
Public Input via Bismarck and Burleigh Websites	February and March 2014
Tornado: Mitigation Planning Team Meeting	August 14, 2014
Dam Failure: Mitigation Planning Team Meeting	October 13, 2014
Shortage or Outage of Critical Materials: Mitigation Planning Team Meeting	October 23, 2014
Train Derailment: Mitigation Planning Team Meeting	November 3, 2014
Wildland Fire: Mitigation Planning Team Meeting	November 4, 2014
Winter Storm: Mitigation Planning Team Meeting	November 13, 2014
Severe Summer Weather (excluding Tornado): Mitigation Planning Team Meeting	November 19, 2014
Drought: Mitigation Planning Team Meeting	December 3, 2014
Biological Infestation (Urban Forest): Mitigation Planning Team Meeting	December 22, 2014
Communicable Disease: Mitigation Planning Team Meeting	January 6, 2015
Hazardous Materials Release: Mitigation Planning Team Meeting	January 14, 2015
Fire: Mitigation Planning Team Meeting	January 26, 2015
Geologic Hazard: Mitigation Planning Team Meeting	February 18, 2015
Flood: Mitigation Planning Team Meeting	February 18, 2015
Aircraft Accident: Mitigation Planning Team Meeting	February 25, 2015
Community Emergency Response Committee – Final Meeting	March 11, 2015

Hazard Specific Mitigation Planning Team Committees

*Lead Planner

Active Shooter / Active Threat			
First Name	**Last Name**	**Position Title**	**Agency**
*Dan	Donlin	Chief of Police	Police
*Glen	Ternes	Police Lieutenant	Police
Becky	LaBella	Safety Director	Bismarck Public Schools
Gary	Stockert	Emergency Manager	Emergency Management

Aircraft Accident			
First Name	**Last Name**	**Position Title**	**Agency**
*Greg	Haug	Airport Manager	Bismarck Airport
Tim	Thorsen	Airport Operations Manager	Bismarck Airport
Matthew	Remynse	Assistant Marketing & Operations Manager	Bismarck Airport
Tom	Painter	ARFF Chief	Bismarck Airport
Keith	Hunke	Assistant City Administrator	Administration
Bob	Johnston	Mayor	City of Lincoln
Joely	HeavyRunner	Safety Director	United Tribes Technical College
Corey	King	Emergency Response Specialist	NOAA/National Weather Service

Biological Infestation (Urban Forest Damaging Pests)			
First Name	**Last Name**	**Position Title**	**Agency**
*Jeff	Heintz	Director – Service Operations	Public Works
Jackson	Bird	City Forester	Forestry
Keith	Hunke	Assistant City Administrator	Administration - Bismarck
Jessica	Douglas	Environmental Health Specialist	Environmental Health
Crys	Kuntz	EPR Coordinator SWC Region	Public Health
Renae	Moch	Director of Public Health	Bismarck/Burleigh Public Health
Greg	Smith	Operations Director	Bismarck Parks and Recreation
Gary	Stockert	Emergency Manager	Emergency Management

Communicable Disease			
First Name	**Last Name**	**Position Title**	**Agency**
*Renae	Moch	Director	Bismarck Burleigh Public Health
*Anton	Sattler	Environmental Health Administrator	Environmental Health
Crys	Kuntz	EPR Coordinator SWC Region	Public Health
Keith	Hunke	Assistant City Administrator	Administration - Bismarck
Charlie	Whitman	City Attorney	Bismarck Attorney's Office
Tom	Painter	ARFF Chief	Airport Rescue and Fire Fighting
Kirby	Kruger	Director of Disease Control	ND Dept of Health
Steve	Pickard	CEFO	ND Dept of Health
Deanna	Solhjem	Local Epidemiologist	ND Dept of Health: Disease Control
Gary	Stockert	Emergency Manager	Emergency Management
Jason	Stugelmeyer	Lieutenant	Police Department

Dam Failure			
First Name	**Last Name**	**Position Title**	**Agency**
*Keith	Hunke	Assistant City Administrator	Administration - Bismarck
Mike	Dannenfelzer	Communications Director	Combined Communications Center
Mel	Bullinger	City Engineer	Engineering
Bob	McConnell	Director of Human Resources	Human Resources
Corey	King	Emergency Response Specialist	NOAA/National Weather Service
Randy	Lamberth	Facility Manager	United Tribes Technical College
Gary	Stockert	Emergency Manager	Emergency Management
Darrel	Nucech	GIS Coordinator	GIS
Todd	Lindquist	Garrison Project Operations Project Manager	USACE (provided input and review via e-mail)

Drought			
First Name	**Last Name**	**Position Title**	**Agency**
*Keith	Demke	Director of Utility Operations	Public Works
Keith	Hunke	Assistant City Administrator	Administration - Bismarck
Charlie	Whitman	City Attorney	Bismarck Attorney's Office
Gary	Stockert	Emergency Manager	Emergency Management
Greg	Smith	Operations Director	Bismarck Parks and Recreation
Kent	Theuer	EM Specialist	ND Dept of Agriculture
Corey	King	Emergency Response Specialist	NOAA/National Weather Service
Allen	Schlag	Hydrologist	NOAA/National Weather Service

Fire			
First Name	**Last Name**	**Position Title**	**Agency**
*Rob	Carlson	Battalion Chief	FIre
Ron	Kunda	Fire Marshal	Fire
Dean	Meyer	Deputy Chief	Fire
Beth	Johnson	Vice President of QA	HIT Inc.
Gary	Stockert	Emergency Manager	Emergency Management
Brady	Blaskowski	Building Official	Community Development

Flood			
First Name	**Last Name**	**Position Title**	**Agency**
*Keith	Demke	Director of Utility Operations	Public Works
Jeff	Heintz	Director – Service Operations	Public Works
Terry	Halstengard	Stormwater Program Coordinator	Public Works
Mel	Bullinger	City Engineer	Engineering
Jeff	Solemsaas	Lt. / Traffic Commander	Police
Corey	King	Emergency Response Specialist	NOAA/National Weather Service
Greg	Smith	Operations Director	Bismarck Parks and Recreation
Joely	HeavyRunner	Safety Director	United Tribes Technical College
Randy	Lamberth	Facility Manager	United Tribes Technical College
Bob	McConnell	HR Director	Bismarck Human Resources
Carl	Hokenstad	Director of Community Development	Community Development
Gary	Stockert	Emergency Manager	Emergency Management
Darrel	Nucech	GIS Coordinator	GIS
Karen	Goff	Dam Safety Engineer (email input)	ND State Water Commission

Geologic Hazards (ie: Slope Failure)			
First Name	**Last Name**	**Position Title**	**Agency**
*Mel	Bullinger	City Engineer	Engineering
*Linda	Oster	Design and Construction Engineer	Engineering
Mark	Berg	Traffic Engineer	Engineering
Greg	Smith	Operations Director	Bismarck Parks and Recreation
Keith	Demke	Director of Utility Operations	Public Works
Jeff	Heintz	Director – Service Operations	Public Works
Carl	Hokenstad	Director of Community Development	Community Development
Gary	Stockert	Emergency Manager	Emergency Management
Darrel	Nucech	GIS Coordinator	GIS
Ed	Murphy	State Geologist (e-mail input)	NDGS Department of Mineral Resources

Hazardous Materials Release			
First Name	**Last Name**	**Position Title**	**Agency**
*Kurt	Leben	Battalion Chief	Fire
Dean	Meyer	Deputy Chief	Fire
Anton	Sattler	Environmental Health Administrator	Environmental Health
Renae	Moch	Director	Bismarck/Burleigh Public Health
Crys	Kuntz	EPR Coordinator SWC Region	Public Health
Corey	King	Emergency Response Specialist	NOAA/National Weather Service
Nathan	Heinert	Meteorologist/Forecaster	NOAA/National Weather Service
John	Lippert	Safety & Emergency Management Coordinator	CHI St. Alexius Health
Brad	Erickson	Safety Director	Sanford Health
Derek	Lampkin	Hazmat Manager	Burlington Northern Santa Fe
Gary	Stockert	Emergency Manager	Emergency Management
Darrel	Nucech	GIS Coordinator	GIS
Jeff	Heintz	Director – Service Operations	Public Works
Keith	Demke	Director – Utility Operations	Public Works

Wildland Fire: Wildland Urban Interface			
First Name	**Last Name**	**Position Title**	**Agency**
*Jeff	Holte	Battalion Chief	Fire
Jackson	Bird	City Forester	Forestry
Greg	Smith	Operations Director	Bismarck Parks and Recreation
Corey	King	Emergency Response Specialist	NOAA/National Weather Service
Janine	Vining	Meteorologist	NOAA/National Weather Service
Gary	Stockert	Emergency Manager	Emergency Management
Darrel	Nucech	GIS Coordinator	GIS

