Hall County Regional Planning Commission

Wednesday, September 03, 2008
Regular Meeting

Item F5

Hall County Hazard Mitigation Plan

Insert a narrative here

Staff Contact:

To: Regional Planning Commission

From: Chad Nabity

Date: August 25, 2008

Re: All-Hazards Mitigation Plan for Hall County

Attached is a final draft of the Hall County Hazard Mitigation Plan. This draft has been sent to all of the communities for adoption. Doniphan has adopted their portion with some changes to correct typos. Wood River will adopt theirs on Sept 2nd. The rest of the communities should follow suit before the end of September.

The Hall County Regional Planning Commission was the recipient of a grant from FEMA through the Nebraska Emergency Management Agency to develop hazard mitigation plans for the member communities. We met in March of last year to begin the process and this is the result of that meeting and work by the Nebraska Department of Natural Resources, the Army Corps of Engineers and Hall County Staff.

FEMA has reviewed the draft and given it preliminary approval. Adoption of this plan does not commit these communities to the projects outlined but it does give these mitigation projects priority should funding become available from FEMA.

Staff recommends that the Regional Planning Commission hold a public hearing and take comment on the plans and then adopt them and recommend adoption by the elected officials.

Hall County
All-Hazards Mitigation Plan

Completed by
Nebraska Department of Natural Resources
U.S. Army Corps of Engineers

September 2008

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Chapter 1 – Introduction

I. Purpose of this Plan

The purpose of this plan is to fulfill local multi-jurisdictional Hazard Mitigation Plan requirements. The plan will identify hazards, establish community goals and objectives, and select mitigation activities that are appropriate for Hall County.

The Disaster Mitigation Act of 2000 (DMA2000), Section 322 (a-d) requires that local governments, as a condition of receiving federal disaster mitigation funds, have a mitigation plan that describes the process of identifying hazards, risks and vulnerabilities, identify and prioritize mitigation actions, encourage the development of local mitigation, and provide technical support for those efforts.

In addition, this plan has fulfilled the requirements of the National Flood Insurance Reform Act of 1994 (NFIRA). With this Act, Congress authorized the establishment of a Federal grant program to provide financial assistance to States and communities for flood mitigation planning and activities. The Federal Emergency Management Agency (FEMA) has designated this the Flood Mitigation Assistance (FMA) program.

Under the FMA program, FEMA provides assistance to states and communities for activities that will reduce the risk of flood damages to structures insurance under the National Flood Insurance Program (NFIP). FMA is a State-administered cost-share program through which states and communities can receive grants for flood mitigation planning, technical assistance, and mitigation projects.

Only projects for mitigation activities specified in an approved Flood Mitigation Plan are eligible for FMA project grants. These activities include elevation, acquisition, and relocation of flood-prone insurable structures.

The purpose of this plan is to produce a program of activities that will best tackle Hall County's hazard and flood problems and meet other, community-specific needs. Consistent with FEMA planning process guidelines, the purpose of this plan is to accomplish the following objectives:

- Ensure that all possible activities are reviewed and implemented so that disaster related hazards are addressed by the most appropriate and efficient solution;
- Link hazard management policies to specific activities;
- Educate residents about potential hazards that threaten the community, including but not limited to floods, extreme weather events, tornadoes and high wind events, earthquakes, and human-made events;
- Build public and political support for projects that prevent new problems from known hazards and reduce future losses;
- Fulfill planning requirements for future hazard mitigation project grants, and;
- Facilitate implementation of hazard mitigation management activities through an action plan.

II. Methodology

The methodology used for the development and updating of the Hall County Hazard Mitigation Plan, consisted of the following tasks:

1. Public Involvement
2. Coordination with other agencies or organizations
3. Hazard area inventory
4. Problem identification
5. Review and analysis of possible mitigation activities
6. Local adoption following a public hearing
7. Periodic review and update

This hazard mitigation plan contains a list of potential projects and a brief rationale or explanation of how each project or group of projects contributes to the overall mitigation strategy outlined in the plan.

This plan summarizes the activities outlined above to assess the effects of the hazards to which Hall County residents deemed they were most vulnerable, and recommends mitigation solutions.

The Mitigation Plan will be evaluated and updated every five years. In addition, the plan will be updated as appropriate when a disaster occurs that significantly affects the County, whether or not it receives a Presidential Declaration. The update will be completed as soon as possible, but no later than 12 months following the date of the disaster event.

Routine maintenance of the plan will include adding projects as new funding sources become available, or removing projects as they are completed.

People involved in the planning process:
There was no official planning committee for this mitigation plan. Main personnel involved were:

Steve McMaster – Nebraska Department of Natural Resources
Randy Behm – U.S. Army Corps of Engineers
Tony Krause – U.S. Army Corps of Engineers
Chad Nabity – Hall County Regional Planning Commission

Elected officials and/or personnel involved in this multi-jurisdictional planning process:

Hall, County of
- Scott Arnold, County Board Chairman
- Patrick O'Neill, Commissioner, Hall County Regional Planning
- Debra Reynolds, Hall County Regional Planning Commission

Alda, Village of
- Dave Harders, Village Board Chairman
- Leslie Ruge, Citizen, Regional Planning Commission member

Cairo, Village of
- Jaye Monter, Citizen, Regional Planning Commission member
- Terry Gallagher, Cairo Emergency Management Director

Doniphan, Village of
Bill Hayes, Citizen, Regional Planning Commission member
Grand Island, City of
Mitchell Nickerson, Grand Island City Council
Joyce Haase, Grand Island City Council
Barbara Quandt, City of Grand Island
Dan Petsch, Grand Island Public Schools
Steve Riehle, Grand Island City Engineer/Public Works Department
Bob Niemann, Citizen, Regional Planning Commission member
Dianne Miller, Citizen, Regional Planning Commission member
Scott Eriksen, Citizen, Regional Planning Commission member
Wood River, City of
Don Snodgrass, Citizen, Regional Planning Commission member
Larry Harnisch, Wood River Rural Schools Superintendent
Hall County Emergency Management Agency
Jon Rosenlund, Director
Larry J. Smith, Deputy Director
Mindy Oystermen, Coordinator

Other plans/documents used in the development of this mitigation plan:

- The flood portion of this plan was largely completed by the US Army Corps of Engineers, which has a different flood document library.
- *Flood Insurance Study* was used to supplement the information from the Corps of Engineers with additional information about specific flood history. FIS information was obtained for Grand Island and Wood River.
- Community Comprehensive Plans were used to identify future growth areas and objectives.
- Proprietary NDNR spreadsheet of significant historic flood events in Nebraska.

Public Participation

The initial public meeting was held on March 7, 2007. During this meeting, citizens and officials of Hall County identified three main goals of this mitigation planning effort:

1) Reduce or prevent future damage from natural hazard events,
2) Increase public safety, and
3) Increase public education about natural hazard events in their community.

Sign-in sheets and other public participation documentation is provided in this report as **Appendix C**.

III. Organization of Plan

Chapter 1 – presents the purpose and goals of the plan, methodology used, organization of the plan, and a background study of Hall County.

Chapter 2 – by section, known hazards in Hall County are identified. For each hazard, a background, list of historical events, hazard assessment, vulnerability assessment, and possible mitigation actions is also given.

Chapter 3 – outlines the public participation process undertaken during the planning process, for prioritizing projects, and for updating the plan.

Chapter 4 – addresses implementation procedures and a process for updating the plan.

IV. Hall County – Background

Hall County

Hall County was created by an act of the Nebraska Territory Legislature on November 4, 1858. Its boundaries were redefined on February 1, 1864, and again March 1, 1871. It was named in honor of Augustus Hall (1814-1861), chief justice of the Nebraska Territory, and former congressman from Iowa. Today, there are five incorporated communities in Hall County – the cities of Grand Island and Wood River, and the Villages of Alda, Cairo, and Doniphan. The location of Hall County and these communities is shown on the next page as **Figure 1**.

Grand Island

In 1857, a group of settlers from Davenport, Iowa, supported by banking interests set out to find and start a settlement located within an area named by French fur traders as "La Grande Isle", an island in the Platte River. The group of settlers arrived at their destination and began their settlement on July 4, 1857. In the spring of 1866, the Union Pacific surveyors laid out and platted a town called Grand Island on the north side of the Platte River, but decided to keep the name of Grand Island as a place name. Around this time, Grand Island had a population of 500. By July of 1868, the Union Pacific Railroad had extended west to Grand Island. This railroad and the Overland Route contributed to significant growth for Grand Island. At that time, gold had been discovered at Pike's Peak in Colorado. Thousands of people traveled to Western states in seek of great fortune. Everything that Grand Island sold was offered at high prices, bringing financial gain for its merchants. By 1870, the census reported that Grand Island's population had grown to 1,057 people. Grand Island was later incorporated as the County's first city on November 28, 1872.

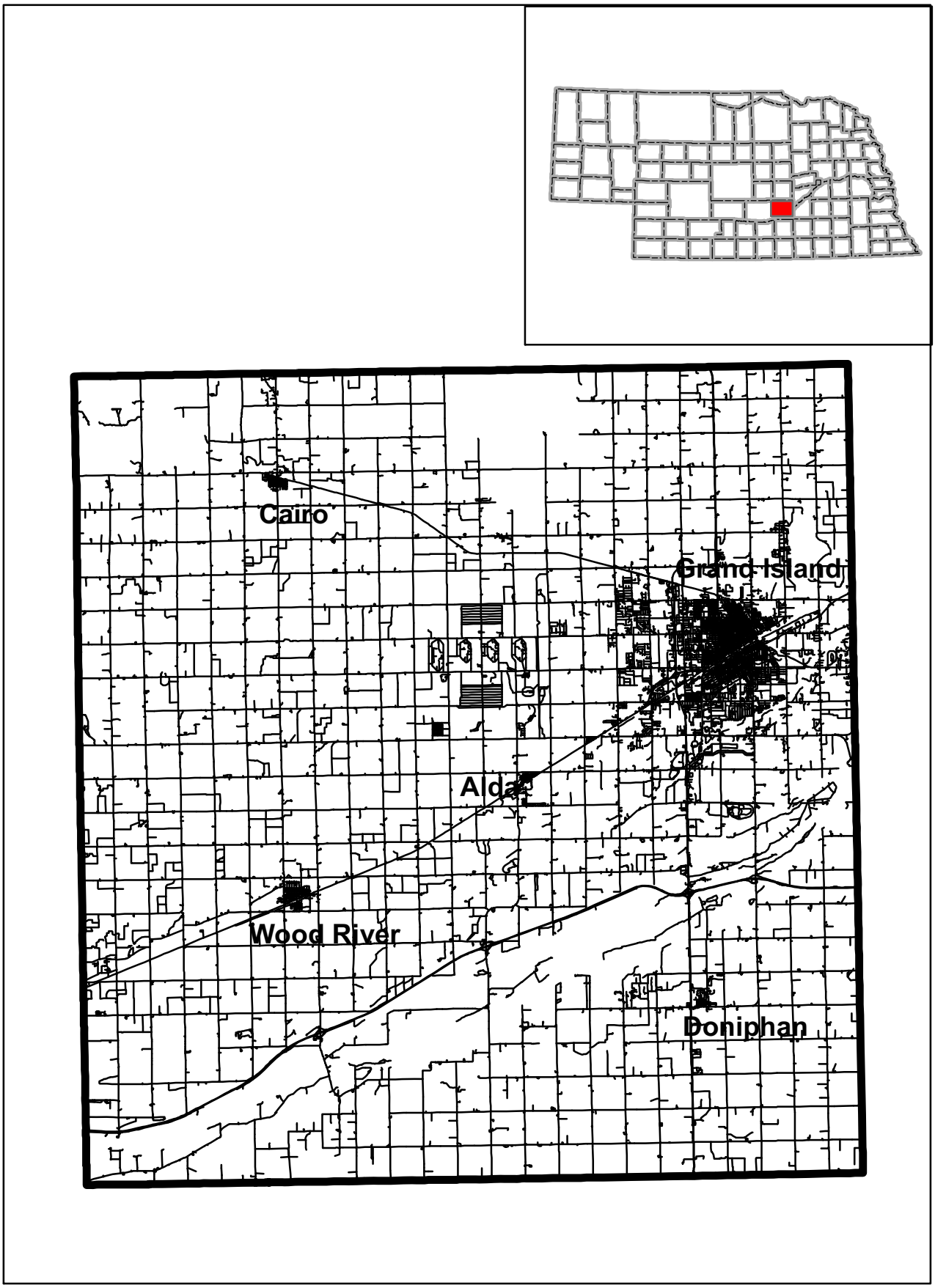
Wood River

After the Union Pacific rails were laid in 1866, a depot and boarding house called "Wood River Station" was constructed, named for the Wood River valley in which it is located. It was first laid out in 1869, but in an effort to centralize their depots, Union Pacific moved the Wood River Station two miles east where the City of Wood River is located today.

Alda

In 1858, a stage station and post office called "Pawnee" were established just south of what is now Alda. In 1871, because of confusion with the town of "Pawnee City" in southeastern Nebraska, the post office for a different name. "Alda" was chosen since it was the name of the first child born at this location. In 1873, the railroad decided to centralize their stations to accommodate homesteaders hauling their grain to market. The little settlement of Alda was

Figure 1
Hall County Location and Communities



obliged to re-locate to a site eight miles southwest of Grand Island. It was incorporated as a Village in 1916.

Cairo

In 1886, the Burlington & Missouri River Railroad built a line from Grand Island to Billings, Montana, to penetrate the Sandhills ranching country and the lumber regions of Montana. Water stops were placed eight to ten miles apart and were used as freight centers for the farmer's crops and, as a result, became towns. Also in 1886, the Lincoln Land Company bought a farmstead for the platting and incorporated the community and called it Cairo because it reminded them of a desert in Egypt. In keeping with that theme, many of the town's roads have Egyptian names such as Thebe, Alexandria, Medina, Nubia, Suez, Mecca, and Nile. One year later, Cairo boasted a booming population of 200.

Doniphan

The Union Pacific Railroad crossed Nebraska in the 1860s and opened the area to settlement. In 1879, a line which became part of the St. Joseph & Western Railroad was built. It was inevitable that a town should grow between Grand Island and Hastings. This town was named in honor of Colonel John Doniphan of Saint Joseph, Missouri, who was then attorney for the railroad on which it is located. The town was surveyed in 1879, and the Village of Doniphan was incorporated on January 9, 1884.

	Dam Failure	Drought	Earth-quake	Flood	Levee Failure	Summer Storm	Land slide	Winter Storm	Tornado /Wind	Wildfire
Probability	Low	High	None	High	Low	High	None	High	High	Low
Extent	Limited	Limited	Zero	Severe	Limited	Severe	None	Severe	Severe	Limited
Previous Occurrence	No	Yes	No	Yes	No	Yes	Yes	Yes	Yes	Yes

Probability: Based on history, what is the likelihood this type of event will happen again?
- None, Low, Medium, or High

Extent – If this event were to happen, how extensive could the damage be?
- Zero, Limited, Severe, Full, or Unknown

Previous Occurrence: Is there an historic record of this type of hazard in Hall County?

The above table shows the cumulative input from the initial public meeting and is not necessarily representative of individual communities. Community-specific information is provided in the sections in this plan for each participating community in **Appendix D**. The County adoption and each community's adoption resolution is provided in **Appendix E**.

In the initial public meeting for the development of this hazard mitigation plan, representatives from Hall County's communities were asked to rate their community's risk and vulnerability for a list of hazards. The tabulation of the responses is included with the public meeting documentation in **Appendix C**. In order from highest likelihood to lowest, meeting attendees ranked their community most vulnerable to the hazard types of: severe winter and summer storm, tornado, flood, drought, wildfire, and dam failure. Hazards receiving zero votes were earthquake and landslide.

In the following sections of this plan, only the hazard types which have a significant likelihood of occurring or have a reason to potentially occur are listed. These types are: severe weather (summer and winter), tornado, flood, drought, and dam failure. Earthquake will not be considered in this plan because of the lack of recognized underlying geological features and because of no past instances of a damaging earthquake. Landslide will not be considered because there is little topographic relief in most of Hall County and because the University of Nebraska's Center for Advanced Land Management Information Technologies (CALMIT) does not have any landslide hazard mapped in the County. The wildfire hazard will not be addressed in this plan because the threat and associated risk is not high enough and there are no realistic or feasible mitigation action which can be taken to reduce the level of risk there is in Hall County.