Severe Summer Weather (excluding Tornado)			
First Name	**Last Name**	**Position Title**	**Agency**
*Dean	Meyer	Deputy Chief	Fire
Mike	Dannenfelzer	Communications Director	Combined Communications Center
Greg	Smith	Operations Director	Bismarck Parks and Recreation
Corey	King	Emergency Response Specialist	NOAA/National Weather Service
Tony	Merriman	Lead Meteorologist	NOAA/National Weather Service
Joely	Heavy Runner	Safety Director	United Tribes Technical College
Gary	Stockert	Emergency Manager	Emergency Management
Darrel	Nucech	GIS Coordinator	GIS

Shortage or Outage of Critical Materials			
First Name	**Last Name**	**Position Title**	**Agency**
*Gary	Stockert	Emergency Manager	Emergency Management
Jeff	Heintz	Director of Service Operations	Public Works
Renae	Moch	Director	Bismarck/Burleigh Public Health
Mike	Dannenfelzer	Communications Director	Combined Communications Center
Burt	Pfliger	Environmental Health Specialist	Environmental Health
Crys	Kuntz	EPR Coordinator SWC Region	Public Health
Matt	Puliafico	Border States Electric	Border States Electric
Mike	Schoepp	Region Gas Superintendent	Montana Dakota Utilities
Craig	Lohstreter	Region Electric Superintendent	Montana Dakota Utilities

Tornado			
First Name	**Last Name**	**Position Title**	**Agency**
*Dean	Meyer	Deputy Chief	Fire
Greg	Haug	Airport Manager	Airport
Tom	Tkach	Supervisor	Combined Communications
Mike	Dannenfelzer	Communications Director	Combined Communications Center
Brady	Blaskowski	Building Official	Community Development
Dwight	Offerman	Lt. - Patrol	Police
Crys	Kuntz	EPR Coordinator SWC Region	Public Health
Renae	Moch	Director	Public Health
Greg	Smith	Operations Director	Bismarck Parks and Recreation
Corey	King	Emergency Response Specialist	NOAA/National Weather Service
Joely	Heavy Runner	Safety Director	United Tribes Technical College
Gary	Stockert	Emergency Manager	Emergency Management
Jared	Auch	GIS Analyst	GIS
Darrel	Nucech	GIS Coordinator	GIS

Train Derailment			
First Name	**Last Name**	**Position Title**	**Agency**
*Kurt	Leben	Battalion Chief	Fire
Keith	Hunke	Assistant City Administrator	Administration - Bismarck
Burt	Pfliger	Environmental Health Specialist	Environmental Health
Renae	Moch	Director	Public Health
Derek	Lampkin	Hazmat Manager	Burlington Northern Santa Fe
Corey	King	Emergency Response Specialist	NOAA/National Weather Service
John Paul	Martin	Warning Coordination Meteorologist	NOAA/National Weather Service
Gary	Stockert	Emergency Manager	Emergency Management
Jared	Auch	GIS Analyst	GIS
Darrel	Nucech	GIS Coordinator	GIS
Jeremy	Curtis	Officer (Bomb Commander)	Police

Winter Storm			
First Name	**Last Name**	**Position Title**	**Agency**
*Jeff	Heintz	Director of Service Operations	Public Works
Jonathon	Hildremyr	Fire Captain	Fire
Jeff	Holte	Battalion Chief	Fire
Glen	Ternes	Sgt.	Police
Crys	Kuntz	EPR Coordinator SWC Region	Public Health
Renae	Moch	Director	Public Health
Greg	Smith	Operations Director	Bismarck Parks and Recreation
Corey	King	Emergency Response Specialist	NOAA/National Weather Service
Joely	Heavy Runner	Safety Director	United Tribes Technical College
Gary	Stockert	Emergency Manager	Emergency Management
Darrel	Nucech	GIS Coordinator	GIS
Randy	Ziegler	Deputy Chief	Police

Participant Roster

Bismarck Mitigation Planning Kick-Off Meeting: Plan Development Coordination Meeting

January 16, 20114

SIGN IN

Bismarck Mitigation Plan Initial Plan Development Coordination Meeting

January 16, 2014 Kick-Off Meeting

Name	Position Title	Department - Bismarck
Mark A Berg	Traffic Engr	Engrng
Keith Demke	Director - Utility Operations	Public Works
Jeff Heintz	PW Director - Service Ops	PW
Sheila Hillman	Director Finance	Finance
Darrel Nucech	GIS Analyst	Finance
Joel Boespflug	Fire Chief	FD
Dave Meyer	Deputy Chief	"
Randy Boyle	Deputy Chief	Police
Dan Donlin	Chief of Police	Police
Bill Wocken	City Administrator	Admin
Tim Thorsen	Airport Ops Mgr	Airport
Bob McConnell	HR Director	HR
Gloria David	Public Information Officer	Admin.

SIGN IN

Bismarck Mitigation Plan Initial Plan Development Coordination Meeting

January 16, 2014 Kick-Off Meeting

Name	Position Title	Department - Bismarck
Keith Hunke	Asst. City Administrator	Admin - Bismarck
Anton Sattler	EH Administrator	Fire
Dave Dravitch	Deputy Chief	Police
Renae Moch	Director	BBPH
Franz Blaskowski	Plans Examiner/Interim Building Official	Community Development
Judy Stockert	Emergency Manager	Fire / Emergency Management

Bismarck Mitigation Plan Development Kick-Off Meeting Invite List			
Name	**Department or Division**	**Name**	**Department or Division**
Keith Hunke	City Administration	Bill Wocken	City Administration
Joel Boespflug	Fire	Dan Donlin	Police
Jeff Heintz	Public Works	Renae Moch	Public Health
Carl Hokenstad	Community Development	Mel Bullinger	Engineering
Brady Blaskowski	Community Development	Anton Sattler	Environmental Health
Greg Haug	Airport	Tim Thorsen	Airport
Charlie Whitman	Attorney	Mary Jane Schmaltz	Library
Bob McConnell	Human Resources	Charlie Jeske	Civic Center
Mike Dannenfelzer	Combined Communications	Sheila Hillman	Finance
Wayne Stoppler	IT/GIS	Darrel Nucech	GIS
Keith Demke	Public Works	Bill Brown	

Bismarck Mitigation Plan – Initial Plan Development Coordination Meeting

January 16, 2014 Bismarck Public Works, 1:30 PM

Agenda

A. Plan Requirements Overview – Bismarck and FEMA
B. Identify Hazards
C. Review/Revise Stakeholder Meeting Invite List
D. Future Planning Meetings Overview and Timeline
E. Identify Hazard Specific Mitigation Plan Review Teams
F. Overview of Key Action Items for Hazard Specific Plan Review Teams
    i. Review/revise current Mitigation Plan content
    ii. Review stakeholder input and public input
    iii. Enhance risk and vulnerability assessments (develop "problem statements")
    iv. Recommend Hazard Specific Mitigation Action(s) based on Vulnerabilities / Problem Statements
G. Department/Division mitigation capabilities summaries

Meeting Summary

Bismarck Mitigation Plan – Initial Plan Development Coordination Meeting

January 16, 2014 Bismarck Public Works, 1:30 PM

A. Plan Requirements Overview – Bismarck and FEMA
    - Keith Hunke and Gary Stockert provided an overview of the mitigation planning requirements.
B. Identify Hazards
    - Potential hazards along with the various sources of hazard identification (ie: Bismarck EOP, NDDES mitigation plan, THIRA, etc) were discussed. Participants identified natural, technological, and human-cause hazards to address within the mitigation planning efforts. A Hazard identification worksheet was included in the agenda packet. It was revised to include Biological Infestation, Geologic Hazards, Train Derailment, and Shortage or Outage of Critical Materials or Infrastructure.
C. Review/Revise Stakeholder Meeting Invite List
    - Gary Stockert provided a draft list of stakeholders to invite to the next meeting (Stakeholder mitigation planning meeting). The list was revised to include additional agencies/personnel. The stakeholder invite list is a separate document.
D. Future Planning Meetings Overview and Timeline
    - The agenda packet included a document entitled "Bismarck Mitigation Plan – Proposal for Plan Development Strategy." The proposed planning/outreach strategy was discussed. No changes were made to the proposed plan development/outreach strategy.
E. Identify Hazard Specific Mitigation Plan Review Teams
    - A draft spreadsheet entitled "Hazard Specific Mitigation Planning Teams" was included in the agenda packet. For each hazard, a department was identified to provide a lead team member. Participants indicated which departments would provide personnel to participate on the various hazard specific teams.
F. Overview of Key Action Items for Hazard Specific Plan Review Teams
    - Gary Stockert provided an overview of the planning expectations or requirements of the hazard specific teams to include recommending mitigation actions based on vulnerabilities/problem statements. In turn, these problem statements would be based on hazard analysis (ie: risk, impact, and vulnerability assessments).
G. Department/Division mitigation capabilities summaries
    - Gary Stockert informed the participants of the intention to include "mitigation capabilities" as an important element of the mitigation plan.

Bismarck Mitigation Plan Stakeholder Meeting: January 30, 20114

Bismarck Mitigation Plan Stakeholder Meeting Invite List			
Name	**Agency**	**Name**	**Agency**
Dan Schaefer	Metro Area Ambulance	Craig Lohstreter	Montana Dakota Utilities
Wes Engbrecht	Capital Electric	Brad Erickson	Sanford Health
Greg Busch	St. Alexius Medical Center	Tom Painter	Airport Rescue and Fire Fighting
Mary Siverson	RSVP+	Melanie Moen	American Red Cross
Tim Sell	Salvation Army	Dan Sweeney	Chaplaincy
Kris Magstadt	Long Term Care Association	Robin Were	BisMan Transit
Becky LaBella	Bismarck Public Schools	John Lemieux	Bismarck State College
John Herold	St. Mary's Central High School		Light of Christ Catholic Schools
	Shiloh Christian School	Mary Senger	Burleigh County Emergency Mgmnt
Marcus Hall	Burleigh County Highway Dept	Patrick Heinert	Burleigh County Sheriff's Office
Tom Doering	Morton County Emergency Mgmnt	John Paul Martin	NOAA/National Weather Service
Corey King	NOAA/National Weather Service	Kelvin Hullet	Bis/Man Chamber of Commerce
Randy Bina	Bis Parks and Recreation Dept	Joely Heavy Runner	United Tribes Technical College
Robert Keller	University of Mary	Kim Osadchuck	Burleigh County Social Services
James Prochniak	ND Highway Patrol	Mark Quire	Civil Support Team
Greg Wilz	ND Dept of Emergency Services	Todd Sando	State Water Commission
Facility Management Division	State Capitol	Auditor	City of Lincoln
Jim Neubauer	City of Mandan	Derek Lampkin	BNSF
Allen Klein	Bismarck Rural Fire	Ralph Gabrysh	USACE
Shad Piehl	Rasmussen College	Dot Frank	Bis/Man Homebuilders Association
Bill Brown	ND Dept of Emergency Services	Randy Aden	Dakota Missouri Valley Railroad
Patrick Flanagan	Civil Support Team		
The same City Departments were also invited. See "kick-off" invite list.			

SIGN IN

Bismarck Mitigation Plan Initial Plan Development Stakeholder Meeting

January 30, 2014

Name	Position Title	Agency/Organization	E-mail
Jessica Douglas	Environmental Health Spec.	City of Bismarck Environ. Health	jdouglas@nd.gov
RANDY LAMBERTH	FACILITY MANAGER	UNITED TRIBES TECH. COLLEGE	rlamberth@utte.edu
Joely Heavy Runner	Safety Director	UTIC	Jheavyrunner@utte.edu
Corey King	Emergency Response Specialist	NOAA/NWS	Corey.King@noaa.gov
Tom Painter	ARFF Chief	Bis Airport	Tom.Painter@flymetro.com
Greg Haug	Airport Mgr.	Bis Airport	ghaug@nd.gov
Becky LaBella	Safety Coordinator	Bismarck Public Schools	becky.labella@bismarckschools.org
Cydalynn Kuntz	Bismarck Burleigh Public Health	/ EPA Coordinator	ckuntz@nd.gov
Kurt Leben	Battalion Chief	Bis. Fire Dept	kleben@nd.gov
Greg Smith	Operations Director	Bismarck Parks	gsmith@bisparks.org
Mike Donnelleher	Communications Director	Bis/Ber Combined Comm	mdonnelleher@nd.gov
Gary Stockert	Emergency Manager	Bismarck	gstockert@nd.gov

SIGN IN

Bismarck Mitigation Plan Initial Plan Development Stakeholder Meeting

January 30, 2014

Name	Position Title	Agency/Organization	E-mail
Mary Senger	Emergency Manager	Burleigh Emergency Mgt	msenger@nd.gov
Jeanette Earle	HMA - Mitigation	NDDES	jearle@nd.gov
Derek Lamberson	HAZMAT manager	BNSF	Derek.Lamberson@bnsf.com
Burt Pfliger	EHP - Fire	Bismarck Fire	bpfliger@nd.gov
Kris Magstadt	ED Director	ND Long Term Care	kris@ndltca.org
Beth Johnson	VP of QIA	HIT, Inc.	bjohnson@hitinc.org
Rob Carlson	Battalion Chief	Bismarck Fire	rcarlson@nd.gov
Brooks Martin	Battalion chief	Bismarck Fire	bwmartin@nd.gov
Craig Lohstroter	Electric Superintendent	MDU	craig.lohstroter@mdu.com
Greg Busch	Dir. of Safety/Sec.	St. Alexius	gbusch@primecare.org
Linda Brew	Admin Staff Officer	Burleigh Co. Social Serv	lbrew@nd.gov

Bismarck Mitigation Plan Stakeholder Meeting
January 30, 2014 Bismarck Public Works, 1:30 PM

Agenda

A. Plan Requirements Overview
B. Hazard Identification
C. Future Planning Meetings Overview and Timeline
D. Hazard Specific Mitigation Plan Review Teams
E. Overview of Key Action Items for Hazard Specific Plan Review Teams
F. Stakeholder Participation Form

Meeting Summary
Bismarck Mitigation Plan Stakeholder Meeting
January 30, 2014 Bismarck Public Works, 1:30 PM

Meeting Summary

A. Plan Requirements Overview
   - Gary Stockert provided a brief overview of planning requirements, focusing on the requirement to meet city strategic plan goals relating to enhancing safety of the citizens/community. The plan purpose/mission statement was also reviewed.

B. Hazard Identification
   - The hazards identified during the initial mitigation meeting (January 16, 2014) were reviewed. Recommendations were made via participant feedback forms to include additional hazards: active shooter, pandemic influenza, and biological terrorism.

C. Future Planning Meetings Overview and Timeline
   - Gary Stockert provided an overview of the planning development strategy, focusing on planning process relevant to the stakeholders: public input and hazard specific mitigation planning team participation opportunities as well as the final mitigation meeting to prioritize mitigation actions.

D. Hazard Specific Mitigation Plan Review Teams
   - Gary Stockert provided an overview and invite regarding the hazard specific mitigation planning teams. A participant feedback form was distributed as a method of identifying those interested in supporting the various teams throughout the planning process.

E. Overview of Key Action Items for Hazard Specific Plan Review Teams
   - Gary Stockert provided an overview of the planning expectations or requirements of the hazard specific teams to include recommending mitigation actions based on vulnerabilities/problem statements. In turn, these problem statements would be based on hazard analysis (ie: risk, impact, and vulnerability assessments).

F. Stakeholder Participation Form **See Next Page**
   - A stakeholder mitigation planning participation form was distributed as a method to receive stakeholder input regarding hazards as well as how they would like to support the mitigation planning process (ie: sign up to support a hazard specific mitigation planning team).
   - The form also requested input on additional stakeholders and points of contact as well as any ideas on hazards, vulnerabilities, and suggested mitigation actions. The forms included feedback on hazards and additional stakeholders to contact.
   - Seventeen (17) forms were completed and returned as of February 4, 2014.

Bismarck Hazard Mitigation Plan Development – Stakeholder Participation
Hazard Specific Planning Teams and/or Plan Review

Name _____ Title: _____

Agency _____

E-mail or phone contact: _____

✓ **I would like to participate as a planning team member to help identify vulnerabilities, develop problem statements, and identify mitigation actions (ideas) for the hazards checked below.**

	Communicable Disease		Fire		Aircraft Accident
	Dam Failure		Wildland Fire		Train Derailment
	Drought		Winter Storm		Shortage or Outage of Critical Materials or Infrastructure
	Flood		Biological Infestation		
	Thunderstorm		Geologic Hazards		
	Tornado		Hazardous Materials Release		

Primary tasks of each hazard specific planning team:

- Develop/enhance hazard analysis, risk and vulnerability assessments.
- Develop Problem Statements (based on the vulnerabilities)
- Recommend and prioritize recommended mitigation actions.