Also, for obvious geographical and geological reasons, the following hazard types were not considered due to there being no likelihood of occurring in Nebraska: volcanic eruptions, avalanches, hurricanes, tidal surges, and tsunamis. Any additional hazards not listed here which do occur will be added to the mitigation plan through future updates.

Hall County Vulnerability Assessment
With a financial vulnerability perspective, the Nebraska Department of Property Assessment and Taxation keeps records for counties. The entire taxable value of assets in Hall County for 2007 was $3,294,925,981. Broken out by property class, the total assessment valuation and percentage of total is:

Residential real property:	$	1,681,389,049	(51.0%)
Commercial real property:	$	735,781,920	(22.3%)
Agricultural Land and homes/outbuildings:	$	547,152,909	(16.6%)
Commercial/Industrial personal property:	$	122,882,196	(3.7%)
Public service corporation real and personal:	$	60,076,541	(1.8%)
Railroad real and personal property:	$	58,228,297	(1.8%)
Industrial real property:	$	56,171,809	(1.7%)
Agricultural personal property:	$	32,911,396	(1.0%)
Recreational real property:	$	331,864	(.01%)

Realistically, the entire building stock within the whole County will not all be impacted by one disaster event. However, each structure in the County is at the same vulnerability to disaster types like severe weather and tornadoes.

For smaller communities, the NDNR completed fieldwork which determined the number of structures by main structure type (residential, commercial, public, non-profit, and out buildings). For the larger community of Grand Island, the computer vulnerability assessment program HAZUS® was used to assist with the vulnerability assessment since it would not be possible to drive every street in the community.

2.10 SEVERE WEATHER

2.11 Background

Severe weather can be separated into severe winter storms and severe summer storms. Weather hazards for severe summer storms include the qualities of a storm which make it officially classified as severe by the National Weather Service: winds exceeding 58 mph, hail in excess of ¾-inch diameter, or a tornado. For the purposes of this plan, severe summer weather will also include intense rainfall, frequent lightning, and non-storm-related intense heat. Weather hazards for severe winter storms are not defined, but usually include many of the following: extreme cold, heavy snowfall (defined as 4 inches in 12 hours or 6 inches in 24 hours), ice, and strong winds which push the wind chill well below zero degrees.

In the warm season months, thunderstorms and supercell thunderstorms produce lightning, and severe storms can produce hail. Lightning is one of the most consistent causes of death for natural hazards in Nebraska because it can kill people who are outside when a thunderstorm is overhead or nearby. Although hail has the potential to kill people, the primary risk is to property like windows, roofs, siding, trees, and cars. In Nebraska, hail can also cause total losses in agricultural fields across extensive areas. Strong winds down tree limbs and power lines, in

addition to having the potential for causing significant property damage and community interruption. Property owners can obtain insurance to cover themselves financially, but there may be ways to prevent tree and power line damage from occurring through property urban tree management.

Periods of extreme heat are common in all parts of Nebraska during the warmest months. The problem is made worse when the high temperature is accompanied by high humidity. The main risk for intense heat is to persons who may become isolated in an unventilated area. Recorded deaths in Nebraska that are associated with extreme heat are largely a result of outdoor exercise or work during this kind of weather condition. The very young and very old are at additional risk because they tend to have weaker respiratory systems.

For severe winter storms, heavy snow can bring a community to a standstill by inhibiting transportation (like whiteout conditions), knocking down utility lines, and by causing structural collapse in buildings not designed to withstand the weight of the snow. Repair and snow removal costs can be significant. Ice buildup can collapse utility lines and communication towers, as well as make transportation difficult and hazardous. Ice can also become a problem on roadways if the air temperature is high enough so that precipitation falls as freezing rain rather than snow.

Extreme cold can lead to hypothermia and frostbite in people who are exposed to the weather without adequate clothing protection. Cold causes fuel to congeal in storage tanks and supply lines, stopping electric generators. Cold temperatures can also overpower a building's heating system and cause water and sewer pipes to freeze and rupture. Extreme cold increases the likelihood for ice jams on flat rivers or streams. When combined with high winds, extreme cold becomes a very dangerous wind chill, which is hazardous to health and safety.

2.12 Severe Weather History

Through its National Climate Data Center (NCDC), the National Oceanic and Atmospheric Administration (NOAA) compiles a list of recorded storm events. These records go back to 1950; however, reports were given by county only, and community-specific information was not started until 1994.

Hail

According to NCDC, from 1995 to 2006, there were 50 recorded significant hail events impacting Hall County – this averages out to slightly more than four events per year. The largest recorded hail in Hall County was 5 inches in diameter and fell on April 7, 1978. Four-inch diameter hail fell in July of 1975. The majority of the 50 hail events were for diameters ranging from ¾ inches to 1¾ inches. Based on more than 50 years of history, five-inch hail should be the largest hail to expect; however, the current national record size for a hailstone is seven inches, which fell near Aurora in neighboring Hamilton County in 2003.

The National Weather Service uses a guide to equate common items with an approximate hail diameter. Often, hail is reported based on the size comparison to these items and is not directly measured with a measuring device. The relationship is as follows:

Approximate Hail Size

Appearance	Approximate Size (in.)
Pea	0.25-0.50 inch
Penny	0.75
Nickel	0.88
Quarter	1.00
Half dollar	1.25
Walnut/Ping Pong ball	1.50
Golf ball	1.75
Hen egg	2.00
Tennis ball	2.50
Baseball	2.75
Tea cup	3.00
Grapefruit	4.00
Softball	4.50

Aug. 5, 1995: Grand Island – $1.5 million in property damage caused by 2-inch hail
June 15, 1997: Cairo – $100,000 damage caused by ¾-inch hail
Alda – $50,000 damage caused by 1-inch hail
Aug. 21, 1997: Grand Island – $150,000 damage caused by 2-inch hail
May 5, 2002: Doniphan – $1 million damage caused by 2¾-inch hail
Grand Island – $2 million damage caused by 3-inch hail
May 4, 2003: Cairo – $200,000 damage caused by 2¾-inch hail
Grand Island – $250,000 damage caused by 1¾-inch hail
May 10, 2005: Cairo – $100,000 damage caused by baseball sized hail
Grand Island – $100,000 damage caused by 1¾-inch hail
June 16, 2006: Wood River – $200,000 damage caused by 1¾-inch hail
Sept. 15, 2006: Grand Island – $100,000 damage caused by 2¾-inch hail

From 1995 to 2006, hail has caused $7,752,000 damage to property in Hall County. Over this eleven year period, that averages approximately $705,000 in property damage every year. In this same period, there have not been any years which have not witnessed a significant hail event somewhere in the County. Therefore, it would be safe to assume that damaging hail storms occur somewhere in Hall County at least one time per year. From 1995 to 2006, hail caused $11.84 million in crop damage. NCDC reports that two persons have been injured by high winds in Hall County from 1950 to 2006.

Severe Summer Storms:
From 1995 to 2006, severe storms caused $3,981,000 in property damage – this averages $362,000 in damage per year. There have been two injuries caused by severe storms since 1950 – both were from impacts caused by high winds: one was on July 9, 1986, and the other on August 2, 1992. Since both events occurred before community-specific reporting started in 1994, it is not possible to tell where or how the injuries occurred. Although unofficial wind gusts have been estimated over 90 mph, the highest measured wind speed was 85 mph (74 knots) recorded on June 25, 1990, at an unknown location in Hall County. In neighboring counties, wind speeds have been recorded as high as 90 mph near Central City in 2004 and in June of 2003, gusts of 90 mph were recorded near Axtell and 107 mph in Dawson County. This means

that winds up to 70 mph should be expected from severe thunderstorms, gusts up to 80 mph are certainly not unusual, and gusts over 100 mph are possible in the County.

It is safe to say that at least one severe summer storm will occur every year, and a detailed history of these events would be too extensive to chronicle. According to the NCDC statistics since 2000, Hall County experienced this many severe thunderstorms (in parenthesis) in each year:

2000 (3)	2003 (4)
2001 (5)	2004 (6)
2002 (3)	2005 (3)
2003 (4)	2006 (8)

Noteworthy severe summer storms and weather events are:

August 17, 1999: The area received 2-3 inches of rain in an hour and intense straight-line winds damaged five homes west of Doniphan. Property damage was set at $125,000.

May 26, 2002: 80 mph winds developed and roared through Cairo. Windows were blown out of cars, and roofs were blown off a few businesses. Property damage was set at $150,000.

May 13, 2003: Property damage was set at $100,000 in Grand Island after a strong thunderstorm rolled through and destroyed a sign, and caused damage to trees and sheds.

June 23, 2003: With a top wind gust measured at 78 mph, a total of $725,000 in damage across five counties was sustained from strong thunderstorms.

July 6/7, 2003: A storm of similar strength followed the same path as the June storms. Extremely high winds over 70 mph were reported north of Grand Island, and across several counties, the total damage estimate was $1.3 million.

May 10, 2005: 70 mph winds destroyed a construction trailer at the Grand Island Airport and caused minor damage southeast of town. Total damage was estimated at $100,000.

April 6, 2006: Wind gusts over 60 mph winds blew over a semi trailer on Interstate 80 south of Grand Island and caused property damage of $75,000 north and east of Doniphan.

June 16, 2006: 65 mph winds took down large tree limbs and power poles, causing approximately $10,000 in property damage.

September 15, 2006: 60 mph winds blew down trees and caused property damage of about $10,000 in Wood River.

Lightning:

Since 1950, there were no reported lightning strike damages for Hall County.

Severe Winter Storm

With its location on the prairie, Hall County has been visited frequently by severe winter storms throughout its history. One of the most spectacular and harrowing events in the history of the Great Plains was the Blizzard of January 12, 1888. Other storms had produced colder temperatures and greater amounts of snow, but it was the combination of gale winds, blinding snow, and rapidly falling temperatures that made the 1888 blizzard so dangerous. No accurate count of the total deaths from the storm is possible, but estimates for Nebraska have ranged from 40 to 100.

The early-season October 1997 snow storm dropped large amounts of snow across central and south-central Nebraska. A 50-mile swath from Alma to York saw total snow amounts in excess of 15 inches, with 24 inches reported in Guide Rock. The early snow meant that trees had not dropped their leaves, which led to incredible amounts of tree-related damage to power lines in Hall County, and even in Lincoln and Omaha. Record cold accompanied the snow on October 26th, which hampered cleanup and restoration activities. Total property damage was estimated at $15 million with an additional $1.5 million in crop damage.

From January 1st to the 3rd, 1999, up to 5 inches of snow with a freezing drizzle layer on top led to accidents which killed 2 and injured 6. Also, a Cairo man died from hypothermia while attempting to walk home from a wedding late at night.

The winter of 2004 was unusual because of the large snowfall events which occurred within weeks of each other. On January 4, most of Hall County saw at least six inches of snow with higher depths south toward Adams County. On January 25, the first snow dropped eight inches in Grand Island with higher depths east of Hall County toward York. A smaller winter storm brought a few inches of snow on February 1, and the next big snow dump occurred on February 4, which saw depths of 12 inches in Grand Island and 11 inches for Cairo.

The worst natural disaster on record was an ice storm which occurred in late December, 2006. Called the "New Years Ice Storm," this disaster caused an estimated $240 million in damage, largely to the State's public power electricity infrastructure system. At the height of the storm, the Nebraska Public Power District (NPPD) and its public power utility wholesale customers lost service to more than 40,000 customers, primarily in Central Nebraska, including some in Hall County. Service was restored to all customers by January 19th. NPPD sustained damage to 18 substations and a total of 37 transmission line segments totaling 1,053 miles. A total of 1,137 of NPPD's transmission line structures were damaged as well as 301 miles of transmission line conductor (wire). Between 200 and 300 contract workers assisted in the reconstruction effort. Total expenses for restoration and reconstruction were $123.7 million, with approximately $74 million of this amount expected to be reimbursed by post-disaster Public Assistance the Federal Emergency Management Agency. The remaining amount will be financed through long-term debt and paid over 20 to 25 years.

The impact of this ice storm were not only felt with power outages. Due to the loss of transmission capability from the Gerald Gentleman Station, which is situated west of the impacted area. NPPD and Lincoln Electric System were forced to purchase replacement power on the open energy market. NPPD paid $34 million. NPPD is using $22 million of existing District funds in a Rate Stabilization Account to partially off-set the $34 million in increased energy costs. The remaining balance of $12 million is being recovered over a 12-month period through a Production Cost Adjustment charge. Lincoln Electric System paid $9.77 million for replacement power and was able to recoup this added expense by October 19th by placing a 5.5% surcharge on all electric bills.

Like severe summer storms, it is a virtual certainty that Hall County will experience a severe winter storm every year. Since 2000, the County has experienced the following number (in parenthesis) of severe winter storms each year:

2000 (5); 2001 (5); 2002 (2); 2003 (1); 2004 (4); 2005 (3); 2006 (4); 2007 (2)

Temperature extremes:
Although extreme heat and extreme cold are not common, they are also not rare. What makes these events truly dangerous is when extreme heat is combined with high humidity and when extreme cold combines with high winds to produce dangerous windchills.

The National Climate Data Center shows no extreme heat events for Hall County since 1995, but does show six extreme cold or windchill events.

Extreme cold temperatures can get down to –10 or –20 degrees. When combined with high winds, recorded extreme wind chills are most commonly –30 to –60 degrees. Extremely cold temperatures and a stiff northwest breeze combined to drop the wind chill factor to –60 degrees on January 9, 1997. A week later, bitterly cold wind chills returned aboard strong north winds. Temperatures dropped sharply to single-digits – in turn, the wind chill dropped to between –35 to –50 degrees. On December 20, 1998, a deepening arctic air mass settled in and dropped the air temperature down to –17 degrees as wind chill readings ranged from –20 to –45 degrees. On January 3, 1999, a Cairo man died from hypothermia after being exposed to the sub-zero temperatures on a walk home after a wedding celebration. The growing season officially ended a bit early in 2000 when, on October 8 and 9, consecutive morning low temperature records were broken. In Grand Island, the thermometer dropped to 17 degrees.

Previous County Severe Weather Mitigation Actions
Hall County was a Project Impact community in 2000. As a function of this designation, the City distributed 4,500 NOAA weather radios for $15 each, and were available to any resident in the County. Grand Island has also been a Tree City USA since 1987 and Doniphan since 1995. Being a Tree City USA community means there is a reduced damage potential resulting from falling trees and limbs from tornadoes, high wind, and ice events.

Severe weather preparedness, response, and mitigation are primarily responsibilities of the Hall County Emergency Management Agency (HCEMA). HCEMA participates in Severe Weather Awareness Week each year by placing articles in the local paper and running information over the City's local government television channel. HCEMA also participates during the test warning day by using all of our normal procedures like in an actual event. HCEMA also participates in Winter Awareness Week by placing articles in the local newspaper. Each spring, HCEMA also completes grade school tours, talking to 500-600 kids about severe weather and what to do for severe weather.

Grand Island and Cairo are StormReady® communities through the National Weather Service (NWS). To be a StormReady community, communities prepare an action plan which helps them respond to all types of severe weather. There are six main guidelines: Communication, NWS Information Reception, Hydrometeorological Monitoring, Local Warning Dissemination, Community Preparedness, and Administrative. The guidelines for successful participation are based on population, which are separated into four population ranges. Grand Island is in the top population range (more than 40,000) while Cairo is in the lowest population range (less than 2,500). The higher the population range, the more activities the communities need to do in order

to receive a StormReady certification. For more information about the StormReady program, visit: http://www.stormready.noaa.gov/.

2.13 Probability of Severe Weather Events

It is certain that Hall County will continue to be impacted by severe summer storms and severe winter storms, along with the various dangerous and damaging components which accompany both.

2.14 Vulnerability Assessment of the Severe Weather Hazard

Every structure in the entire County is at equal risk to hail damage or being impacted by other severe weather events. According to the Nebraska Department of Property Assessment and Taxation, this represents approximately $3,294,925,981. See the community-specific section for a more structural inventory and financial damage potential for each city.

2.15 Potential Severe Weather Mitigation Measures

Like tornadoes, there is little one can do to mitigate severe weather events – just be prepared.