✓ **I am able to support the mitigation plan development in the following way(s):**

✓ **I recommend the following agencies/individuals be contacted. They would likely want to participate as a hazard specific planning team member or provide feedback on the mitigation plan.**

Agency	Name	Hazard or Area of Expertise

Stakeholder or Public Citizen Input

Hazard:
Vulnerability(s):
Recommended Mitigation Action(s):

Rosters – Hazard Specific Mitigation Planning Team Meetings

Tornado	August 14, 2014

Bismarck Tornado Mitigation Planning Meeting – SIGN IN - August 14, 2014

Name	Agency	Position Title
Jared Auck	City of Bismarck GIS	GIS Analyst
Corey King	NOAA/NWS Bismarck	Emergency Response Specialist
Darrel Nuccio	City of Bismarck GIS	GIS Coordinator
DWIGHT OFFERMAN	BISMARCK PD	LT. - PATROL
TOM TUNCA	COMBINED COMMUNICATIONS	SUPERVISOR
Dean Meyer	Fire	Deputy Chief
Greg Smith	Parks & Rec	Operations Director
Greg HAUGE	Bis Airport	Airport Mgr
Renae Moch	Public Health	Director
Gary Stockert	Bismarck Emerg Mgmt Div.	Emergency Manager

Dam Failure	October 13, 2014

Bismarck Dam Failure Mitigation Planning Meeting – SIGN IN – October 13, 2014

Name	Agency	Position Title
Keith Hunke	City of Bismarck	Asst. City Administrator
RANDY LAMBERTH	UNITED TRIBES TECH. COLLEGE	ASST. FACILITIES MANAGER/PS NORTHAC LIFE
Mike Dannenfelzer	Bismarck/Burleigh Communications	Communications Director
MEL BURLINGER	CITY OF BISMARCK	CITY ENGINEER
Bob McConnell	City of Bismarck	HR Director
Gary Stockert	Bismarck Emergency Mgmt	Emergency Manager

Shortage or Outage of Critical Materials	October 23, 2014

Bismarck Shortage of Critical Materials Mitigation Planning Meeting – SIGN IN – October 23, 2014

Name	Agency	Position Title
Craig Lohstreter	MDU	Region Electric Superintendent
Mike Schoepp	MDU	Region Gas Superintendent
Renae Moch	BBPH	Director of Public Health
Jeff Heintz	Bis. PW	Director
Mike Dannenfelzer	BBCCC	Director
Gary Stockert	Bis Emergency Mgmt	Emergency Manager

Train Derailment	November 3, 2014

Bismarck Train Derailment Mitigation Planning Meeting – SIGN IN – November 3, 2014

Name	Agency	Position Title
Jeremy Curtis	Bismarck Police	Bomb Squad / Detective
Bart Pfleger	Bismarck Fire/EM	EMP
Keith Hunke	Bis Admin	Asst City Admin.
Jared Auck	Bismarck GIS	GIS Analyst
Kurt Leben	Bismarck Fire	Bat. Chief
Corey King	NWS Bismarck	Emergency Response Specialist
Renae Moch	Public Health	Director
John Paul Martin	NOAA - NWS Bismarck	Warning Coordination Meteorologist
Derek Lampkin	BNSF By Phone 763-782-3350	Manager - Haz Mat Field Operations + EM Response
Gary Stockert	Bismarck Emergency Mgmnt	Emergency Manager

Wildland Fire	November 4, 2014

Bismarck Wildland Fire Mitigation Planning Meeting – SIGN IN – November 4, 2014

Name	Agency	Position Title
Wade Jackson Bird	PW - Forestry	City Forester
Gary Stockert	Bismarck Emergency Mgmnt	Emergency Manager
Greg Smith	Bismarck Parks	Operations Director
Jeff Holte	Bismarck Fire	Battalion Chief
Janine Vining	NOAA - NWS	Meteorologist
Corey King	NOAA - NWS	Emergency Response Specialist

Winter Storm	November 13, 2014

Bismarck Winter Storm Mitigation Planning Meeting – SIGN IN – November 13, 2014

Name	Agency	Position Title
Corey King	NOAA-NWS Bismarck	Emergency Response Specialist
Jeff Holte	Bismarck Fire	Battalion Chief
Jeff Hunke	Bis PW	Director PW Services
Jonathan Hildreman	Bismarck F.D.	Captain
Gary Stockert	Bismarck Emergency Mgmnt	Emergency Manager
Colin Turner	Bismarck PD	Lt.

Severe Summer Weather (Thunderstorm, Extreme Heat)	November 19, 2014

Bismarck Severe Summer WX (Thunderstorm/Extreme Heat) Mitigation Planning Meeting – SIGN IN – November 19 2014

Name	Agency	Position Title
Corey King	NOAA NWS Bismarck	Emergency Response Specialist
Tony Merriman	NWS Bismarck	Lead Meteorologist
Greg Smith	Bismarck Parks	Operations Director
Dean Meyer	Bismarck Fire	Deputy Chief
Gary Stockert	Bismarck Emergency Mgmt	Emergency Manager
Mike Dannenfelzer	Combined Communications Center	Comm Director

Drought	December 3, 2014

Bismarck Drought Mitigation Planning Meeting – SIGN IN – December 3, 2014

Name	Agency	Position Title
Corey King	NOAA-NWS	Emergency Response Specialist
Allen J. Schlag	NOAA - NWS	Hydrologist
Gary Stockert	Bismarck E. Management	Emergency Manager
Charlie Whitman	Bis City Attorney	City Attorney
Keith Demke	Bismarck Public Works	Utility Operations Director

Biological Infestation (Urban Forest Damaging Pests)	December 22, 2014

Bismarck Biological Infestation (Urban Forest) Mitigation Planning Meeting – SIGN IN – December 22, 2014

Name	Agency	Position Title
Jeff Heintz	City of Bismarck, Public Works	Director of Public Works - Service Operations
JACKSON BIRD	CITY OF BISMARCK, PW	CITY FORESTER
Gary Stockert	Bismarck Emerg Mgmt	Emergency Manager

Communicable Disease	January 6, 2015

Bismarck Communicable Disease Mitigation Planning Meeting – SIGN IN – January 6, 2015

Name	Agency	Position Title
Tom Painter	Airport Fire	ARFF Chief
Crystalynn Kurtz	BBPH	EPR Coordinator
Deanna Sollhjem	ND DoH	Field Epi
Steve Pickard	ND DoH	CFED
Kirby Kruger	ND DoH	Director - Disease Control
Charlie Whitman	City	City Attorney
Anton Sattler	Env. Health	Env. Health Administrator
Renae Moch	BBPH	Director of Public Health
Gary Stockert	Bismarck Emerg. Mgmnt	Emergency Manager

Hazardous Materials Release	January 14, 2015

Bismarck Hazardous Materials - Mitigation Planning Meeting – SIGN IN – January 14, 2015

Name	Agency	Position Title
John Lippert	CHI St. Alexius Health	Safety + Emergency Mgmnt Coord.
Kurt Leben	Bismarck Fire	Battalion Chief
Keith Demke	Bismarck Public Works	Director - Utility Operations
Cory Kirg	NOAA/NWS Bismarck	Emergency Response Specialist
Nathan Heinert	NOAA/NWS Bismarck	Meteorologist/Forecaster
Anton Sattler	Bismarck Fire	Administrator
Gary Stockert	Bismarck Emergency Mgmnt	Emergency Manager

Fire	January 26, 2015

Bismarck - Fire Mitigation Planning Meeting – SIGN IN – January 26, 2015

Name	Agency	Position Title
Ron Kunda	BFD	FM
Brady Blaskowski	BCDD	Building Official
Rob Carlson	BFD	Battalion Chief
Gary Stockert	Bismarck Emerg. Mgmnt	Emergency Manager

Geologic Hazard	February 18, 2015

Bismarck Geologic Hazard Mitigation Planning Meeting – SIGN IN – February 18, 2015

Name	Agency	Position Title
Mel Bullinger	City Engineering Dept	City Engineer
Mark A Berg	City Engineering Dept	Traffic Engineer
Linda Oster	City Engineering	Design + Const. Engineer
Darrel Nucech	City IT/GIS	GIS Coordinator
Keith Demke	City – Public Works / Utilities	Director of Utility Operations
Greg Smith	Parks and Recreation	Operations Director
Jeff Heinz	City - Public Works - Service Ops	Director of PW - Service Ops
Gary Stockert	Bismarck Emergency Mgmnt	Emergency Manager

Flood	February 18, 2015

Bismarck Flood Mitigation Planning Meeting – SIGN IN – February 18, 2015

Name	Agency	Position Title
Jeff Solemsaas	Bismarck P.D.	Lt./Traffic Commander
Darrel Nucech	Bismarck IT/GIS	GIS Coordinator
Corey King	NOAA/NWS Bismarck	Emergency Response specialist
Keith Demke	Bismarck Public Works / Utility Ops	Director of Utility Operations
Terry Halstengard	Bismarck Public Works	Storm Water
Joaly Heavy Runner	UTTC	Safety Director
Jeff Heinz	Bismarck	Director of P.W. - Service Ops
Greg Smith	Parks & Rec	Operations Director
Mel Bullinger	Bismarck, Engineering	City Engineer
Bob McConnell	Bismarck, Human Resources	HR Director
Gary Stockert	Bismarck Emergency Mgmnt	Emergency Manager

Aircraft Accident	February 25

Bismarck Aircraft Accident Hazard Mitigation Planning Meeting – SIGN IN – February 25, 2015

Name	Agency	Position Title
Tom Painter	ARFF	Fire Chief
Jim Thorson	BIS Airport	Airport Ops Mgr
Matthew Remington	BIS Airport	Asst. Marketing & Ops MGR
Greg Haug	BIS Airport	Airport MGR
Cory King	NOAA, NWS	Emergency Response Specialist
Gary Stockert	Emergency Management	Emergency Manager
Kathleen Donahue	NDDES	Deputy Recovery & Mitigation

CERC Agenda
Final Mitigation Planning Meeting
March 11, 2015

Finalizing Bismarck Multi-Hazard Mitigation Plan

1. Meeting Purpose
    a. Plan Review and Approval Process: Local, State, Federal
    b. Plan Adoption via City Commission
2. Mitigation Plan Content and Format Overview
    a. Highlights: Sections 3, 4, and 10
3. Overview of Section 3: Mitigation Actions Summary
4. Executive Summary and Mitigation Strategy Overview
    a. Risk Assessment Overview
        i. Hazard Ranking – review and finalize
5. Mitigation Implementation Action Plan
    a. Additional Mitigation Action Items (updates)
    b. Review of Mitigation Assignments
    c. Review/update mitigation action time frame, cost and funding source where applicable
    d. Integrating requirements of mitigation plan into other planning mechanisms
    e. Review and Integration of Public Input
6. Mitigation Actions – Prioritizing
7. Review of Remaining Plan Sections
8. Post- Meeting: Discussion of Next Steps
    a. Comment Period / Public Review of Plan
    b. Other?
    c. Submitting to DES

Meeting Summary: In reviewing and the Multi-Hazard Mitigation Plan, the meeting participants focused on the mitigation strategy including the mitigation action implementation action plan. Public input received to date was reviewed for purposes of plan integration. Each plan section was reviewed to ensure it meets Bismarck mitigation planning needs as well as to prepare for a final public review/comment period and submitting to ND Department of Emergency Services for plan review/approval at the state and federal level (DES and FEMA).