GOALS: 1) Reduce or prevent future damage from natural hazard events,
2) Increase public safety

Objective 1.1 Ensure continued operation of critical facilities, utilities, and the local transportation system.

- Action 1.1.1: Obtain emergency generators to be used as backup power in case of complete power outage – as seen from ice storm of December, 2006
- Action 1.1.2: Work with owners of critical facilities to ensure they are adequately protected against extreme winter conditions and have an uninterruptible power supply.
- Action 1.1.3: Work with schools and other critical facilities to ensure that they receive severe weather warnings – perhaps have them purchase weather radios.
- Action 1.1.4: Develop a snow route plan for the community that takes major streets and critical facilities into account. Post "Emergency Snow Route" signs along this route and educate the public to keep their vehicles off of these routes during heavy snow events, or risk being towed. Publish this route in the local telephone books or other locations which could be referenced by residents. This option would be most useful for larger populations concentrations like Grand Island.
- Action 1.1.5: Require all new development, where appropriate, to bury all electric lines.
- Action 1.1.6: Work with local property owners in developed areas to bury power lines in areas which experience power outages due to downed lines.

Objective 1.2: Reduce tree-related damage to property and utilities

- Action 1.2.1: Develop an urban tree management plan. As a free service, the Nebraska Forest Service offers advice on proper "urban forest" planning, tree selection, planting, and tree care. This service should be utilized in areas of the city which experience more tree-related problems. The Nebraska Forest Service performs a free "Tree inventory" and offers technical advice for communities. Communities can then use this information to develop or change their local tree programs.

- Action 1.2.2: Bury overhead power lines and service lines in areas where tree problems exist.
- Action 1.2.3: Communities can provide information about proper tree selection (especially in power line rights-of-way) and maintenance to residents.
- Action 1.2.4: Communities should consider becoming a "Tree City USA". This program is offered through the National Arbor Day Foundation, and through it communities receive direction, technical assistance, public attention, and national recognition for their urban and community forestry programs through the Nebraska Forest Service and USDA Forest Service.
- Action 1.2.5: Educate homeowners about how to maintain trees on their property since it is their liability if a tree on their property damages someone else's personal property.
- Action 1.2.6: Have available information to educate homeowners about types of desired trees for planting on private property. Information should include: insect susceptibility, potential disease problems, blossom or seed characteristics, cold weather hardiness, and other items.

Goal 3: Increase Public Education

Objective 1.3: Increase severe weather awareness

- Action 1.3.1: Continue to promote severe weather awareness, education, and safety tips through local media outlets. Such a campaign should include practical tips like staying indoors when lightning is around and recommended behavior during extreme temperatures. This could be combined with awareness campaigns from other disasters.
- Action 1.3.2: Communities could develop a more detailed Severe Weather Preparedness Week and Winter Awareness Week outreach programs to educate children and/or the public about the nature of different disaster types, where to watch for storm warnings, what to do, where to go during a severe weather warning, and others.

2.20 FLOOD

2.21 Background

The majority of Hall County is situated in the Platte River valley, which means that there is very little vertical relief (See **Figure 2**), even from watershed to watershed. The drainage system of Hall County is dominated by the Platte River, which flows from southwest to northeast (See **Figure 3**). Only in the extreme northwest corner of the county is there the relief required for upland streams. The communities of Hall County developed where they did due to the proximity to water sources and railroad plans. As the reliance on proximity to surface water has declined over time, this has left many Hall County communities with significant water problems – not only flooding, but also related to a high water table.

Other than the Platte River, significant water courses in Hall County are: Wood River, Prairie Creek, Moores Creek, Silver Creek, and Dry Creek. Platte River is the controlling drainage for most of the County, which means that all of the water courses listed above either parallel or drain into the Platte. A small portion of Hall County south and east of Doniphan is in the Big Blue River watershed.

Figure 2
Hall County Boundary and Topography

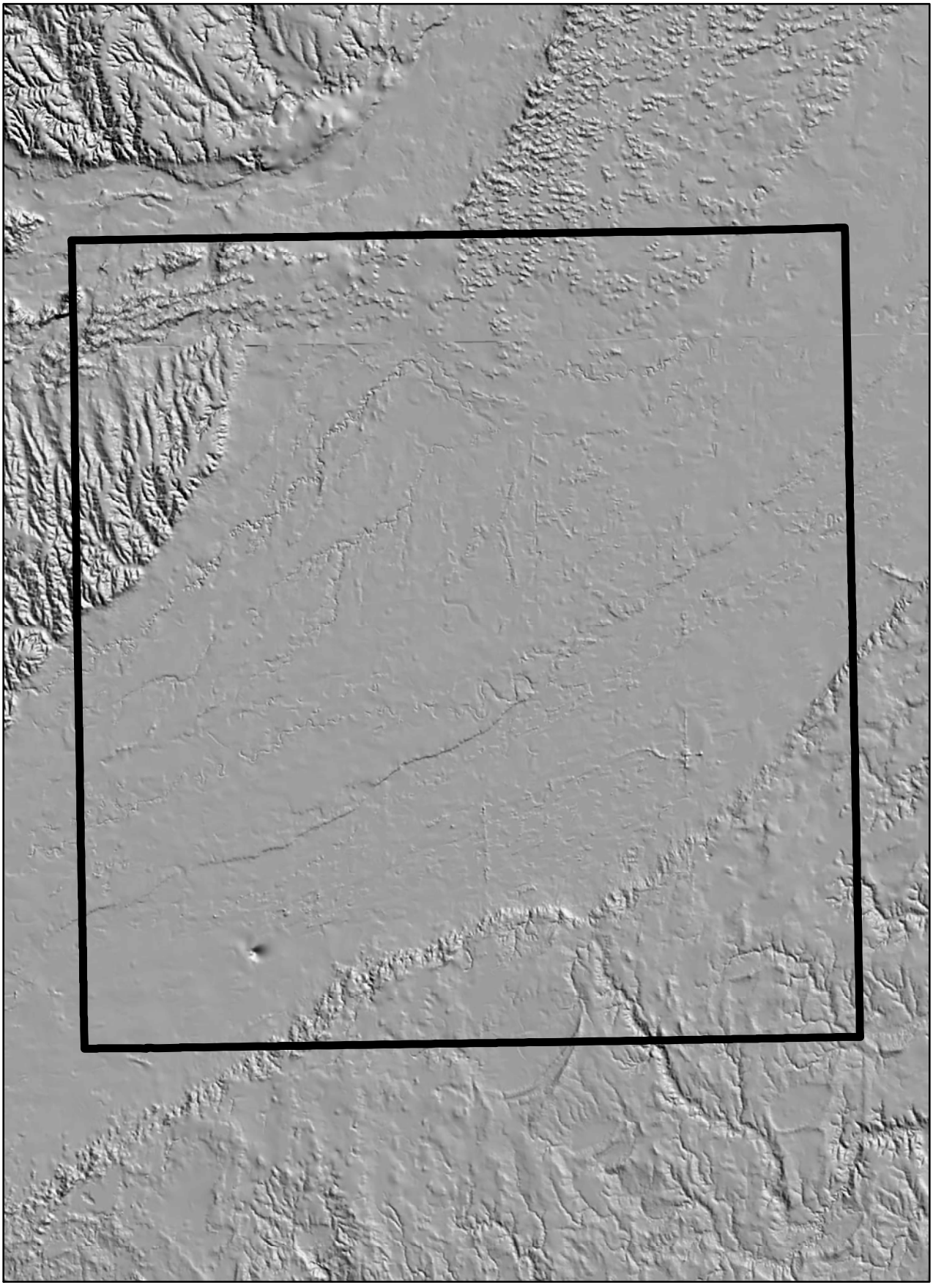
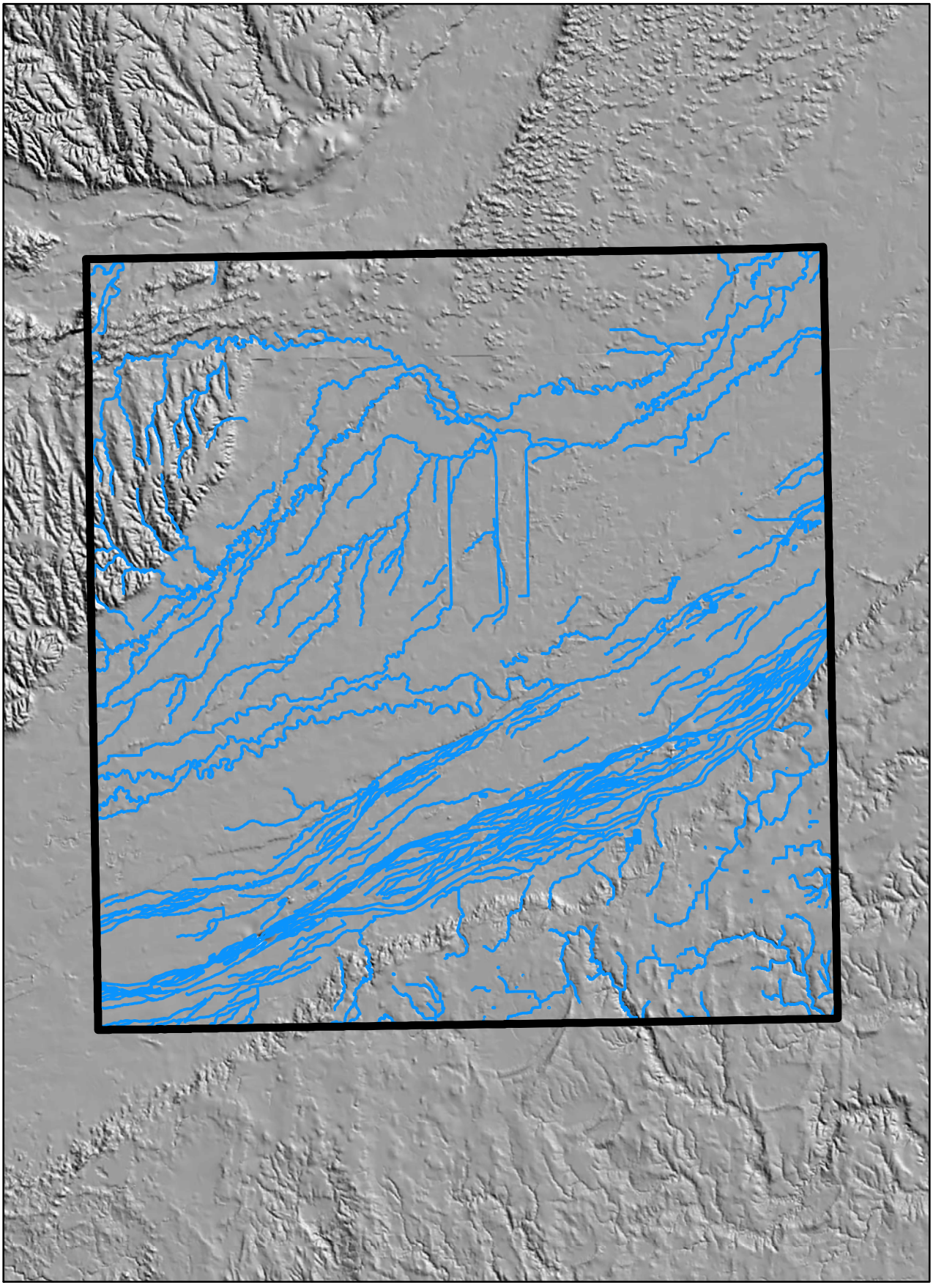


Figure 3
Hall County Drainage Pattern



Hall County's largest population center, Grand Island, has an extensive floodplain that is associated with the Prairie/Moores/Silver Creeks. They are often mentioned together as one flood source because they all drain areas parallel to each other and because a large enough rain will allow water to cascade from one of the creeks into the others.

Due to the shallow depth of the Platte River channel, ice jams are possible during winter and early spring months. However, the primary flood risk is to flash floods from intense warm-month rainfall events and from slower moving riverine floods on the Platte River, which result from rapid snowmelt, excessive and sustained rainfall upstream, or both.

Repetitive Loss Properties in Hall County

A repetitive loss property is defined as any structure which has had two or more flood insurance claims filed for it in any ten-year period since 1978. The Federal Emergency Management Agency (FEMA) has started targeting mitigation efforts for these repetitive loss properties because of the significant drain they represent to the flood insurance pool of the National Flood Insurance Program. Mitigation of these properties in Nebraska has been slow because of the regulation which requires the jurisdictions the properties are in to have an adopted and approved all-hazards mitigation plan as a condition of eligibility for federal mitigation assistance. Once all-hazards mitigation plans like this one are approved, Nebraska will be in a better situation to mitigate some of these repetitive loss properties.

According to the 2006 Repetitive Loss list provided by FEMA, the following communities have this many repetitive loss properties:

Hall County: 1 (Doniphan address)
Alda: 0
Cairo: 0
Doniphan: 0
Grand Island: 1
Wood River: 0
HALL COUNTY TOTAL: 2

2.22 Flood History

Historic Flood Events

Since floods impact communities and not areas, a more detailed and extensive list of flood records have been placed in the community-specific section in **Appendix D**.

Official flood reports for watercourses other than the Platte River are difficult to find because there is a lack of good and consistent river gage data for Hall County. The only gage in the County which is currently operating full-time is the Platte River gage at Grand Island, which is located approximately 2.5 miles southeast of the City on the Highway 34 bridge on the Hall County/Hamilton County line. Other gages on different water courses were operated as follows:

Gage	Dates of Operation	Agency
Wood River near Alda	1953 to 1994	USGS
Wood River near Alda	1994 to 2002	NDNR
Platte River S. Channel near Gr. Island	1983 to 1989	USGS
Dry Creek at Cairo	1949 to 1953	USGS
Silver Creek at Ovina	1991 to 1995	USGS
Silver Creek near Ovina	1991 to 1999	USGS

Most communities in Hall County were incorporated in the late 1800s, and the first flood reports on the Platte River date to that era. Little is known about the "Great Flood of 1883" because there was such little population in Hall County at the time. However, the sketchy reports that do exist point to flood damage in Kearney and Ashland; therefore, the Platte was also flooding in Hall County. Hydrological journals of the day only reference this flood by saying there was a major inflow into the Missouri River somewhere between the established towns of Sioux City, Iowa, and Kansas City, Missouri.

The most extensive flood event to impact Hall County occurred from a long period of excessive rainfall in May and June of 1967. The total damage from the Platte River flood of 1967 was $49,309,015 – of which $40.8 million was private damage ($23 million in agricultural damage, $12 million in transportation damage, and $5 million was classified as "urban" damage) and $8.5 million was public damage. The Wood River was on the rampage in Grand Island, where three people were killed, 1800 buildings were flooded, and 11,000 of the City's 28,600 residents were directly impacted. Total damage in Grand Island was set at $6.25 million ($38.2 million in 2006 dollars).

On May 11 and 12, 2005, portions of Hall County received more than seven inches of rain in a 24-hour period, causing between $12 and 15 million in damage in the County, and damaged 2769 homes and businesses. Hall County was later declared a federal disaster area (FEMA-1590-NE-DR) by President Bush on June 23.

Previous Hall County Flood Mitigation Actions

Hall County is situated in the Central Platte Natural Resources District (CPNRD). Natural resources districts were created along major watershed boundaries in the 1970s with the intent to steward the area's natural resources. In addition to the having an authority for flood control, the CPNRD also operates a rain gage reporting network called NeRAIN and undertakes information and outreach programs for the NRDs population.

In combination with the CPNRD, Hall County has undertaken several major flood reduction projects.

Wood River Flood Control Project

After 30 years of planning, the Wood River Flood Control Project was dedicated in spring of 2004. The 300-foot wide diversion channel diverts excess water from the Wood River and Warm Slough to the east and into the Platte River. This project provides flood control protection

for 1500 homes and businesses. The project was tested by a flood event one year later on May 11, 2005, when 7.21 inches of rain fell in a 24-hour period. From a hydrological standpoint, this event would have resulted in a flood similar to the devastating 1967 flood; however, the Project functioned as designed, and flood damages were minimal for the protected area. The Central Platte Natural Resources District estimated that the $17 million project paid for itself in this event, less than one year after dedication. The project was sponsored by CPNRD and was funded 42.5% by CPNRD, 35% by City of Grand Island, 11.25% Hall County, and 11.25% Merrick County. The project was constructed by the US Army Corps of Engineers, and the Natural Resources Development Fund (administered by the Nebraska Department of Natural Resources) provided the 60% of the non-federal share of the planning.