Community Emergency Response Committee Meeting **Final Mitigation Planning Meeting**	March 11, 2015

SIGN IN SHEET - Bismarck Final Mitigation Planning Meeting (CERC) March 11, 2015

Name	Department	Position Title
Renae Moch	Public Health	Director
Keith Hunke	Administration	Asst. City Administrator
Joel Boespflug	BFD	Fire Chief
Jeff Heintz	Bis. P.W.	Director of PW
Dan Donlin	BPD	Chief
Gary Stockard	Emergency Mgmnt	Emergency Manager

Lead Planner / Emergency Management Meetings Bismarck Emergency Management also met with the various lead planners to discuss mitigation planning strategy and to initiate hazard profile drafting, identification of existing mitigation capabilities, and to identify potential mitigation ideas. The Bismarck Emergency Manager worked in cooperation with the various lead planners to prepare for the mitigation planning team meetings and to develop initial draft mitigation plan content.		
Hazard: Lead Planner Meeting	**City Department Lead Planner Assignment**	**Date**
Tornado	Fire	February 27, 2014
Hazmat and Train Derailment	Fire	March 18, 2014
Wildland Fire	Fire	March 20, 2014
Fire	Fire	March 21, 2014
Tornado	Fire	March 28, 2014
Flood	Public Works	July 1, 2014
Communicable Disease	Public Health	August 6, 2014
Geologic Hazard	Engineering	August 14, 2014
Fire	Fire	August 19, 2014
Winter Storm and Biological Infestation	Public Works/Forestry	August 22, 2014
Dam Failure	Administration	September 2, 2014
Wildland Fire	Fire	September 25, 2014
Communicable Disease	Public Health	October 1, 2014
Wildland Fire	Fire	October 22, 2014
Shortage or Outage of Critical Materials	Team Meeting	October 23, 2014
Active Shooter	Police	November 13, 2014
Aircraft Accident	Airport	November 17, 2014
Flood	Public Works	November 18, 2014
Communicable Disease – Environmental Health	Environmental Health	December 2, 2014
Fire	Fire	December 3, 2014
Hazmat Release	Fire	December 4, 2014
Geologic Hazard	Engineering	December 8, 2014
Active Shooter	Police	December 30, 2014
Fire	Fire	January 12, 2015
Active Shooter	Police	February 23, 2015
The Active Shooter hazard profile was developed via lead planner meetings and finalized via e-mail communications between Emergency Management and Bismarck Police Department.		

Public Input Summary

At the start of the Multi-Hazard Mitigation Plan development process, the City of Bismarck and Burleigh County invited public input via website surveys conducted in February/March 2014 as well as invitation to a public meeting held at the Bismarck Public Library in February of 2014. Again in March 2015, Bismarck Emergency Management promoted and invited public input via the same website survey.

Bismarck and Burleigh combined, via website surveys, received 61 responses. The concerns and ideas expressed were reviewed and integrated during the hazard specific mitigation planning meetings. The public input was found to be consistent with the mitigation ideas identified by hazard specific planning teams for consideration. Public input regarding mitigation actions were integrated into the planning process via the hazard specific hazard mitigation planning team meetings and the final Community Emergency Response Committee (CERC) meeting.

Public Input - Mitigation Ideas Summary from the public input survey via Bismarck:

- Flood
    - Enforce existing ordinances and building codes relevant to urban flooding, erosion control, and river flooding
    - Public Education regarding FEMA and local guidelines/requirements
- Local Traffic Concerns: Although not within the scope of this mitigation plan, these concerns were shared with Bismarck Police Department.
- Train Derailment
    - Implement a slower speed

Based on the Burleigh County website survey feedback (57 responses), the hazards selected as highest threat include Severe Summer Weather (21 responses), Flood (11), Severe Winter Weather (10), and Hazardous Materials Release (6).

Public Input Mitigation Ideas Summary from the public survey via Burleigh County:

- Severe Summer Weather
    - Public Education/Awareness
- Flood Mitigation and Preparedness:
    - Levee Construction
    - Grade Raises
    - Flood Response Plans
    - Public Education
    - Zoning (more restrictive)
    - Garrison Dam flood control
- Severe Winter Weather:
    - Trees (snow fences)

- Hazardous Materials Release:
    - Build a pipeline to move oil
    - Designate Hazmat routes
    - Joint Training and Exercises

An opportunity to review and provide comment on the Bismarck Draft Multi-Hazard Mitigation Plan was publicized. The mitigation plan was made available for review via the city's website on the home page. Comments were limited to minor corrections and general positive comments about the plan and the planning project.

Additional Public Input

Following the 2011 flood event, Bismarck held two public input meetings in 2012 via contract with Apex Engineering and implemented mitigation actions which are identified in Section 3 as pre-existing mitigation.

Bismarck Emergency Management conducts or participates in on-going communications with the public regarding all phases of emergency management, including mitigation. Some of the venues that have provided opportunity for input regarding hazards and mitigation ideas during the planning process include:

- National Weather Service Open House: September 13, 2014
- Local Emergency Planning Committee Meeting: November 12, 2014
    - Included discussion on hazmat route study preliminary results
- Presentation for Boy Scouts: February 11, 2014
- Local Business Meeting – KK BOLD; re Train Derailment Hazard: May 20, 2014
- Local Business Meeting – Plains Commerce Bank; re Tornado Safety/Mitigation: June 26, 2014
- Local Business Meeting - City Air Mechanical re Train Derailment and Tornado: June 30, 2014
- Presentation for Boy Scouts: September 3, 2014
- Knollwood Condos Association Meeting: September 9, 2014
- Various Media including Live Interview interactions regarding Train Derailment Hazard
- Chamber of Commerce members – Train Derailment Tabletop Exercise: October 12, 2014

<u>Previous Mitigation Planning Efforts</u>

The official mitigation planning process in the development of this Multi-Hazard Mitigation Plan began on January 6, 2014. However, previous planning efforts included the development of a draft community specific mitigation plan initiated in 2009. In developing the previous draft, various public input and mitigation planning meetings resulted in mitigation ideas that were completed and are now listed as "pre-existing" mitigation.

Public Input Opportunity

Public Input – Open Meeting Invite	February 20, 2014

Page 2B ■ Thursday, February 20, 2014

Emergency managers seek comment

Burleigh County and Bismarck emergency managers are seeking comments about how to make the community safer from potential hazards. Residents can share their ideas about Bismarck and Burleigh County mitigation plans Monday at the Bismarck Public Library. The meeting begins at 5:30 p.m.

Participants can share ideas and identify potential community-wide hazards and mitigation approaches that would lower risk to the community. Comments received will be used to draw up a specific community mitigation plan.

For more information, visit www.bismarck.org or www.Burleigh.co.com.

Public Input Meeting Agenda	February 24, 2014

February 24, 2014
7:00-8:00 PM
Bismarck Library, Room B

Agenda

1. Mitigation Plans – Bismarck and Burleigh
2. Mitigation Plan Purpose
3. Hazards Overview
4. Public Input: Hazard Identification
5. Public Input: Identification of hazard related Vulnerabilities
6. Public Input: Identification of Mitigation Actions

Public Input Invite via City Website	March 3, 2014

You are here:Home > Headlines & Announcements

Administration

Posted on March 3, 2014

Public Input Requested for Development of Bismarck Mitigation Plan

The City of Bismarck is seeking your input on how we can make our community safer from all potential hazards. You're invited to participate and share your ideas regarding the development of the Bismarck community specific mitigation plan. Please complete the survey in the link below to provide your thoughts regarding hazards that concern you, share your ideas on areas of vulnerability as well as any mitigation (prevention) suggestions that you may have. Your survey input will be shared with hazard specific planning teams.

Bismarck Mitigation Planning Public Input Survey

Next =>
Mayor Warford Declares March "Mylanna Awareness Month"

Public Input Survey via City of Bismarck Website	February/March 2014 and March 2015

You are here: Home > Forms

Bismarck Mitigation Planning - Public Input Survey

Bismarck is seeking your input on how we can make our community safer from all potential hazards.

Bismarck is developing a community specific mitigation plan to ensure we identify risks and vulnerabilities that may be addressed through mitigation efforts.

Your input helps ensure hazards along with associated risks and vulnerabilities are identified as well as suggested mitigation (preventative) actions.

You may complete this survey multiple times as you wish, focusing on a separate hazard each time.

Mitigation Definition: Sustained action taken to reduce or eliminate long-term risk before an incident occurs.

Mitigation Planning Purpose Statement: To protect life, property, environment, economy, and quality of life within the City of Bismarck from hazard/disasters through mitigation planning efforts to include identification of applicable mitigation strategies to eliminate or minimize risk and/or impact.

To take survey, simply click within the text boxes and type your responses.

Survey time will vary depending on your level of response to questions 1 through 3. It should take less than one minute to complete questions 4 through 10.

Hazard Identification:

1. Identify one significant hazard of highest concern to you which has potential for significant impact to our community. The hazard may be a natural hazard, human-caused, or technological hazard. A sample list is included at the end of this survey for your reference. You may repeat this survey to identify additional hazards as desired.

Indentification of Related Risk and Vulnerability:

2. Based on the one hazard you identified in question #1, describe the risk and the primary vulnerability(s) in your opinion. "Risk" is the potential for damage or loss (frequency and likelihood of occurrence). "Vulnerability" may be described as community assets (people, places, things) which are susceptible to damage or injury from the hazard.

3. Based on the vulnerability(s) you described in #2, what mitigation

(preventative) measures would you recommend be considered? Mitigation measures are those actions taken before an incident that eliminate or minimize risk, impact or vulnerability.

General Guidance Regarding Question #3: Mitigation measures are investments in the community's future safety and sustainability. Mitigation helps to prevent injury and loss of life, prevent damage to community assets, and reduce risk. Types of mitigation actions typically fall into these categories: Local Plans and Regulations (ex: ordinances, building codes, zoning, etc.), Structural Projects (ex: Modifying existing structures and infrastructure to protect or remove from a hazard area), Natural System Protection (ex: erosion control or wetlands restoration) and Education and Awareness Programs.

4. I live in Bismarck.	Yes	No
4a. I live in Burleigh County?	Yes	No
5. I work in Bismarck.	Yes	No
6. I live in Morton County	Yes	No
7. Name (Optional)		
8. Phone (optional)		
9. Email (Optional)		
10. General Comments (Optional)		

Specific hazards to be addressed through mitigation planning efforts in 2014 and beyond are not limited to those listed below. However, this list provides for examples of wide-area hazards potentially affecting all or much of the community. You may use this list to assist you with ideas if you wish to complete the survey again. When identifying hazards, you are not limited to the list below.

• Biological Infestation	• Active Shooter
• Communicable Disease	• Aircraft Accident
• Dam Failure	• Hazardous Materials Release
• Drought	• Homeland Security Incident (ex: Terrorism
• Flood	• Train Derailment
• Fire • Wildland Fire	• Shortage or Outage of Critical Materials or Infrastructure (ex: extended power outage)
• Geologic Hazard (ex: landslide)	• Tornado
• Thunderstorm	• Winter Storm

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Public Input Opportunity March 2015 – Public Input Website Survey	
KXNews HIGH DEFINITION NEWS WEATHER	Bismarck Emergency Manager conducted an interview with KX News on March 3, 2015 to continue promoting and welcoming public input throughout the mitigation planning process as well as continued public involvement after plan completion via plan review and comment at any time.

City of Bismarck Takes Input on Multi-Hazard Mitigation Plan VIDEO INCLUDED

Updated: Mar 03, 2015 6:15 PM CST

The City of Bismarck is collecting public input on how to deal with potential hazards...

Bismarck

NEWS RELEASE

For Immediate Release:
March 2, 2015

For More Information Media Contact:
Gary Stockert
Bismarck Emergency Manager
Phone: (701) 222-6727

Bismarck Seeks Citizen Input on Development of Multi-Hazard Mitigation Plan

BISMARCK, N.D. – The City of Bismarck is seeking citizen input on how we can make our community safer from potential hazards. Bismarck residents are invited to share their ideas regarding the development of the Bismarck Community Specific Multi-Hazard Mitigation Plan by completing an on-line survey. Citizen input will be accepted through Friday, March 13. The survey is contained in the link below:
http://nd-bismarck.civicplus.com/forms.aspx?fid=272

As a survey participant, citizens have the opportunity to express their ideas and identify potential community-wide hazards, related vulnerabilities and mitigation approaches that would minimize risk and impact to the community. Information shared in the survey will be gathered to identify key themes, and allow subsequent planning and action in the development of the community specific mitigation plan. The draft plan document will also be made available for review and comment at a later date. The document will be made available upon completion and approval at www.bismarcknd.gov/emergencymanagement.

For more information visit www.bismarcknd.gov

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Public Input Opportunity

See News Release – previous page

Mitigation Plan – Comment Period – Public Input

Legal Notice Submitted to Bismarck Tribune March 17, 2015:

Bismarck Multi-Hazard Mitigation Plan – Public Comment Period.

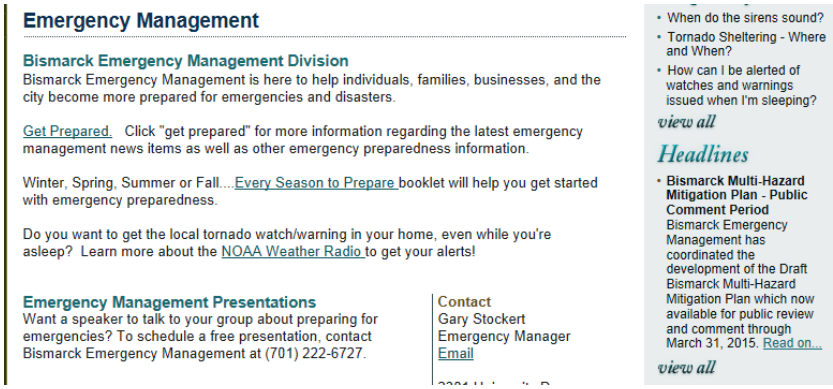
Notice is hereby given that Bismarck Emergency Management has coordinated the development of the Draft Bismarck Multi-Hazard Mitigation Plan which is now available for public review and comment through March 31, 2015.

The plan identifies and profiles hazards to assess risk and vulnerability relating to natural, technological, and human-caused hazards, and identifies mitigation strategies and specific mitigation actions for reducing potential impact. Comment regarding the plan including recommendations on how to make our community safer from potential hazards/disasters is welcome.

The Draft Bismarck Multi-Hazard Mitigation Plan is available for review and comment at www.bismarcknd.gov/emergencymanagement. Comments regarding the plan can be e-mailed to Gary Stockert, Emergency Manager at gstockert@bismarcknd.gov or by calling 701-222-6727. Written comments regarding the plan should be postmarked by March 31, 2015 and mailed to Gary Stockert, Emergency Manager, Bismarck Emergency Management, 2301 University Drive Bldng #21, 58504.

Once the Multi-Hazard Mitigation Plan is finalized, it will remain available at www.bismarcknd.gov/emergencymanagement for review and comment at any time throughout the 5-year planning cycle.

March 18, 2015: Public Review/Comment on Draft Mitigation Plan available on Bismarck Website



Bismarck Tribune
Public Notice
March 20, 2015

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Once the Multi-Hazard Mitigation Plan is finalized, it will remain available at www.bismarcknd.gov/emergencymanagement for review and comment at any time throughout the 5-year planning cycle.

3/20 - 20777783

Bismarck Emergency Management also notified area stakeholders by e-mail (March 20, 2015) regarding the availability of the mitigation plan available for review and comment. Notification by e-mail included those invited to the initial kick-off meetings in January 2014 as well as those involved in the plan develoment process.