Prairie/Silver/Moores Creek Flood Control Project

In May of 2000, the CPNRD and City of Grand Island contracted out to perform a detailed hydrologic analysis of northern and western Grand Island. The analysis was also to evaluate options for reducing flood damages and to present the preferred alternative. An engineering firm was selected in September of 2005 to provide engineering services for the design and oversight of the flood control project. The flood control project is designed in three phases, expecting to be completed in 2015. Construction of Phase 1 began in January of 2007. The phases are:

Phase 1 – Silver Creek Low Land Stormwater Detention Cells

The first phase of the project is the construction of four large floodwater detention cells along the Silver Creek channel with a total excavation near 4.5 million cubic yards of earth. The cell design includes the lowering and re-grading of Silver Creek for more then two miles. The detention cells will detain stormwater runoff in excess of the 2-year storm. A 3' x 3' concrete box culvert will be used as the outlet and will release the water from the cells at a rate equal to the 2-year storm. A second 3' x 6' gated box culvert will be used for rapid draw down of the cells. A berm is being placed around the cells, approximately 2 foot above existing ground, to provide sufficient capacity to detain runoff from the 100-year storm with a 1-foot freeboard.

Phase 2 – Basin Divide and Silver/Moores Creek Diversion Channel

A diversion channel that will connect Silver Creek to Moores Creek and a levee that will prevent flood water from flowing from one basin the adjacent basin. The stormwater released from the cells when combined with runoff excess, flows from the Prairie Creek and will cause flooding within the city of Grand Island. This levee will be designed to meet the requirements set forth by FEMA. A diversion channel will be constructed to divert water from Silver Creek to the Moores Creek floodway.

Phase 3 – Upland Dams and Prairie/Silver Creek Channel

A series of upland detention dams and an overflow channel from Prairie Creek to Silver Creek. The exact locations of the detention sites will be finalized in the final design phase of this project. Several sites are available and will be evaluated after geological investigations have been completed. The channel between Prairie and Silver Creek will serve to carry excess flows from Prairie Creek to Silver Creek.

Prairie Creek Clearing

Although the Prairie Creek Flood Control Project had a local effect, damages could be reduced on Prairie Creek by keeping the channel clear. Projects have been completed from the mouth of

Prairie Creek in Merrick County to the Hall-Buffalo county line. Annual maintenance cost to CPNRD is $10,000.

Dry Creek Clearing
After a windstorm/tornado in 1998, landowners requested CPNRD to clear a channel northeast of Cairo. The project was completed in 1998, however, area landowners petitioned the NRD to clear an additional 21,000 feet. That project will be completed the winter of 2007/08. Maintenance is done by the NRD.

Lower Warm Slough Prairie
In 2002, CPNRD spent $110,000 to complete snagging and clearing from Grand Island to Central City.

Moores Creek Flood Control Project
Project sponsors of the feasibility study for the flood control on Moores Creek include CPNRD, the City of Grand Island, Merrick County and Hall County. The three-phase project consisted of channel improvements, construction of three detention/retention and wildlife habitat enhancement cells, and construction of waterways and bridges to enable storm runoff. Annual maintenance cost is estimated at $20,000.

2.23 Probability of Future Flood Events

It is certain that the Hall County area will continue to be impacted by flash flood and riverine flood events while ice jam floods may be less common.

2.24 Vulnerability Assessment of the Flood Hazard

The US Army Corps of Engineers completed the vulnerability assessment portion of this report. Community-specific flood vulnerability information is given for each community in **Appendix D**. As shown in **Appendix A**, the Corps was able to find 1478 (398 Zone A, 69 Floodway, and 1011 Zone AE) structures in the floodplain in Hall County and was able to determine assessed valuations for many of them, which have a total of $126,100,206. The table below shows the number of structures that the Corps of Engineers found in a regulated floodplain by community.

Community	Floodplain Structures	Value
Hall County	408	$29,961,679
Alda	7	$518,285
Cairo	13	$650,447
Doniphan	0	$0
Grand Island	1045	$94,872,642
Wood River	5	$97,153
Totals	**1478**	**$126,100,206**

For the 408 structures in the floodplain in unincorporated areas of Hall County, 294 are in Zone A, 23 are in a floodway, and 91 are in Zone AE.

Critical facilities and valuations in the floodplain in unincorporated Hall County are:

Emmanuel Church ($81,303)
Cameron Church (no value)
Eight Interstate 80 interchanges (no value)

Note that these numbers are slightly different from NDNR's floodplain structure counts (see community-specific counts in Appendix D) because NDNR did not look outside of a community's corporate limits and did not count insignificant out buildings.

2.25 Potential Flood Mitigation Measures

Objective 2.1: Determine valuation information for the remaining structures in the vulnerability assessment in order to have a more complete concept of the County's true total flood risk.

GOALS: 1) Reduce or prevent future damage from natural hazard events,
2) Increase public safety

Objective 2.2: Maintain good standing in the National Flood Insurance Program

Action 2.2.1: Continue to regulate development in floodplain areas

Action 2.2.2: Continue to provide floodplain management technical assistance under the County's authority

Objective 2.3: Mitigate Hall County's repetitive loss properties.

- Action 2.3.1: Make application to one of FEMA's mitigation programs. Hall County, City of Grand Island, Central Platte NRD, other source can provide the non-federal match.

Objective 2.4: Undertake flood control projects under the NRD's authority

- Action 2.4.1: Continue to utilize existing programs for the NRD's various flood control programs. Proposed sites will need to go through a rigorous process to determine project feasibility before they are constructed.

Objective 2.5: Mitigate losses for floodprone buildings not on FEMA's repetitive loss list

- Action 2.5.1: Operate as non-federal cost-share partner for FEMA-funded or other sponsored nonstructural mitigation projects such as buyout/removal and elevation. All communities and jurisdictions will be considered if there is need; however, higher priority will be given to structures in an identified floodway.

GOALS: 3) Increase Public Education

Objective 2.6: Increase awareness of citizens in Hall County about their flood risk and what can be done to reduce vulnerability to flooding

- Action 2.6.1: Continue to use existing NRD education and outreach programs to educate and inform the public about natural hazard mitigation options and what the NRD is doing in this area.
- Action 2.6.2: Explore options of working with the Hall County Emergency Management Agency to expand non-flood natural disaster educational opportunities.

2.30 TORNADO

2.31 Background

Tornadoes and high winds have been a way of life in Nebraska since the time of pioneers in the late 1800s. With its location at the frequent convergence area for Canadian, Gulf of Mexico, and Pacific air masses, Nebraska is located in a part of the United States where tornadoes are a common occurrence. Nebraska is ranked fifth in the nation for the number of tornadoes, but 23rd in number of tornado fatalities and 24th in tornado injuries. Nebraska averages 39 tornadoes per year, with the most recorded tornadoes being 102 in 1999. All 93 counties in Nebraska have had tornadoes since 1950. The peak month for tornadoes is June, and 78% of all Nebraska tornadoes have occurred in traditional tornado season of May through July. In terms of timing, 71% of all Nebraska tornadoes have occurred between 3:00 and 9:00 pm, and 53% of all Nebraska tornadoes between 4:00 and 8:00 pm.

The "Fujita Scale" was used to classify and compare both the actual tornadoes and the damage caused by tornadoes and was used from 1971 until 2007. On February 1, 2007, the Enhanced Fujita Scale, or EF Scale, was implemented as its replacement. The Scale was revised to reflect better examinations of tornado damage surveys, so as to align wind speeds more closely with associated storm damage. The rating system is as follows:
EF0: Light damage (29% of all tornadoes). Wind up to 85 mph. Peels surface off some roofs; some damage to gutters or siding; branches broken off trees; shallow-rooted trees pushed over.
EF1: Moderate damage (40%). Wind 86 to 110 mph. Roofs severely stripped; mobile homes overturned or badly damaged; loss of exterior doors; windows and other glass broken.
EF2: Considerable damage (24%). Wind 111 to 135 mph. Roofs torn off well-constructed houses; foundations of frame homes shifted; mobile homes completely destroyed; large trees snapped or uprooted; light-object missiles generated; cars lifted off ground.
EF3: Severe damage (6%). Wind 136 to 165 mph. Entire stories of well-constructed houses destroyed; severe damage to large buildings such as shopping malls; trains overturned; trees debarked; heavy cars lifted off the ground and thrown; structures with weak foundations blown away some distance.
EF4: Devastating damage (2%). Wind 166 to 200 mph. Well-constructed houses and whole frame houses completely leveled; cars thrown and small missiles generated.
EF-5: Incredible damage (less than 1%). Wind above 200 mph. Strong frame houses leveled off foundations and swept away; automobile-sized missiles fly through the air in excess of 100 meters; high-rise buildings have significant structural deformation; incredible phenomena will occur.

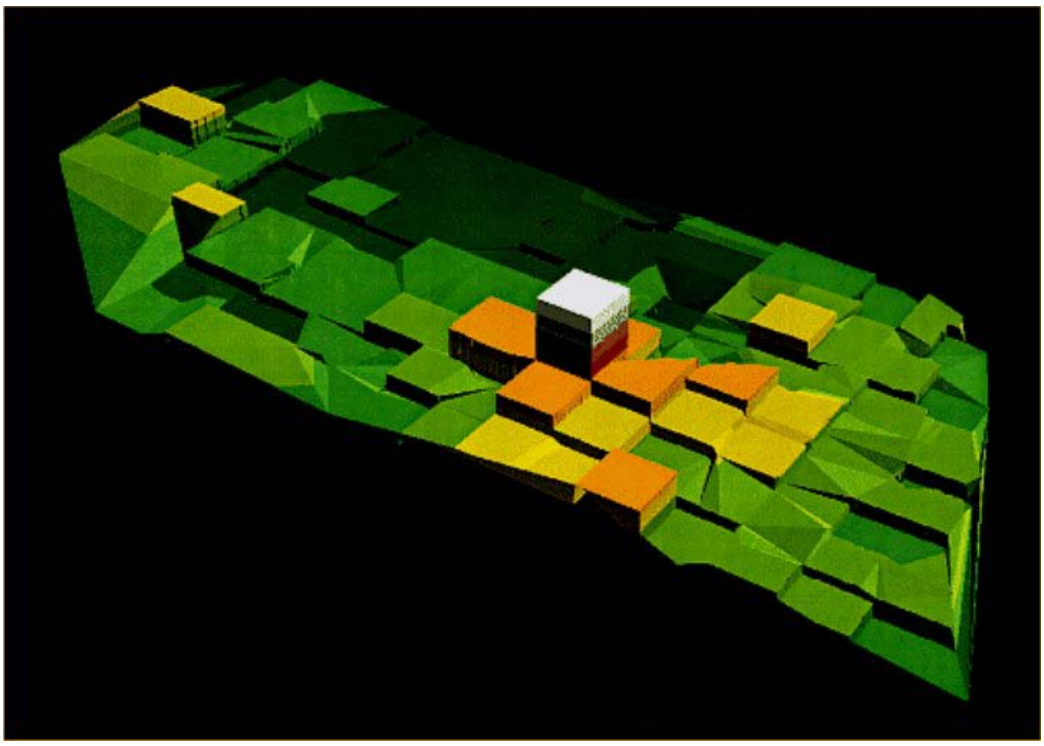
Tornadoes are further classified as follows:
EF0 and EF1: Weak EF2 and EF3: Strong EF4 and EF5: Violent
Although EF0 and EF1 tornadoes are classified as "weak," the 85 mph upper-end rating of an EF0 tornado would be considered very severe if associated with a severe thunderstorm, and there is potential for extensive damage.

2.32 Tornado History

The discussion of tornadoes in Hall County starts with the tornado outbreak of June 3, 1980, which devastated entire sections of Grand Island – especially the City's northwest and north central residential areas, and the southern business district. The tornadoes killed five people, injured more than 400, caused $300 million in damage. The destruction covered more than 150 city blocks, including losses to 357 homes, 33 mobile homes, 85 apartments, and 49 businesses. This event has been turned into book and a television movie (*"Night of the Twisters"*), and was studied by a special team of research scientists, including Professor T. Theodore Fujita himself. This tornado outbreak captivated scientists because the storm included both cyclonic and anticyclonic tornadoes.

According to the High Plains Regional Climate Center, Hall County has seen 70 tornadoes from 1950 to 2006, which places the County fifth in the State for number of twisters. However, on a density basis which factors in the area of county, Hall County has the highest density of tornadoes at 128.2 tornadoes per 1000 square miles. Second on the list is Thayer County at 95.7. It must be noted that these figures could be dramatically changed if the 1980 tornado outbreak were considered one event rather than seven separate tornadoes.

The figure below shows a graphic interpretation of tornado density by county from 1953 to 1999. The pattern clearly shows a "hot spot" of tornadic activity in central Nebraska with Hall County being the bulls eye.



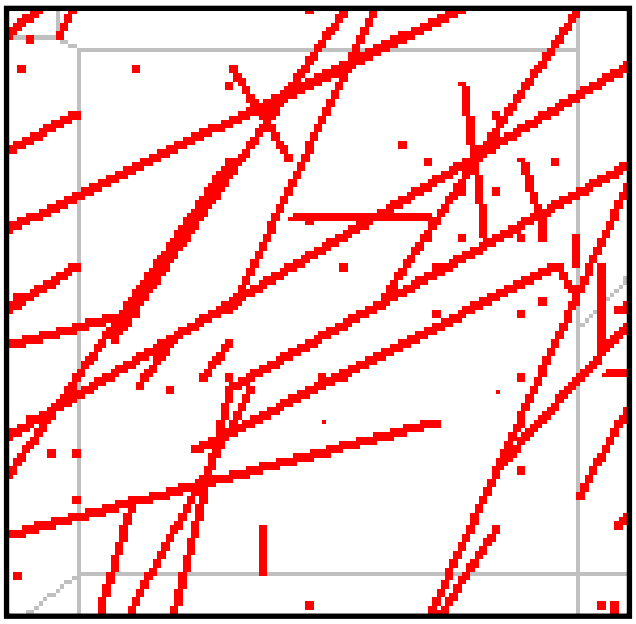
According to the National Climatic Data Center, there have been 73 tornadoes in Hall County since 1950. The table below shows the details for 58 of these tornadoes, having stripped out the recorded tornadoes (except for 1980) which are most likely duplicate records of the same storm.

Note that community-specific records did not begin until 1993. Also, when a community is listed in the first column, it usually means that it was the closest community – not that a tornado hit that community directly.

Location or County	Date	Time	Magnitude	Deaths	Injured	Property Damage
1 HALL	05/29/1953	2130	F1	0	0	0K
2 HALL	06/20/1954	2300	F1	0	0	3K
3 HALL	07/09/1955	2300	F1	0	0	3K
4 HALL	05/20/1957	1700	F2	0	0	0K
5 HALL	05/04/1959	1500	F1	0	0	3K
7 HALL	05/28/1959	1720	F0	0	0	3K
8 HALL	06/17/1960	2320	F1	0	0	0K
9 HALL	08/23/1960	1500	F1	0	0	25K
10 HALL	05/13/1961	1920	F1	0	0	25K
11 HALL	06/05/1961	1753	F	0	0	0K
12 HALL	05/23/1964	2000	F1	0	0	3K
13 HALL	06/14/1964	0135	F0	0	0	0K
14 HALL	05/08/1965	1730	F4	0	0	25.0M
15 HALL	05/25/1965	1732	F	0	0	0K
16 HALL	06/13/1967	2000	F1	0	0	0K
17 HALL	05/13/1968	1710	F1	0	0	25K
18 HALL	06/23/1968	2102	F1	0	0	0K
19 HALL	06/04/1971	2015	F0	0	0	25K
20 HALL	06/06/1971	1615	F0	0	0	3K
21 HALL	07/03/1973	2010	F1	0	0	2.5M
22 HALL	09/02/1973	1730	F0	0	0	25K
23 HALL	10/09/1973	1730	F2	0	5	250K
24 HALL	05/16/1977	1930	F	0	0	25K
25 HALL	05/19/1977	1515	F2	0	0	275K
26 HALL	09/01/1977	2045	F	0	0	250K
27 HALL	06/03/1980	1945	F3	1	25	2.5M
28 HALL	06/03/1980	2000	F1	0	5	25K
29 HALL	06/03/1980	2005	F3	1	40	25.0M

30 HALL	06/03/1980	2046	F1	0	0	25K
31 HALL	06/03/1980	2116	F4	3	110	250.0M
32 HALL	06/03/1980	2125	F2	0	18	2.5M
33 HALL	06/03/1980	2200	F1	0	2	2.5M
34 HALL	08/10/1980	2135	F1	0	0	250K
35 HALL	10/16/1980	0130	F1	0	0	2.5M
36 HALL	05/10/1982	1603	F1	0	0	3K
37 HALL	06/24/1982	1605	F1	0	0	3K
38 HALL	06/04/1984	1911	F0	0	0	0K
39 HALL	06/11/1984	2020	F3	0	0	2.5M
40 HALL	08/05/1985	1950	F0	0	0	0K
41 HALL	09/04/1985	2154	F1	0	0	25K
42 HALL	04/13/1986	1635	F1	0	0	25K
43 HALL	07/11/1986	2110	F1	0	0	250K
44 HALL	07/24/1986	1500	F1	0	0	3K
45 HALL	08/17/1987	1910	F1	0	0	2.5M
46 HALL	03/13/1990	1720	F3	0	0	2.5M
47 HALL	03/13/1990	1744	F3	0	0	2.5M
48 HALL	07/25/1990	1625	F0	0	0	0K
49 HALL	05/29/1991	2142	F0	0	0	0K
50 HALL	06/15/1992	1820	F1	0	0	25K
51 Upland to Wood River	05/07/1993	1752	F2	0	0	5.0M
52 Grand Island	08/05/1995	1422	F0	0	0	2K
53 Grand Island	08/04/1996	07:00 PM	F0	0	0	0
54 Cairo	06/11/1997	07:25 PM	F1	0	0	750K
55 Doniphan	06/11/1997	07:50 PM	F0	0	0	0
56 Wood River	05/02/1999	06:17 PM	F1	0	0	100K
57 Wood River	05/07/2005	05:30 PM	F0	0	0	0
58 Wood River	05/11/2005	09:05 PM	F0	0	0	125K
				5	**205**	**$ 330.054M**

The figure below is taken from a program called Severe Plot, which is provided by the National Weather Service. It shows the tracks of tornadoes across Hall County. The predominant track is from southwest to northeast, which happens because of the way that fronts and the summer monsoonal flow interact across Nebraska during tornado season.



Previous Hall County Tornado Mitigation Actions
In Grand Island, West Park Plaza Trailer Park on West Highway 30 has a tornado shelter. Additionally, many businesses will welcome people during a tornado if they are open for business at the time; however these buildings may not be structures built to FEMA-recognized standards for a tornado shelter.

Tornado preparedness, response, and mitigation are primarily responsibilities of the Hall County Emergency Management Agency (HCEMA). HCEMA owns and maintains the sirens for all of Hall County, and is working with the city/county joint board on a system of funding annual improvements or expansion to the warning system. The following are activities that HCEMA undertakes for regular education and outreach:

- Participates in the annual Severe Weather Awareness Week by placing articles in the local paper and airing information on the City's local government television station
- Conducts test warning days by using all of their normal procedures as if there were an actual event, including setting off the warning sirens
- Completes annual education programs to grade schools each year, reaching approximately 500 to 600 kids. At these programs, they discuss severe weather, and where to go and what to do if there is a tornado warning.
- To maintain their StormReady® certification, Grand Island and Cairo are required to continue their activities related to communication, warning dissemination, and monitoring.

2.33 Probability of Tornado Events

Although they do not necessarily occur every year, history shows that tornadoes in Hall County are common and should be expected.

2.34 Vulnerability Assessment of the Tornado Hazard

Every structure in Hall County is at risk to tornadoes. According to the Nebraska Department of Property Assessment and Taxation, this represents a value of $3,294,925,981. **Appendix D** includes the structural inventories and vulnerability information for the communities in Hall County.

2.35 Potential Tornado Mitigation Measures

Unlike floods, tornadoes and high winds do not occur in a defined area – the entire community is vulnerable. Therefore, instead of mitigation, the primary focus should be on warning, preparedness, and response. But there are projects that the city and homeowners can undertake to reduce the damage from these events.

Goal 1: Reduce or prevent future damage from natural hazard events
Goal 2: Increase Public Safety from Tornadoes

The locations of tornado sirens in the communities participating in this plan are given in **Appendix D**. On these maps, a series of buffer zones (1/2 mile, 1 mile, 1.5 miles) is provided to show different distances from these sirens. A half-mile area is a very conservative estimate for adequate audible distance. However, tornado sirens are meant for outdoor warning only and are not designed to wake up people while they are sleeping or to alert motorists or people who are in noise environments. In addition, the weather that is necessary for these sirens to function may have loud wind and thunder noise which may affect how the sirens are heard. The decibel level of the existing sirens should be identified and a maximum range of the sirens should be determined to see if there is adequate coverage of the entire city. New sirens should be added as new development takes place which is outside or on the edge of the existing tornado siren coverage.

The same is true for tornado shelters. There is usually a concentration of potential public buildings which could be used as shelters in the downtown area of a community. However, for homes without basements, mobile homes, and businesses, there is usually no recognized shelter. Major employers may have designated tornado safe rooms for their workers, but all businesses and high-density residential concentrations would benefit from designating and publicizing a shelter or other existing structure which meets tornado safe room specifications. An engineering consultant may be required to complete this sort of assessment.

Objective 3.1: Increase public safety
- Action 3.1.1: Pursue a federal grant to retrofit public school buildings or other public facilities with a tornado shelter or with higher-designed windows and doors. These designs could also be incorporated into new public buildings. FEMA publication #361 should be used for constructing public shelters.

Objective 3.2: Increase safety of the general public in the business district and in parts of communities with few shelter options
- Action 3.2.1: Identify and designate tornado shelters, publicize the locations of all public tornado shelters to increase public awareness – perhaps with a sign on the building.

- Action 3.2.2: Construct tornado shelters for mobile home concentrations or in other locations with vulnerable construction such as slab-on-grade.
- Action 3.2.3: In areas especially prone to damaging high winds, "hurricane straps" and better-designed windows and doors can be used to attach the roof rafters to the ceiling supports of the highest floor. This would need to be done as a building retrofit and would not be expensive. New construction can use this building technique very cheaply.
- Action 3.2.4: Offer information to home owners about tornado safe rooms to be constructed as a part of their homes.

Objective 3.3: Ensure adequate outdoor warning siren coverage

- Action 3.3.1: Perform assessment of the tornado siren coverage for communities, add sirens if found to be deficient.
- Action 3.3.2: Codify regulations that require additional tornado sirens as development occurs outside of current coverage areas.

Objective 3.4: Oversee adequate indoor warning coverage

- Action 3.4.1: Purchase NOAA weather radios for critical facilities (i.e., public schools)
- Action 3.4.2: Purchase or encourage non-public critical facilities (i.e., nursing homes) to purchase weather radios.
- Action 3.4.3: Educate a community's businesses about purchasing additional warning systems, especially in manufacturing facilities where it may not be possible to hear the outdoor sirens.

Goal 3: Increase Public Education

There is a natural decline in risk perception in communities which have not seen a tornado or high wind event in recent history. In addition, persons relocating to Hall County may not be aware of the danger that severe weather and tornadoes presents, and they may not know what to do in case of a warning. The same tree-related objectives in the severe weather section apply for tornadoes.

Objective 3.5: Help residents know what to do in case of a tornado warning

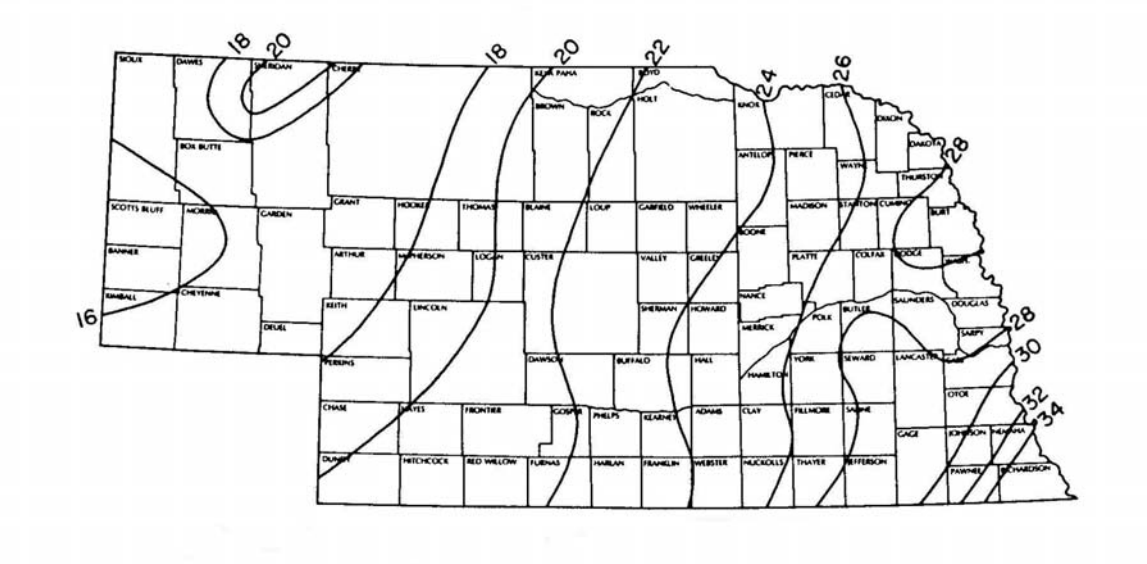
- Action 3.5.1: Residents should be made aware that tornadoes are possible in their community. They should know where to go in the event of a tornado (i.e., to a shelter or internal room/basement in their houses).
- Action 3.5.2: Educate homeowners about how to maintain trees on their property since it is their liability if a tree on their property damages someone else's personal property.
- Action 3.5.3: Have available information to educate homeowners about types of desired trees for planting on private property. Information should include: insect susceptibility, potential disease problems, blossom or seed characteristics, cold weather hardiness, and other items.

2.40 DROUGHT

2.41 Background

Figure 4 below is the isohyet map of the State of Nebraska which shows the average rainfall across the State. In an average year, Hall County will receive approximately 24-25 inches of precipitation per year. In average years, this represents enough rainfall to prevent drought; however, it is during successive years of below-average rainfall that droughts do have an impact.

Figure 4 – Nebraska Isohyet Map
(Average Annual Rainfall in Inches)



Confounding the discussion of drought is the fact that there are different definitions of drought: meteorological drought, agricultural drought, and hydrological drought. Meteorological drought is defined usually on the basis of the degree of dryness (in comparison to some "normal" or average amount) and the duration of the dry period. A meteorological drought must be considered as region-specific since the atmospheric conditions that result in deficiencies of precipitation are highly variable from region to region. For example, some definitions of meteorological drought identify periods of drought on the basis of the number of days with precipitation less than some specified threshold.

Hydrological drought is associated with the effects of periods of precipitation (including snowfall) shortfalls on surface or subsurface water supply (i.e., streamflow, reservoir and lake levels, ground water). The frequency and severity of hydrological drought is often defined on a watershed or river basin scale. Although all droughts originate with a deficiency of precipitation, hydrologists are more concerned with how this deficiency plays out through the hydrologic system. Hydrological droughts are usually out of phase with or lag the occurrence of meteorological and agricultural droughts. It takes longer for precipitation deficiencies to show up in components of the hydrological system such as soil moisture, streamflow, and ground water and reservoir levels. As a result, these impacts are out of phase with impacts in other economic sectors.

Agricultural drought links various characteristics of meteorological (or hydrological) drought to agricultural impacts, focusing on precipitation shortages, differences between actual and potential evapotranspiration, soil water deficits, reduced ground water or reservoir levels, and so forth. Plant water demand depends on prevailing weather conditions, biological characteristics of the specific plant, its stage of growth, and the physical and biological properties of the soil. Deficient topsoil moisture at planting may hinder germination, leading to low plant populations per hectare and a reduction of final yield. However, if topsoil moisture is sufficient for early growth requirements, deficiencies in subsoil moisture at this early stage may not affect final yield if subsoil moisture is replenished as the growing season progresses or if rainfall meets plant water needs.

The three different definitions all represent significant things in Nebraska. A meteorological drought is the easiest to determine based on rainfall data and is an easier drought to monitor from rain gauges and reports. An agricultural drought represents difficulty for Nebraska's agricultural-based economy and is also relatively easy to monitor based on crop viabilities for different regions. A hydrological drought means that stream and river levels are low, which also has an impact for surface water and ground water irrigators. In addition, in-stream discharges that fall below a pre-required level also place the State in a regulatory difficulty with US Fish and Wildlife and with neighboring states over cross-border flowage rights. Hydrologic drought is somewhat more difficult to monitor since it requires some field verification of stream levels.

Nebraska is fortunate to have the National Drought Mitigation Center on the campus of the University of Nebraska in Lincoln. The NDMC provides drought monitoring and technical assistance to all areas of the world.
NDMC's website is found at: http://www.drought.unl.edu/.
Specific drought impacts by county are recorded at: http://droughtreporter.unl.edu/.

The impacts of drought can be categorized as economic, environmental, or social. Many economic impacts occur in agriculture and related sectors, including forestry and fisheries, because of the reliance of these sectors on surface and subsurface water supplies. In addition to obvious losses in yields in both crop and livestock production, drought is associated with increases in insect infestations, plant disease, and wind erosion. Droughts also bring increased problems with insects and diseases to forests and reduce growth. The incidence of forest and range fires increases substantially during extended droughts, which in turn places both human and wildlife populations at higher levels of risk. Income loss is another indicator used in assessing the impacts of drought because so many sectors are affected.

Although environmental losses are difficult to quantify, growing public awareness and concern for environmental quality has forced public officials to focus greater attention and resources on these effects. Environmental losses are the result of damages to plant and animal species, wildlife habitat, and air and water quality; forest and range fires; degradation of landscape quality; loss of biodiversity; and soil erosion. Some of the effects are short-term and conditions quickly return to normal following the end of the drought. Other environmental effects linger for some time or may even become permanent. Wildlife habitat, for example, may be degraded through the loss of wetlands, lakes, and vegetation. However, many species will eventually recover from this temporary aberration. The degradation of landscape quality, including

increased soil erosion, may lead to a more permanent loss of biological productivity of the landscape.

Social impacts mainly involve public safety, health, conflicts between water users, reduced quality of life, and inequities in the distribution of impacts and disaster relief. Many of the impacts specified as economic and environmental have social components as well.

2.42 Drought History

In addition to differing definitions, there is also some debate about whether or not an area has experienced or is currently experiencing a drought. Certainly, Hall County has experienced times when certain water usages had to be voluntarily curtailed in order to maintain an adequate water reserve. However, although these periods may have witnessed below-average rainfall, the impacts were not felt much further than an inconvenience to homeowners. A significant portion of Hall County – especially in the Grand Island area – has a high water table, which reduces the impact of a drought. In certain areas, there can be standing water even if there has been no rain for weeks. In Hall County, there have been no instances of drought which have caused drastic impacts to the extent that land use regulations or emergency actions have had to be used.

Going back to 1993, the National Climatic Data Center shows two droughts: in 2000 and 2002. Drought reporting is completed by regions instead of counties, so it is not possible to break out a damage estimate for Hall County. For the drought of 2000, Governor Nelson estimated that the total agricultural effect on the Nebraska economy was around $1 billion with direct agricultural losses estimated at $240 million. Two regions of the State were particularly hard hit: near the Kansas border by Superior and from the area north of Grand Island to north of York. In 2002, The prolonged drought across central and south-central Nebraska was occasionally classified into the "Extreme" to "Exceptional" category in the summer and fall. Most dry land crops were near a total loss and there was some decreased yield with irrigated crops. Total direct agricultural losses was estimated at $480 million.

Previous Hall County Drought Mitigation Actions

Other than monitoring, there is precious little that can be done to mitigate a drought. As a result, extensive drought monitoring networks have been established. The purpose of monitoring is to see that a drought is indeed happening so that planners are then able to take appropriate actions to stem the impacts before they reach crisis level.