Public Input Detail

Public Input Burleigh County Website Hazards of Concern – 57 responses	February 2014

4. Please select the one hazard you think is the highest threat to your area:

Value	Count	Percent %
Communicable Disease (Including Human, Animal, and Plant Diseases)	0	0.0%
Dam Failure	0	0.0%
Drought	1	1.8%
Flood (Including Riverine, Levee failure, Closed Basin, Ice Jam, and Flash Floods)	11	19.3%
Geologic Hazards (Including Landslide, Earthquake, and other Geologic/Mining Hazards)	0	0.0%
Hazardous Materials Release (Including Oil and Gas Industry)	6	10.5%
Homeland Security Incident (Including Multiple Types of Terrorism and Cyber-Terrorism)	3	5.3%
Severe Summer Weather (Including Tornadoes, Hail, Downbursts, Thunderstorm Winds, Lightning, and Extreme Heat)	21	36.8%
Severe Winter Weather (Including Blizzards, Heavy Snow, Ice Storms, and Extreme Cold)	10	17.5%
Shortage or Outage of Critical Materials or Infrastructure	2	3.5%
Transportation Accident (Including Vehicular, Railway, and Aircraft Accidents)	2	3.5%
Urban Fire or Structure Collapse	0	0.0%
Wildland Fire	1	1.8%
Windstorm	0	0.0%

Continued…

5. Please select the one hazard you think is the second highest threat to your area:

Value	Count	Percent %
Communicable Disease (Including Human, Animal, and Plant Diseases)	2	3.5%
Dam Failure	0	0.0%
Drought	0	0.0%
Flood (Including Riverine, Levee failure, Closed Basin, Ice Jam, and Flash Floods)	5	8.8%
Geologic Hazards (Including Landslide, Earthquake, and other Geologic/Mining Hazards)	0	0.0%
Hazardous Materials Release (Including Oil and Gas Industry)	6	10.5%
Homeland Security Incident (Including Multiple Types of Terrorism and Cyber-Terrorism)	3	5.3%
Severe Summer Weather (Including Tornadoes, Hail, Downbursts, Thunderstorm Winds, Lightning, and Extreme Heat)	18	31.6%
Severe Winter Weather (Including Blizzards, Heavy Snow, Ice Storms, and Extreme Cold)	10	17.5%
Shortage or Outage of Critical Materials or Infrastructure	0	0.0%
Transportation Accident (Including Vehicular, Railway, and Aircraft Accidents)	6	10.5%
Urban Fire or Structure Collapse	0	0.0%
Wildland Fire	5	8.8%
Windstorm	2	3.5%

Statistics	
Total Responses	57

6. Is there another hazard not previously listed that you think is a wide-scale threat to your area?

Value	Count	Percent %
Yes, please explain:	9	15.8%
No	48	84.2%

Statistics	
Total Responses	57

Open-Text Response Breakdown for "Yes, please explain:"	Count
Flooding due to an ice jam	1
Gangs, crime, drugs = homeland security issues not just "terrorism"	1
Gas Pipeline Rupture	1
Terrorist or Solar generated Electro-Magnetic Pulse	1
active shooter	1
crime	1
power outage	1
severe summer weather	1
traffic Increased	1

Continued…

10. In your opinion, what are some steps your local government could take to reduce or eliminate the risk of future hazard damages in your community?

Count	Response
1	Build a pipeline to safely move oil other than my tanker truck or railroad car.
1	Build levees
1	Build the Sibley Island levee to protect our community.
1	Build up S. Washinton Street and build a dike across Sibley Park continuing to Oahe Bend.
1	Commit to a levee plan now.
1	Continue the flood mitigation projects as monies allow
1	Dredge river south of Bismarck
1	Educate the public on preparedness and response to a disaster
1	Increase police, firefighters and first responders in Burleigh County.
1	Joint task force with Morton County for hazard/safety concerns.
1	Monitor severe weather and floods more closely.
1	Prepare residents of Burleigh County on how to react to natural diasters and who to call.
1	Prevention before the disaster happens
1	by having a better flood plan in plaice
1	flood planning is the biggest concern
1	keep the big dam empty come spring ,risk would be much less
1	levee/ dams, zoning, trees to prevent drifting snow
1	more awareness
1	rereduce legislation that makes it difficult for citizens to act
1	HazMat transportation controls. Designated HazMat routes through the county. Equipped and trained emergency response personnel. Enhanced weather alert systems to include additional warning devices. Training with other agencies - State, National Guard.
1	Increased communication with residents, although I do not live in a flood plan many of my friends are.
1	Community meetings/communication/preparedness training(encouraging locals to prepare with food/water/supplies 2-weeks on hand), hardening facilities/infrastructure/communication against EMP threat.
1	Improve roads including raising them 48th ave s, 12th st s, Oahe Bend, Sibley Dr. The work done last year by the county was deplorable. patch on the road here and there and ineffective culverts added. A complete waste of money. Emergency Management does a good job keeping us informed and with planning procedures.
1	Watch the water that is let out of the Garrison Dam. I know we had to be sacrificed for the better of the community but it sure is stressful when you are night shift workers and the shelter would not allow day sleepers. I never want to go through a flood again.
1	get training for local first responders, training scenerios, involve leaders from first responder agencies and develop preplans for different hazards
1	Planning and training the general public to understand that if they live in a high risk area, they should be prepared for the worst. They choose to live in the flood plain and mantate they are covered so the society does not have to pick up the bill for their choice.
1	You have done a great job with managing emergency situations, I am sure there is room for making adjustments. Thanks for taking the time and planning to make improvements.
1	Thinking Before Taking Action Will Go a LOng Ways>>>>>>>>>>>everyone needs to be Involved....
1	Re: prairie fires, we in the country need immediate information about the size and exact location of fire via specific radio/tv stations while the fire is happening so we can take necessary action to protect our property and farm animals.
1	Happy to hear Warford is leaving-- maybe we will get some actual visionaries running Bismarck. This community is reactive not proactive.
1	regarding floods, when trying to prepare in 2011, there were not many good resources to assess the chances of water reaching us. We are not considered in a flood zone even though we are a couple feet lower than many properties on the banks of the river. Water did find us eventually, but we had no idea where it would come from. A map of elevations

	was eventually made available but it would have been good to have one that was specifically designed to show flood potential, and have it much earlier.
1	One of my biggest current concerns is the ability of local communities to recover from a disaster if any infrastructure is damaged. It is difficult enough to find affordable housing with the building boom in the region, and a disaster would only exacerbate that problem. I think being prepared for a potential influx of out of town contractors is a potential big concern.
1	More restrictive zoning. We allow people to build in areas knowing that a disaster, such as a flood, is only a matter of time.
1	Stop supporting bismarck's expansion into the flood plains for one. Place stricter regulations on railway companies' use of older rail cars, the condition of the oil cars and the number of oil cars transported on any one load.
1	Support state and federal efforts to create pipeline infrastructure for transporting energy (oil, natural, gas) and mitigate truck and rail usage
1	Reroute semi truck that carry oil or gas from I-94 to other highway with less population. And improve emergency services to all especially deaf commuinity.
1	expand roads...i.e.66th st...other the Washington there are no other roads that so straight N and S...E and W at least there is the interstate. Also the brainless group who aloud people to build in the middle of the river. I mean really come on. Truly no common sense.
1	More combined agency drills including NDDES,Sheriff,Police,State Radio,Bismarck Central Dispatch,Department of Health,Sanford, St Alexius,Hazmat crews
1	Consolidate the Bismarck and Burleigh County Emergency Management offices into one organization under the county as it once was. This would ensure better coordination between the city and county during widespread emergencies, and better synchronize all other efforts on a day to day basis

Continued…

Public Input Received via Bismarck City Web-Site Surveys February/March 2014 and March 2015.						
Question 1: Hazard Identification	**Question 2: Vulnerability**	**Question 3: Mitigation Ideas**				
Identify one significant hazard of highest concern to you which has potential for significant impact to our community.	**Based on the one hazard you identified in question #1, describe the risk and the primary vulnerability(s) in your opinion.**	**Based on the vulnerability(s) you described in #2, what mitigation (preventative) measures would you recommend be considered?**	**Bismarck Resident (Yes/No)**	**Works in Bismarck (Yes/No)**	**Date Received**
flooding	medium risk people and places vulnerable especially along tributaries (small streams and creeks in NE & NW Bismarck) and Missouri river flood plain.	more stringent building codes, flood proof basement construction standards, more staff for stormwater enforcement.	Yes	Yes	3/4/2014
Water, development of subdivisions and having builders and landscapers follow what the city has implemented for correct water diversions and erosion control.	Risk is the loss of personal property, buildings, building values resale and arguments between neighbors.	Stay on builders and landscapers to use proper erosion control. Comment after comment I hear is "its cheaper to pay the cities fines that it is to do proper erosion control. Landscapers like builders should be certified some how. I suggest builder and landscapers must apply for building permits (builders do) but at the same time educate them on the correct water flow pattern the city has issued and sign a waiver they will go by these guidelines. I can give you my PERSONAL experience of a bad landscaper and I have three or four others fighting with water in there basements due to the neighbors landscaping or there own.	Yes	Yes	3/9/2014
Flood and building in areas that are above base flood elevation but without common knowledge of water flow or possible changes.	Risk, loss of life, buildings, values, resale, and homes going back to a bank. Losing community flood insurance by being put on probation by FEMA.	Knowledge to builders, engineers, the city officials on how flood is not just the river, it is heavy rain, rapid ice and snow melt. I know of several homes built after 1985 that where not built to FEMA guidelines and or county guidelines. One of which an engineer told the owner/builder as long as the main floor is two feet above BFE we are ok. This Senior engineer and I fought back and forth and then I showed him FEMA guidelines and city/county guidelines and what is considered a basement buy FEMA. A crawlspace in ND is a basement unless it is above ground and more people need to know this. I could go on forever on this topic.	Yes	Yes	3/9/2014

Public Input Received via Bismarck City Web-Site Surveys February/March 2014 and March 2015.						
Question 1: Hazard Identification	**Question 2: Vulnerability**	**Question 3: Mitigation Ideas**	**Bismarck Resident (Yes/No)**	**Works in Bismarck (Yes/No)**	**Date Received**
Identify one significant hazard of highest concern to you which has potential for significant impact to our community.	**Based on the one hazard you identified in question #1, describe the risk and the primary vulnerability(s) in your opinion.**	**Based on the vulnerability(s) you described in #2, what mitigation (preventative) measures would you recommend be considered?**			
General Comment: I am not just mad cause I have a water issue I am mad that builders are allowed to build in dumb areas and nothing is being considered (I don't feel. When a large structures come into developments after the fact it changes water flow to homes. KLJ comes to mind and I have evidence of the changes it has done on our street after it was built and asphalt laid down. #1 reason for flood in the nation is community development.					
Red Light runners. I have watched countless times someone or people go threw a red light on hwy 83 at every intersection. This is not just on hwy 83 but where I see it the most.	peoples lives.	We need more man power to help in N Bismarck and it is nothing for someone to run a red light cause they want to, or they are simply not paying attention to the road rather there cell phone. (I am guilty of liking my cell too) I think we all know we need better and more man power in this community. Growing pains or not we need to make it happen.	Yes	Yes	
General Comment: I watched three people go threw a red light on frontier and 3rd with a cop sitting right at the light first in line. He/she not sure was to busy on there laptop or didn't care.					3/9/2014
Train Derailment	high risk, especially if it involves an oil train. Vulnerability is people and places.	slower train speeds	Yes	Yes	3/4/2015

Public Input – Flood Specific. The official mitigation planning process began on January 6, 2014. However, Bismarck was active in mitigation planning activities prior to 2014 including public input collected following the 2011 flood event via contract with Apex Engineering.	January 17, 2012 Public Input Meeting

5. What should the City of Bismarck do to protect your property, should another ice jam or river flood happen in 2012?

- Hold the Corps of Engineers responsible
- Remove sandbar storm sewer channel – ask for NDNG assistance
- Permanent dikes – do it right and better – include paths?
- Add gauging stations
- Add communication with Burleigh/Morton/Mandan/State/Corps of Engineers
- Proactive blasting of ice jams
- Build permanent protection for residents
- Build permanent protection for critical infrastructure (i.e., wastewater plant, lift stations, water plant
- Continue monitoring and mapping river bottom/channel
- Does recreational activity (boating) on river affect erosion/sediment buildup?
- Timely public information (ice jam location, evacuation plans, protective measures to be placed)
- Leave levees in place and find ways to close any gaps
- Block drainage ditch west of current location
- Encourage people to buy flood insurance
- Need clearly defined plan – well communicated
- More permanent protection
- Risk mitigation program/education
- Education/assistance for unprotected people
- Be proactive as much as possible
- Get the levees built
- Develop the plan
- New gate
- Permanent levees
- Communicate elevation data
- Protection of property in evacuated areas should be mandatory – police protection to prevent theft
- Some type of <u>permanent</u> protection – need some type of protection – it is there so we need to protect it
- Changed river? Probability and how that affects the river?
- How does Winnipeg work on ice jams?
- Put out more information about the entire system
- Waited too long to react – sandbagging was not needed
- Sandbagging unnecessary in south area – could have been used in other places
- Keep levee D – put walking path on top
- Keep Riverwood Drive levee
- Deliver sandbags where needed

	January 19, 2012 Public Input Meeting

5. What should the City of Bismarck do to protect your property, should another ice jam or river flood happen in 2012?

- Communicate what will be done right away
- Protect City and County with levee along the river bank and move the Washington Street gate as far west as possible
- Build permanent levee to handle 16 feet gauge height and plan to add sandbags to the top if needed; plan for an ice event
- Dredge the river to reduce ice jam threat or flooding
- Issue 'red card' to get sandbags if on wrong side
- Flood mitigation plan
- More river gauges
- Take control of Garrison Dam
- Better coordination
- Send the National Guard to help the areas on the outside of the protection
- Dredge the channel (internal flooding)
- Blocked outlet (internal flooding)
- Permanent flood protection – for/against
- Dredge the river, silt obstructions
- Red card to get sandbags
- Have a dedicated media outlet for information
- Have sandbag filling equipment and supplies ready sooner – Purchase by City?
- Better (more accessible and strategically located) sandbag sites
- Identify some sites where flood water can be held (wetland mitigation)
- Permanent plan/prep to demo on ice jam
- Plug bays/ability to plug – structure
- Permanent protection
- Move drainage P.S.
- City should plan to construct a dike around Southport just like rest of city, just like private citizens ended up doing in 2011 flood and similar fashion to Mandan (reduces tension in neighborhood if City would do) – specially assessed in part if necessary to get done
- Raise Riverwood Drive form pier to curb
- Get sandbags and other supplies in before cut off
- Elevate Riverwood Drive

Continued...

- Organized plan for sandbagging for those who really need them – smaller more control sites and prioritize them
- Organize and create teams of volunteers for sandbagging and request business to go to skeleton staff
- Make recommendation on River management
- Base flood elevation – no basements or egress windows
- Water and where they are pumping it
- Long term plan for all of us!
- Secondary levee for Southport
- Plug for Mills Avenue culvert
- North side of Southport culvert plug
- Elevate Riverwood and Mills
- Coordinate efforts with County
- Continuous dike Southport channel to south and tie to State farmland
- Pump through Tavis Road or nearby to River
- Avoid Washington Street closure
- State assistance – technical advice; equipment; manpower; National Guard
- Dike along the riverbank (long-term)
- Public input for design on Riverwood Drive at curve next to Expressway
- Plug the bay!
- Raise Mills now (Tavis)
- Close the inlet now, ahead of the ice jam
- Road bed elevation – Riverwood Drive, Mills Avenue, west half of Burleigh
- Levee along riverbank from bridge south
- Close off Fox Island boat ramp
- Monitor
- Stay out of the way – let us do what we need to do (if no plan)
- Can do it cheaper than City or County
- Host by City and County (this meeting)
- City/County boundaries - turf

Acryonyms

APHIS: Animal and Plant Health Inspection Service
APZ: Accident Potential Zone
BCA: Benefit Cost Analysis
BCR: Benefit Cost Ratio
BFE: Base Flood Elevation
BNSF: Burlington Northern Santa Fe railroad
BSC: Bismarck State College
CDBG: Community Development Block Grant
CDC: US Centers for Disease Control
CERC: Community Emergency Response Committee (City of Bismarck)
CFS: Cubic Feet per Second
CPC: Climate Predication Center
CPEC: Central Power Electric Cooperative, Inc. (formerly Capital Electric Cooperative)
COG: Continuum of Government
COOP: Continuity of Operations Plan
CRS: Community Rating System
DED: Dutch Elm Disease
DES: ND Department of Emergency Services
DFIRM: Digital Flood Insurance Rate Map
DHS: Department of Homeland Security
DMVW: Dakota Missouri Valley and Western Railroad
DOT: Department of Transportation
DR: Disaster
EAB: Emerald Ash Borer
EAP: Emergency Action Plan
EM: Emergency
EMP: Electro Magnetic Pulse
EOC: Emergency Operations Center
EOP: Emergency Operations Plan
EPA: Environmental Protection Agency
ETA: Extraterritorial Area boundary
FEMA: Federal Emergency Management Agency
FIRM: Flood Insurance Rate Map
FIS: Flood Insurance Study
FRA: Federal Railroad Administration
GIS: Geographic Information System
HazMat: Hazardous Materials
HAZUS-MH: Hazards United States Multi-Hazard
HI: Heat Index

HILF: High Impact, Low Frequency
HMGP: Hazard Mitigation Grant Program
HUD: Housing and Urban Development
HVAC: Heating, Ventilating, and Air Conditioning
IBC: International Building Code
ISO: Insurance Services Office
LEPC: Local Emergency Planning Committee
MDU: Montana Dakota Utilities
MOU: Memorandum of Understanding
mph: miles per hour
MPO: Metropolitan Planning Organization
MSL: Mean Sea Level
NCDC: National Climatic Data Center
ND: North Dakota
NDCC: North Dakota Century Code
NDDoH: North Dakota Department of Health
NDSU: North Dakota State University
NFIP: National Flood Insurance Program
NOAA: National Oceanic and Atmospheric Administration
NRCS: National Resources Conservation Service
NTSB: National Transportation & Safety Board
NWS: National Weather Service
PDM: Pre-Disaster Mitigation
PMP: Probable Maximum Precipitation
RWI: Recreational Water Illness
SCMI: Shortage or Outage of Critical Materials or Infrastructure (hazard name)
SLIC: State and Local Intelligence Center
STAPLEE: Social, Technical, Administrative, Political, Legal, Economic, and Environmental
SWAT: Special Weapons and Tactics
SWC: State Water Commission
SWMP: Storm Water Master Plan
THIRA: Threat and Hazard Identification Risk Assessment
USACE: United States Army Corps of Engineers
USDA: United States Department of Agriculture
USGS: United Stated Geological Survey
WAPA: Western Area Power Administration
WMD: Weapons of Mass Destruction
WRD: Water Resource District
WUI: Wildland Urban Interface