The Central Platte NRD participates in programs which help with drought monitoring. The NRD administers the Nebraska Rainfall Assessment and Information Network (NeRAIN) by supplying individual cooperators with rain gauges. These volunteers read the amount of rainfall daily and enter their observations into an internet-based reporting system. This network allows personnel at all levels of government – primarily local and State – to evaluate emergency operations needs while and to capture hydrologic data for future use. The data will also provide important daily decision-making information for agriculture, industry, home water use, utility providers, insurance companies, resource managers, and educators.

2.43 Probably of Drought Events

It is probable that a drought will impact Hall County in the future.

2.44 Vulnerability Assessment of the Drought Hazard

Due to the nature of a drought and the uncertainty about when it begins and ends, a vulnerability assessment is equally difficult to ascertain. One of the biggest drought impacts that could happen would be to a community's water system intake being rendered useless by declining water levels in a hydrological drought. The entire population in Hall County is theoretically at risk for a drought. However, there is an unequal spread of risk between rural and urban areas. Most urban areas have a water system in place which allows for adequate distribution of water, even in times when drought conditions prevail. Rural areas are more dependent on single-site water wells. In addition, since water is the economic lifeblood of agriculture in these areas, there is a much greater economic vulnerability to these areas. Since relevant drought impacts are more community-specific than area-based, any drought issues are saved for the community-specific reports found in **Appendix D**. There is also a general lack of funding for drought mitigation projects. Most projects that are completed are based on crisis need, so federal grants with application periods are not frequently used. Cost would vary greatly depending on scope and type of project.

2.45 Potential Drought Mitigation Measures

The main drought mitigation measures can be grouped into five main categories: legislation/public policy, water supply augmentation, demand reduction/water conservation programs, emergency response programs, and drought contingency plans.

Goal 1: Reduce or prevent future damage from natural hazard events
Goal 2: Increase Public Safety from Drought

Objective 4.1: Reduce drought impacts through legislation/public policy
- Action 4.1.1: Prepare position papers for legislature on public policy issues
- Action 4.1.2: Examine statutes governing water rights for possible modification during water shortages
- Action 4.1.3: Pass legislation to protect in-stream flows
- Action 4.1.4: Pass legislation providing guaranteed low-interest loans to farmers
- Action 4.1.5: Impose limits on urban development

Objective 4.2: Reduce drought impacts through water supply augmentation
- Action 4.2.1: Issue emergency permits for water use
- Action 4.2.2: Provide pumps and pipes for distribution
- Action 4.2.3: Propose and implemented program to rehabilitate reservoirs to operate at design capacity
- Action 4.2.4: Undertake water supply vulnerability assessments
- Action 4.2.5: Inventory self-supplied industrial water users for possible use of their supplies for emergency public water supplies
- Action 4.2.6: Inventory and reviewed reservoir operation plans

Objective 4.3: Reduce drought impacts through demand reduction/water conservation programs
- Action 4.3.1: Establish stronger economic incentives for private investment in water conservation
- Action 4.3.2: Encourage voluntary water conservation

- Action 4.3.3: Improve water use and conveyance efficiencies
- Action 4.3.4: Implement water metering and leak detection programs

Objective 4.4: Reduce drought impacts through emergency response programs
- Action 4.4.1: Establish alert procedures for water quality problems
- Action 4.4.2: Stockpile pumps, pipes, water filters, and other equipment
- Action 4.4.3: Establish water hauling programs for livestock
- Action 4.4.4: List livestock watering locations
- Action 4.4.5: Establish hay hotline
- Action 4.4.6: Fund water system improvements, new systems, and new wells
- Action 4.4.7: Fund drought recovery programs
- Action 4.4.8: Lower well intakes on reservoirs for rural water supplies
- Action 4.4.9: Extend boat ramps and docks in recreational areas
- Action 4.4.10: Issue emergency irrigation permits for using state waters for irrigation
- Action 4.4.11: Create low-interest loan and aid programs for agricultural sector
- Action 4.4.12: Create drought property tax credit program for farmers
- Action 4.4.13: Establish a tuition assistance program for farmers to enroll in farm management classes

Objective 4.5: Reduce drought impacts through drought contingency plans
- Action 4.5.1: Establish statewide contingency plan
- Action 4.5.2: Recommend that water suppliers develop drought plans
- Action 4.5.3: Evaluate worst-case drought scenarios for possible further actions
- Action 4.5.4: Establish natural hazard mitigation council

Goal 3: Increase Public Education

There are no explicit objectives or actions for this goal; however, there is an implicit action related to this goal for above actions which will require public participation – for example, the voluntary water conservation.

2.50 DAM FAILURE

2.51 Background

Many of Nebraska's communities were founded due to their proximity to water resources. Often, these streams or rivers later needed a dam for flood control or a reservoir for a constant water release. The Nebraska Department of Natural Resources performs annual inspections on all high-hazard dams in the State. A high-hazard dam is one where a large discharge and/or breach of the dam could potentially lead to downstream loss of life. High-hazard dams are designed to the Probable Maximum Precipitation event, which is typically three or four times the rainfall expected from a 500-year event.

In Hall County, the flat topography in combination with the high water table make dams for flood control largely infeasible. There are only two dams in Hall County, and both are classified as low-hazard dams. The information of both of the dams in the County are given below.

County	Dam Name	Stream	Classification	Closest Community	Year Completed
Hall	Benton & Still Dam	Dry Creek	Low	Abbott – 10 miles	1952
Hall	Prairie Creek #4	Prairie Creek	Low	Abbott – 15 miles	1977

Abbott, Nebraska, is an unincorporated area a half-mile north of Highway 2 between Cairo and Grand Island.

The only way that Hall County will be impacted by a dam failure would be from a failure of Kingsley Dam, which holds back Lake McConaughy in Keith County. The dam is on the North Platte River, which meets the South Platte River immediately east of the City of North Platte. According to the Emergency Action Plan for Kingsley Dam, the only community which would be impacted by a failure of Kingsley Dam would be the southern portion of Grand Island. Flow released from a Kingsley Dam failure would travel the approximately 190 river miles to the Highway 34 & 281 bridge in slightly more than 48 hours.

2.52 Dam Failure History

In the development of this mitigation plan, no record could be found of a dam failure in Hall County in the last 40 years.

Previous Hall County Dam Failure Mitigation Actions

Since there are only two low-hazard dams in Hall County, there has been no dam failure mitigation actions undertaken to date. Both dams are regularly inspected and are kept properly maintained.

2.53 Probability of Dam Failures

The likelihood of a Kingsley Dam failure is exceedingly small, especially given that Lake McConaughy water levels are at near-record low after multiple years of drought and low inflow. Both of the dams in Hall County are regularly inspected. In addition, since both dams are classified as low-hazard, even if an intense rain event were to breach them, there would be little to no damage downstream.

2.54 Vulnerability Assessment of the Dam Failure Hazard

Dam breach-routing inundation paper maps have been completed for the Emergency Action Plan required for Kingsley Dam. The maps are kept on-file at the Dam Safety Division of the Nebraska Department of Natural Resources. For security reasons, these maps are not made readily available to the public; however, a general description of the impacts of a dam failure can be provided here.

According to the Emergency Action Plan, the maximum depth of flooding would be 8.1 feet at the Highway 34 & 281 bridge. The maximum depth is for the area closest to the Platte River. Everything south of a general line from Highway 30 & Plum Street on the east to Highway 281 & Webb Road on the west side of town would be inundated to a certain extent. Properties closer to the Platte River would be inundated to a deeper level.

2.55 Potential Dam Failure Mitigation Measures

Given the lack of risk and the routine inspections and maintenance requirements for existing dams, it is believed that all mitigation measures are being performed that can be performed.

2.60 LEVEE FAILURE

2.61 Background

Following the levee-related devastation in New Orleans caused by Hurricane Katrina, the nation has increased the scrutiny of levees, and especially on development behind them. With routine maintenance, most levees will not offer a problem. However, even if a levee is perfectly maintained, the development behind a levee is subject to flooding – and in some cases high velocity flows – if a levee is breached or overtopped by a flood exceeding the levee's design.

In Hall County there is only one levee, and that is associated with the Wood River Diversion project completed by the Corps of Engineers in 2005. As designed, the Diversion is essentially a two-sided levee which alters the flow of a 100-year flood to take it around south Grand Island. A Letter of Map Revision (LOMR) was completed for this project on October 19, 2004, and extensive areas of ponding flooding mapped floodplain were removed across flood map panels 0010, 0015, and 0020 (they are too extensive to put in this report). An additional LOMR was published on September 28, 2007, for the western part of the Diversion project between Highway 281 and the actual diversion point.

2.62 Levee Failure History

Since its completion in 2005, the Wood River Diversion has not failed over been overtopped. On the contrary – in a major flood event in May of 2005, the Diversion performed as designed, saving southern Grand Island from a repeat of the 1967 flood. The Corps of Engineers estimated that the completed project essentially paid for itself from this event.

2.63 Probability of Levee Failures

It is extremely unlikely that the Wood River Diversion will fail. The more likely scenario would be an overtopping from a major rainfall event in excess of the project design. The Corps of Engineers, Central Platte NRD, and the City of Grand Island will ensure that the Diversion project is maintained.

2.64 Vulnerability Assessment of the Levee Failure Hazard

According to the structural inventory completed by the Corps of Engineers, 209 structures are protected by the Wood River Diversion project. This represents 0.9% of the total structures in Grand Island. The Corps of Engineers has determined the valuation of structures protected by the Diversion as $40,860,840, or 2.2% of the City's valuation.

2.65 Potential Levee Failure Mitigation Measures

Given the lack of risk and the routine inspections and maintenance requirements for existing dams, it is believed that all mitigation measures are being performed that can be performed.

2.70 FUTURE DEVELOPMENT AND HAZARD VULNERABILITY

Future development is a matter better reserved for the specific communities, as given in **Appendix D**.

Chapter 3 – Public Participation on Plan

The Nebraska Department of Natural Resources is the lead agency in the planning issues. All of the meetings were open to the public and properly noticed according to the Open Meetings Act of the State of Nebraska (NEB. REV. STAT. §§ 84-1407 TO 84-1414).

Present at the initial public meeting on March 7, 2007, were representatives from the US Army Corps of Engineers, Nebraska Department of Natural Resources, Hall County Emergency Management Agency, community elected officials, and citizens. See the sign-in sheet and newspaper article in **Appendix C** for documentation.

In place of a second public meeting, this plan used the public input system available at the local level through the public hearing process. The Hall County Regional Planning Commission heard discussion of the plan's findings and recommended that the mitigation plan be adopted. Local governments were notified by letter from NDNR of the projects identified by their community representatives in the initial public meeting. A letter was also sent to the Hall County Emergency Management Agency for additional review. In the letter, communities and reviewers were asked if the projects listed were still an adequate representation of their hazard mitigation goals. In addition, local governments were also requested to prioritize their projects. The adoption by each participating community took place after the respective city councils or village boards had worked through the public hearing process.

To fulfill the adjacent jurisdictions review requirement, the initial draft of the Hall County plan was sent to the Central Platte Natural Resources District for comments. Hall County is surrounded by counties in the same NRD.

Steve McMaster, Natural Resources Planner Coordinator for the Nebraska Department of Natural Resources (NDNR), wrote this plan. The draft plan was sent to the Hall County Regional Planning Commission Board for review at its May 7, 2008, meeting for prioritization of mitigation alternatives and to provide comments. Prior to submitting the final draft of the plan for comments, NDNR submitted the draft to FEMA for a "Conditional Approval Pending Adoption" determination. Once received, the Hall County Regional Planning Commission was then requested to adopt the plan at their meeting on September 3, 2008. Documentation showing the adoption at the County level is given as the first page of this report. Local community adoption of their sections of the plan took place after NDNR received and made the comments requested from each community. The local adoptions took place on different dates. Local adoption resolutions are given as the last page for each community in the community-specific portion of the plan in **Appendix D**.

Subsequent evaluations and updating of the plan will involve public display advertisements in the local newspaper or other public notices. The plan will be reviewed and revised as necessary every five years or after a Federally-declared disaster.

Plans and Other Information Used in the Development of this Plan

City of Grand Island Comprehensive Plan
Information: Future development areas

City of Grand Island Flood Insurance Study, FEMA. September 2, 1982.
Information: Flood history, boundary, and statistics

City of Wood River Flood Insurance Study, FEMA. June 3, 1986.
Information: Flood history, boundary, and statistics

High Plains Regional Climate Center: http://www.hprcc.unl.edu

National Arbor Day Foundation – Tree City USA website located at:
http://www.arborday.org/programs/treeCityUSA.cfm
Information: Tree City USA information

National Climate Data Center searchable severe weather database located at:
http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwevent~storms
Information: All-hazard statistics

Nebraska Department of Property and Taxation: http://pat.nol.org

Nebraska flood data, Nebraska Department of Natural Resources spreadsheet.
Information: Historic flood events in Nebraska

Our Town Nebraska ----- "Nebraska…Our Towns" Taylor Publishing, Dallas, TX. 1990.
Also: http://casde.unl.edu/history/
Information: Historic community information

Population statistics from:
- http://factfinder.census.gov
- http://www.dnr.state.ne.us/databank/census/Ne00-90Villagerank.pdf

All maps were generated in-house by the Nebraska Department of Natural Resources.

Chapter 4 – Implementation

Hall County will implement this plan by the methods outlined in this chapter. In addition to a positive benefit-cost ratio, projects will be prioritized and selected for implementation based on community goals, planning objectives, funding availability, environmental concerns, and public support. Projects sponsored for implementation by the County or by a participating community will follow a public process.

Determining which projects should be submitted for funding will be based on a FEMA-approved cost-benefit method. This means that proposed projects would need to be reviewed for cost effectiveness with the assistance of state emergency management or floodplain management personnel. In addition to a positive cost-benefit ratio, projects will be prioritized and selected for implementation based on community goals, planning objectives, funding availability, environmental concerns, and public support.

At its discretion, the County may choose to not implement any of the proposed mitigation projects at this time with the realization that future events may change this stance as well as the prioritization of projects.

The Hall County Regional Planning Commission reviewed the following projects for a recommendation on which projects should receive the highest priority. The County is responsible for making the final decision on which projects are submitted to the appropriate funding agency/program for funding. Unless otherwise decided for specific projects, the County will be the agency responsible for project administration. These projects are those which the County would like to undertake if funding becomes available. Community-specific projects are separate (but which may have the County as a sponsor) and are listed in their specific-community sections in **Appendix D**.

In the plan, several potential mitigation projects are identified. This plan is not designed to have an all-inclusive list of projects, so the plan should be revised and updated as new projects are identified and prioritized by the County or its participating communities. During the planning process, the County heard the range of potential mitigation options available to them, and identified and prioritized the projects listed below. All mitigation options were considered and no options were thrown out – instead, they were ranked into three groups: a higher-priority, medium-priority, and lower-priority. The Hall County Regional Planning Commission reviewed each mitigation option at the May 7, 2008, meeting using the STAPLEE method. The reasons for not including any mitigation option as anything other than "High priority" are given in the STAPLEE failures handout in **Appendix C.** The public had the opportunity to comment on priorities in the public hearing in September 3, 2008. Within each category, the projects are not further prioritized from highest-to-lowest priority because it was believed that all projects within each category were equally important.

Recommendations

HIGHER PRIORITY PROJECTS

Emergency Backup Power Inventory for Critical Facilities
Many of the critical facilities in Hall County have emergency backup power capability. However, an inventory is needed to determine which emergency shelters, emergency responder facilities, vulnerable populations, and other critical facilities are in need of emergency backup capability.

Potential funding sources: Hall County Emergency Management Agency – staff time.

Emergency Backup Power
As witnessed in the major ice storm disaster of December, 2006, entire communities can be left without power for weeks. When a severe winter storm knocks out power, this is also a time when people – especially vulnerable populations – need access to heat and when critical facilities like hospitals need to be able to meet any critical care needs. Large emergency generators can be used to supply power directly to a community's electric grid until outside power can be restored. Also, critical facilities should have emergency backup power capability of their own, not only to be ensure they are able to operate as intended, but also to function as emergency warming centers in extreme cases.

Potential funding sources: The Hazard Mitigation Grant Program (HMGP) is a post-disaster funding program from FEMA. Projects must be identified in this mitigation plan, and these funds will supply up to 75% of the total project cost.

Drainage Improvements
Stormwater problems are common in the flat portions of Hall County, especially in the developed areas of Grand Island. The City and Central Platte NRD have been working to reduce the stormwater problems by constructing detention basins west of the City. The flooding dynamics will continue to change as additional construction occurs around the fringes of existing development.

Potential funding sources:

1. Community Development Block Grant (CDBG) funds are available through the Nebraska Department of Economic Development for planning. Drainage studies and improvements are eligible for funding as long as the City meets low-to-moderate income requirements. Applications are always open, but there are two funding cycles each year.
2. The Central Platte Natural Resources District has funded drainage improvements in the County.
3. The Flood Mitigation Assistance (FMA) program and Pre-Disaster Mitigation program through the Federal Emergency Management Agency (FEMA) receives annual allocations for projects. The Hazard Mitigation Grant Program (HMGP) is a post-disaster funding program, also from FEMA. For all of these programs, projects must be identified in this mitigation plan, and these funds will supply up to 75% of the total project cost.

Floodplain Management
Although not commonly viewed as mitigation, effective floodplain management is the most powerful tool in preventing unwise development in floodprone areas. Every community in Hall County – including Hall County – already participates in the National Flood Insurance Program. These communities will continue to participate and will be able to turn to the Nebraska Department of Natural Resources for technical assistance with specific problems and issues. The main responsibility for the administration of the local floodplain management ordinance has to do with the various aspects of reviewing and issuing floodplain development permits. If there is no or very little floodplain area in a community's jurisdiction or if there is no or very little growth, a community's administration responsibilities in the NFIP will be extremely easy.

Also in the floodplain management category, downstream zoning of dams is idea whose time has come. As a result of the Safety of Dams and Reservoirs Act passed by the Nebraska Unicameral in 2005, zoning of areas downstream of low and significant hazards dams is now possible. The intent is to allow development to be regulated and restricted in these areas since population moving in below a low hazard dam will cause it to be reclassified as a high hazard dam. When this happens, the dam owner would be responsible to undertake costly construction actions to raise the height of the dam, improve the dam to high-hazard specifications, and to ensure regular maintenance and inspections.

Potential funding sources: There is no expense to communities to participate in the NFIP program other than personnel time to administer the program at the local level. Communities are also encouraged to pass zoning regulations for areas downstream of low-hazard and significant-hazard dams.

Flood Control
Flood control and flood damage reduction is one of the primary responsibilities of the Central Platte NRD. Since the NRD was created in 1972, it has constructed numerous flood damage reduction projects in the Hall County. As the population of the County – especially in and around Grand Island – continues to increase and the area of development expands, the need for flood damage reduction measures also increases. The Wood River Diversion project is an example of a completed flood control project and the Prairie/Moores/Silver Creek project is one currently being worked on.

Potential funding sources: Corps of Engineers, Central Platte Natural Resources District, Natural Resources Development Fund through the Nebraska Department of Natural Resources.

Reverse 9-1-1 or New Technology for Warning Dissemination
Reverse 9-1-1 is a system which allows a central location like the 9-1-1 call center or Emergency Operations Center to automatically dial a pre-set list of telephone numbers and issue a recorded warning message. In addition, new technologies are being developed which allow this type of reverse warning system to be put in place with cellular telephones customers, targeted personnel, and geographically targeted populations. These types of warning systems have being implemented on many university and college campuses in light of shootings. In these reverse warning situations, students were informed not to come to the campus or to stay where they were until the situation had been resolved. Essentially, these warning systems would be used when

there is an immediate need for a warning when there is not enough time for people to get to a television or radio.

Potential funding sources: US Department of Homeland Security, Hazard Mitigation Grant Program set-aside funds, Hall County Emergency Management Agency, private through telephone companies.

Purchase NOAA Weather Radio for Critical Facilities
Weather radios are inexpensive enough that communities could purchase them for public critical facilities, such as schools and hospitals. Communities can encourage local businesses to purchase radios, especially elderly care facilities and noisy manufacturing plants which either need to be sure to receive warnings or may not be able to hear outdoor warning sirens.

Potential funding sources: A brief online search of sites which offer NOAA Weather Radios for sale show several options with the average price being about $30-50. Depending on how many radios communities would need for critical public facilities, they might be able to purchase them. Some of Nebraska's emergency management agencies have acquired weather radios at a discounted cost and have distributed them in interested communities. The Hall County Emergency Management Agency could perform a similar service. They are also eligible for FEMA's Hazard Mitigation Grant Program set-aside funds if they are purchased for critical facilities.

NOAA Weather Radio Public Education
The public may not be aware that weather warnings are available to them by purchasing an inexpensive weather radio. The cost for new radios is about $30 and they have the capability to weed out warnings for unneeded counties. The Hall County Emergency Management Agency can educate the public about these radios in their educational/outreach programs. Grand Island was a Project Impact community in the late 1990s, and they used those grant funds to purchase and hand out several thousand weather radios.

Potential funding sources: Hall County Emergency Management, no cost for education. Homeowners.

Public Tornado Shelters
Given Hall County's history with tornadoes, public tornado shelters should be considered. They are fundable under FEMA's non-flood mitigation programs, and most states in FEMA Region VII (Nebraska, Iowa, Missouri, Kansas) have successfully implemented them. However, Nebraska currently has only funded one public tornado shelter: a community building in Cortland after the devastating Hallam Tornado of 2004. Shelters can be built in as new construction or as a retrofit – retrofits are more expensive. The most popular public shelters have been public schools and in areas of large concentrations of population in the summer months such as fairgrounds and parks.

Potential funding sources: The Hazard Mitigation Grant Program (HMGP) and Pre-Disaster Mitigation (PDM) programs from FEMA. The Community Development Block Grant (CDBG)

program can also be used to assist with the funding of public tornado shelters if the community meets certain federal income guidelines.

Information about Tornado Safe Rooms
Tornado safe rooms are areas built into existing or new construction which offer safety from severe weather events. The information about these safe rooms exists and is available, so it would be a matter of educating the availability of this information and encouraging property owners and construction firms to consider building or retrofitting a safe room in their developments.

Potential funding sources: Federal Emergency Management Agency (publications), Hall County Emergency Management Agency, property owners – no cost for education.

Tornado Shelter Assessment
Identify and designate tornado shelters. Any shelters that are identified should be entered into a GIS coverage for spatial analysis of shelter distribution and needs. Publicize the locations of all public tornado shelters to increase public awareness – perhaps with a sign on the building. The Hall County Emergency Management Agency should be the project leader for this activity.

Potential funding sources: Hall County Emergency Management Agency, consultants

Requiring Power Line Burial
Communities can require new developments to bury power lines. Most communities already currently have this as standard building code.

Potential funding sources: No cost to implement, but staff training and enforcement

Power Line Burial Projects
For stretches of exposed transmission, distribution, and service lines which routinely experience problems – whether by ice, wind, or other natural hazard – line burial is an option. Burying power line is more expensive up-front, but essentially eliminates the potential for future line outages.

Potential funding sources: FEMA's non-flood mitigation programs, Southern Public Power District, City of Grand Island, homeowners

Warning Siren for New Development
As development takes place, it can be easy to forget about the need for warning siren coverage. Communities should explore options available to them to increase warning siren coverage as they expand.

Potential funding sources: Hall County Emergency Management Agency, communities, Hazard Mitigation Grant Program set-aside funds.

Urban Tree Management Plan

For all communities in Hall County, it would be beneficial to develop a comprehensive urban forest management plan, especially for public areas and in areas of communities which experience tree-related problems. Smaller communities should request a tree inventory from the Nebraska Forest Service which would give recommended actions to local tree boards. A common misconception is that a tree management plan will mean that the community is liable for damages if they do not take action based on the inventory's findings. In reality, each community is already liable for tree-related damages on public property. An inventory can be completed which stipulates that only trees in public areas will be assessed. Outside of an inventory or urban forest plan, homeowners should also know how to maintain trees on their property since they are responsible for them.

Potential funding sources: Instead of assessing the need for financial assistance, interested communities should send a letter to the Nebraska Forest Service, requesting a community tree inventory. Tree inventories are a free service from the NFS and are beneficial in determining tree-related activities which should be taken immediately or in the near future. Even in communities that have had a tree inventory completed in the last ten years, an updated inventory would be beneficial for local tree boards or other tree-related groups to assess required actions to reduce vulnerability.

Severe Weather Awareness Education

For awareness, severe weather safety tips could be made public by newspaper or other media outlets. Such a campaign should include practical tips like staying indoors when lightning is around and could be combined with awareness campaigns from other disasters, and could take place during Severe Weather Awareness week every March.

Potential funding sources: This is another activity which would not need to require financial resources other than staff time. Severe weather awareness campaigns can be done through various media, in cooperation with the National Weather Service, Hall County Emergency Management Agency, Central Platte Natural Resources District, Nebraska Emergency Management Agency, Nebraska Department of Natural Resources, Federal Emergency Management Agency, U.S. Army Corps of Engineers, and other agencies at all levels.

Flood Awareness Education

A flood awareness program would require the commitment of staff time from each interested community. Agencies such as the Central Platte NRD, Nebraska Department of Natural Resources, Nebraska Emergency Management Agency, Federal Emergency Management Agency, and US Army Corps of Engineers could provide assistance and educational materials. An on-going flood awareness education program might attract interested members of the public to assist as volunteers.

Potential funding sources:

Most education and outreach programs would not require funding. The only commitment would be staff time, time and money spent advertising meetings, and the cost of printing materials.

MEDIUM PRIORITY PROJECTS
Since these projects are not of a high priority, potential funding sources are not as important to identify at this stage.

Provide Tree Planting/Selection Information to Citizens
This information is already available from multiple sources. It would be a question of having communities receive the informational brochures and to have the information available in an accessible location.

Water Supply Augmentation
The Village of Alda and Village of Wood River both have water supply issues which could make their citizens more vulnerable to drought than communities which have an adequate water supply. The State has some revolving loan programs which could be tapped to expand their water supply.

Local Demand Reduction/Conservation Programs
When communities face a water shortage, it is important to reduce the demand on the limited water supply. These programs could be as simple as restricting lawn watering or could get more drastic depending on need. No matter what, a pipeline for disseminating the restrictions is needed.

LOWER PRIORITY PROJECTS

Since these projects are not of a high priority, potential funding sources are not as important to identify at this stage.

Acquisition and Demolition of Floodprone Structures
Some natural resources districts in Nebraska have existing floodway acquisition programs. The Central Platte NRD could initiate a similar program. One of the benefits of a countywide hazard mitigation plan is that all properties in the County will be eligible for FEMA funding from its annually-funded mitigation programs. The City of Grand Island would be an excellent sponsor for the repetitive loss property within its jurisdiction. This alternative was put in the "Lower" category due to the low number of targetable buyout candidates in Hall County.

Specific areas targeted for acquisition projects are:
- Repetitive loss properties listed for Grand Island and Hall County
- All floodprone areas in the County will be considered for buyouts, as requested

Emergency Backup Power for Critical Facilities
This was rated in the Lower category not because it is not needed, but because an inventory should first be completed to know where there a need.

Become a Tree City USA
Grand Island and Doniphan are already Tree City USA communities. Other communities in Hall County can receive the benefits of becoming a Tree City USA.

Hail Education
Some of the most damaging natural hazards events in Hall County have been severe hail storms. There is not a lot that can be done to prevent hail damage to existing homes, but there are things that can be done to reduce future damage to new homes and to vehicles. For new homes, building options would be metal roofs instead of wood shake or traditional asphalt shingles. Another building improvement would be metal siding instead of vinyl or wood, which can be destroyed by hail strikes. Improved warning times would allow owners to move their vehicles to a protected location.

Secure At-Risk Development like Manufactured Homes
Mobile home tie-downs are an easy way to prevent them from rolling during high winds. However, implementing a mitigation project for these types of buildings is problematic since they are often rented and the owners lack the financial capability to install them. Under the Project Impact program in the late 1990s, Grand Island offered these tie-downs as a project and received no takers.

Flood Insurance Education for Homeowners
Information on how to obtain flood insurance should be provided to private property owners – it would be at their discretion to actually purchase the insurance coverage. Since the passage of the National Flood Insurance Reform Act of 1994, lenders have been required to determine if the property to be insured is in a floodplain. If it is, lenders will require flood insurance as a condition of protecting their loan. This is only for loans which are federally-backed such as mortgages or home improvements. For this potential project, "education" could mean something as easy as having FEMA flood insurance brochures available at city/village halls and public libraries to inform the public.

Emergency Snow Route Development and Signage
The City of Grand Island already has this in place, which is the highest priority based on population concentration, and the State takes care of clearing highways. Other communities have a general snow removal plan, but do not have a route identified.

Water Supply Emergency Response Programs/Drought Contingency Plans
Develop contingency plans, including worst case scenarios, in case of an emergency water supply shortfall which cannot be met by voluntary restrictions to reduce demand.

Plan Evaluation

Future plan monitoring, evaluating, and updating will follow this process:

1. Unless otherwise designated by the Hall County Board, Hall County Regional Planning Commission (HCRPC) staff will oversee the plan evaluation and revision process. Alternate staff could be from the Hall County Emergency Management Agency.
2. To assist with the monitoring of the plan, as a recommended project is completed, a detailed timeline of how that project was completed will be written and attached to the plan in a format selected by HCRPC staff. Items to be included will be: timelines, agencies involved, area(s) benefited, total funding (if complete), etc.

3. At the discretion of the HCRPC, a local task force may be used to review the original draft of the mitigation plan and to recommend changes.
4. The persons overseeing the evaluation process will review the goals and objectives of the previous plan and evaluate them to see that they are still pertinent and current. Among other questions, they may want to ask themselves:
    - Do the goals and objective address current and expected conditions?
    - If any of the recommended projects have been completed, did they have the desired impact on the goal for which they were identified? If not, what was the reason it was not successful (lack of funds/resources, lack of political/popular support, underestimation of the amount of time needed, etc.)?
    - Have the nature, magnitude, and/or type of risks changed?
    - Have there been implementation problems?
    - Are current resources appropriate to implement the plan?
    - Were the outcomes as expected?
    - Are there other agencies which should be included in the revision process?
5. Any projects that have been completed since the previous plan will be noted in a "Previous Mitigation Projects" section and removed from further consideration for new projects.
6. If no further action has been made on the recommended projects of the previous version of the plan, HCRPC staff will document this fact.
7. Before incorporating the changes to the plan that are identified as necessary as a part of the monitoring and evaluating portions, the public will be invited to comment through the same process used in the development of the original plan: public notification through newspaper article/public notice, public meetings, and by letter of invitation to relevant stakeholders.
8. At its discretion, the HCRPC may opt to use the plan evaluation, update, and revision worksheets given in this plan in **Appendix B.**

For future reviews, the following <u>minimum</u> procedures must be followed:

Task A: Evaluate the effectiveness of the planning process.

1. Reconvene a Planning Team
2. Review your Planning Process
   Items to Discuss:
    a. Building the Planning Team
    b. Engaging the Public
    c. Data Gathering and Analysis
    d. Coordinating with other Agencies

Task B: Evaluate the effectiveness of your actions.

1. What were the results of the implemented action? Did the results achieve the goals/objectives outlined in the plan? Did the actions have the intended results?
2. Were the actions cost-effective? Did (or would) the project result in the reduction of potential losses?
3. Document actions that were slow to get started or not implemented

Task C: Determine why the actions worked (or did not work)

1. Lack of available resources
2. The political or popular support for or against the action

3. The availability of funds
4. The workloads of the responsible parties
5. The actual time necessary to implement the actions

Incorporation into Existing Planning Mechanisms

There is a lack of regional planning documents into which this countywide plan could be incorporated. At the discretion of the participating communities, this plan could be incorporated into the comprehensive plans of these communities. This would ensure that the mitigation component of the comprehensive plan would be consistently revisited and reviewed. However, care must taken so that this mitigation plan is reviewed and updated every five years.

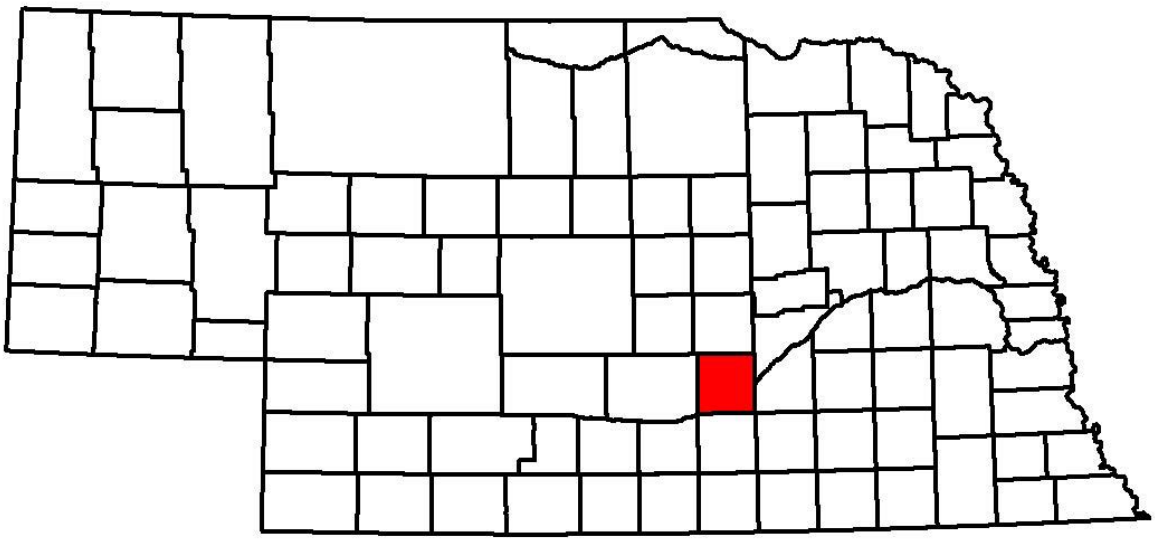
Upon the local adoption of the mitigation plan, each participating community will make sure that it adopts, and is enforcing, the minimum standards established in the building code used in the State of Nebraska. This is to ensure that life/safety criteria are met for new construction.

Any capital improvement planning that occurs in the future will also contribute to the goals in this hazard mitigation plan. This is another item which may be administered at the local level and is not necessarily overseen by the County. However, the County may be able to work with capital improvement planners to secure high-hazard areas for low risk uses.

Appendix A
Corps of Engineers Structural Inventory

US Army Corps of Engineers®

Flood Hazard Mitigation Report for Hall County, Nebraska



Prepared for Incorporation into the Hall County, Nebraska Multi-Hazard Mitigation Plan

August 2008

FLOOD HAZARD MITIGATION REPORT

for

Hall County, NE
(CID #310100)

Prepared for Incorporation into the
Hall County, Nebraska Multi-Hazard Mitigation Plan

August 2008

U.S. Army Corps of Engineers, Omaha District
1616 Capitol Avenue
Omaha, Nebraska 68102-4901

EXECUTIVE SUMMARY

The Hall County Flood Hazard Mitigation Report (FHMR) was authorized under Section 206 of the Flood Control Act of 1960 (33 U.S.C § 709a, as amended). A hazard study was requested by the Nebraska Department of Natural Resources (NDNR) to meet the requirements of the Disaster Mitigation Act of 2000 (DMA2k) for Hall County.

The purpose of this study was to assess the flood risk to and propose flood hazard mitigation measures for structures in Hall County, Nebraska. This project can be split into two distinct parts: flood risk assessment, and flood hazard mitigation recommendations.

To complete the flood risk assessment, data was collected from the community as well as the current effective Flood Insurance Rate Maps (FIRM). This data was used to identify the potential for flood events as well as the potential flood depth. Data was collected from the Hall County Assessors office regarding property value and used to assess the potential consequences of a flood event. Together the probability of flooding and the consequences of flooding were combined to assess the flood risk. Two methods were used to review the flood risk: location in relation to designated flood hazard zones, and ground surface elevation in relation to base flood elevation.

To determine the flood hazard mitigation recommendations, flood zone designations as well as calculated base flood depths were consulted. These mitigation recommendations are primarily directed at single facility non-structural measures.

The results of this project provide flood risk information and flood hazard mitigation recommendations for 3,436 of the 26,238 structures which may be identified as at flood risk for the 6 community jurisdictions in Hall County. Additionally, it was recognized that modern terrain information such as Light Detection and Recognizance (LiDAR) provides ground surface elevation information that may have results which are more reliable than previous methods. The use of LiDAR allowed this project to identify 493 structures which may be at flood risk but are currently shown as being located outside of a designated flood zone. Additional analysis was done conducted for at risk structures and areas of high flood risk.

The use of digital tools and the incorporation of community operated datasets in this study has made it possible for incorporation of the community's GIS network (County Assessors Office, and County GIS office) as well as potential future efforts. These efforts include the review of high flood risk areas for further study, redelineation of existing flood hazard data using updated terrain data, and notification to structure owners of existing flood risk and flood hazard mitigation recommendations.

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Exhibit 11 - Flood Hazard Mitigation Maps

SECTION 1: AUTHORITY

The funding and authority for this Flood Hazard Mitigation Report (FHMR) was authorized under Section 206 of the Flood Control Act of 1960 (33 U.S.C § 709a, as amended). A study was requested by the Nebraska Department of Natural Resources (NDNR) to meet the requirements of the Disaster Mitigation Act of 2000 (DMA2k). The Omaha District of the U.S. Army Corps of Engineers (USACE) compiled flood hazard information and potential mitigation measures for Hall County Nebraska and its associated communities.

SECTION 2: STUDY PURPOSE

The purpose of the Flood Hazard Mitigation Study was to develop a plan to assist Hall County in meeting the requirements of the Disaster Mitigation Act of 2000. Under guidelines of the Disaster Mitigation Act, local governments must have a FEMA-approved mitigation plan in place in order to receive Pre-Disaster Mitigation (PDM) and Hazard Mitigation Grant Program (HMGP) funds from the Federal government.

SECTION 3: DEFINITIONS, OBJECTIVE & SCOPE

Flood risk is defined as the quantifiable likelihood of loss due to flood, and is a function of both the probability of a loss event, and the consequence of the loss event. Flood hazard mitigation is defined as structural and/or nonstructural measures undertaken to limit the adverse impact of flood hazards. Structural flood hazard mitigation measures reduce flood damages by changing the characteristics of the flood at the protected area. These measures include dams and reservoirs, levees, diversions and channel improvements. Nonstructural flood hazard mitigation measures reduce flood damages by modifying the property or activities that are at risk from flooding. These measures include elevation, buyout/acquisition, relocation, wet flood proofing, dry flood proofing and flood insurance.

The objective of this study was to identify the flood risk based on best available information with consideration to factors such as flooding history, flooding source, as well as number of structures located in special flood hazard areas. The results of this risk assessment led to the development of flood hazard mitigation recommendations. These mitigation recommendations are directed at single facility nonstructural measures. Community based nonstructural measures such as flood warning, flood preparedness planning, and floodplain regulations are not covered by this study, but recommended and/or required for all communities. This study assesses the risk to the community based on the best available data, as no new flood hazard data (hydrology or hydraulics) were developed. As such, structural recommendations are beyond the scope of this study. This study does identify the flood risk which could assist in the direction of future efforts aimed at structural flood hazard mitigation measures.

The scope of this study is based on the level of detailed flood elevation information available. Where base flood elevations (BFEs) area available, detailed flood hazard mitigation reviews were completed. Where flood elevation information was not available limited detail flood hazard mitigation reviews were completed. The following lists outline the scope of limited detail and detailed flood hazard mitigation reviews

Limited Detail Flood Hazard Mitigation Review:
- Critical Facilities Identification
- Flood Hazard Identification
- Flood Plain Structures Inventory
- Flood Plain Structures Value Inventory
- Identification of Potential Flood Hazard Mitigation Measures

Detailed Flood Hazard Mitigation Review:
- All items listed for Limited Detail Flood Hazard Mitigation Review
- Base Flood Depth Identification
- Base Flood Depth Structure Inventory
- Base Flood Depth Structure Value Inventory
- Enhanced Identification of Potential Flood Hazard Mitigation Measures

SECTION 4: STUDY AREA

4.1 Community Data

Hall County is located in south-central Nebraska, and is bordered by Howard County on the north, Buffalo County on the west, Adams County on the south, Hamilton County on the southeast, and Merrick County on the northeast. Hall County is a largely agricultural region. The County seat and largest community is Grand Island. Other communities include the City of Wood River and the Villages of Cairo, Doniphan, and Alda.

The climate of Hall County is continental in character, with generally low humidity, relatively low annual rainfall, and wide extremes in temperature.

The topography of the area is extremely flat in relation to the drainage courses making it difficult to identify a definite flood plain in many locations. This intern impacts the community's ability to identify flood risk.

For this Flood Hazard Mitigation Report the study area was subdivided into six jurisdictions. These jurisdictions were established using the S_POL_AR shapefile associated with the ongoing DFIRM project for Hall County.

The presence of detailed flood elevation information dictated the use of detailed or limited-detail flood hazard mitigation reviews. The following table lists the flooding sources with BFEs presented on the effective Flood Insurance Rate Maps (FIRM).

Table 4-1: Flooding Sources with Regulatory BFEs in Hall County

Flooding Sources with Base Flood Elevations
Platte River
Wood River
Wood River Overflow
Prairie Creek
Prairie Creek Overflow
Moore's Creek
Silver Creek

It was recognized that in some areas the delineations used on the effective FIRM maps were based on outdated topographic information, and that there may be structures located outside of the delineated flood hazard areas which require review. For this reason buffers were placed around the special flood hazard areas (SFHA) based on average width of the delineated floodplain at the location of the existing BFEs. Wood River was split into three segments. For areas along the Wood River that are recognized as protected by levee no buffer distance was used and the extents of the special flood hazard area represent the extents of the detailed flood hazard mitigation review boundary. The following table presents the buffers used to establish areas of detailed flood hazard mitigation reviews.

Table 4-2: Buffer Distances used to Establish Detailed Flood Hazard Mitigation Review Boundaries

Detailed Flooding Source	Buffer Distance (ft)
Platte River	647
Wood River	
Section 'A'	116
Section 'B'	914
Section 'C'	195
Wood River Overflow	113
Prairie Creek	482
Prairie Creek Overflow	780
Moore's Creek	758
Silver Creek	876

4.2 Flood History

4.2.1 Historic Flood Events

Official flood reports for watercourses other than the Platte River were difficult to locate because there is a lack of good and consistent river gage data for Hall County. The only gage in the County which is currently operating full-time is the Platte River gage at Grand Island, which is located approximately 2.5 miles southeast of the City on the Highway 34 Bridge on the Hall County/Hamilton County line. Other gages on different water courses were operated as shown in Table 4-3.

Table 4-3: Gaging Stations Pertinent to Hall County

Gage	Dates of Operation	Agency
Wood River near Alda	1953 to 1994	USGS
Wood River near Alda	1994 to 2002	NDNR
Platte River S. Channel near Gr. Island	1983 to 1989	USGS
Dry Creek at Cairo	1949 to 1953	USGS
Silver Creek at Ovina	1991 to 1995	USGS
Silver Creek near Ovina	1991 to 1999	USGS

Most communities in Hall County were incorporated during the late 1800s and the first flood reports on the Platte River date to that era. Little is known about the "Great Flood of 1883" because there was such little population in Hall County at the time. However, the reports that do exist point to flood damage in Kearney and Ashland, therefore, the Platte was also flooding in Hall County. Hydrological journals of the day only reference this flood by saying there was a major inflow into the Missouri River somewhere between the established towns of Sioux City, Iowa, and Kansas City, Missouri.

The most extensive flood event to impact Hall County occurred from a long period of excessive rainfall in May and June of 1967. The total damage from the Platte River flood

of 1967 was $49,309,015 (1967 Dollars) of which $40.8 million was private damage ($23 million in agricultural damage, $12 million in transportation damage, and $5 million was classified as "urban" damage) and $8.5 million was public damage. The Wood River was on the rampage in Grand Island, where three people were killed, 1800 buildings were flooded, and 11,000 of the City's 28,600 residents were directly impacted. Total damage in Grand Island was set at $6.25 million ($38.2 million in 2006 dollars).

On May 11 and 12, 2005, portions of Hall County received more than seven inches of rain in a 24-hour period, causing between $12 and $15 million in damage in the County, and damaged 2769 homes and businesses. Hall County was later declared a federal disaster area (FEMA-1590-NE-DR) on June 23.

4.2.2 National Flood Insurance Program Involvement

Hall County participates in the National Flood Insurance Program (NFIP). The following table summarizes the dates outlined in the Community Status Book for Hall County.

Table 4-4: Community Status Book Review for Hall County

Community	Initial FHBM Identified	Initial FIRM Identified	Current Effective Map Date	Regular-Emergency Date
Alda	6/25/1976	-	NSFHA	6/20/1978
Cairo	5/24/1974	6/20/1978	6/20/1978	6/20/1978
Doniphan	1/24/1975	-	NSFHA	8/1/1978
Grand Island	4/5/1974	3/2/1983	3/2/1983	3/2/1983
Hall County	12/20/1974	8/1/1980	9/29/1986	8/1/1980
Wood River	5/31/1974	12/1/1978	6/3/1986	12/1/1978

Through involvement with the NFIP there have been a number of maps produced for the communities in Hall County. The following tables summarize the current effective and historic maps available through the FEMA Map Service Center (MSC) (https://msc.fema.gov). All of these maps are provided digitally as Exhibit 1.

Table 4-5: Effective FIRM Maps for Hall County

Panel ID	Name	Effective Date
3101000025C	HALL CO *	9/29/1986
3101000050C	HALL CO *	9/29/1986
3101000075C	HALL CO *	9/29/1986
3101000100C	HALL CO *	9/29/1986
3101000125B	HALL CO *	8/1/1980
3101000150C	HALL CO *	9/29/1986
310100IND0	HALL CO *	9/29/1986
310101B	CAIRO,VLG/HALL CO	6/20/1978
3101030005B	GRAND ISLAND,CTY/HALL CO	3/2/1983
3101030010B	GRAND ISLAND,CTY/HALL CO	3/2/1983
3101030015B	GRAND ISLAND,CTY/HALL CO	3/2/1983
3101030020B	GRAND ISLAND,CTY/HALL CO	3/2/1983
310103IND0	GRAND ISLAND,CTY/HALL CO	3/2/1983
3101040005C	WOOD RIVER,CTY/HALL CO	6/3/1986

Table 4-6: Historic FIRM Maps for Hall County available through the MSC

Panel ID	Name	Effective Date
3101000025B	HALL CO *	8/1/1980
3101000050B	HALL CO *	8/1/1980
3101000075B	HALL CO *	8/1/1980
3101000100B	HALL CO *	8/1/1980
3101000150B	HALL CO *	8/1/1980
310100IND0_0880	HALL CO *	9/29/1986
310102B	DONIPHAN,VLG/HALL CO	8/1/1978
310104	WOOD RIVER ,CTY/HALL CO	5/31/1974
3101040005B	WOOD RIVER ,CTY/HALL CO	12/1/1978
310242	ALDA,VLG/HALL CO	6/25/1976

Hall County is currently in the process of converting to FEMAs countywide Digital Flood Insurance Rate Map (DFIRM) format. At the time of this report the DFIRM was not effective; however, a review of the draft data for the DFIRM showed that a majority of the flood hazard designations were remaining unchanged except in the areas near the northwest and southeast corners of the county where the terrain has more relief.

The City of Grand Island has received exemption to Section 1910.3(c)(2) of the NFIP regulations. This exemption allows the city to grant permits for construction of floodproofed residential basements below the base flood elevation. A copy of the exemption is attached as Exhibit 2. For purposes of this study the best available terrain data was used to the ground elevation, this information does not include basement elevations and/or elevation of buildings on fill structural material.

4.2.3 Previous Hall County Flood Mitigation Actions

Hall County is situated in the Central Platte Natural Resources District (CPNRD). Natural resources districts were created along major watershed boundaries in the 1970s with the intent to steward the area's natural resources. In addition to the having an authority for flood control, the CPNRD also operates a rain gage reporting network called NeRAIN and undertakes information and outreach programs for the NRDs population.

In combination with the CPNRD, Hall County has undertaken several major flood reduction projects.

4.2.3.1 Wood River Flood Control Project

The Wood River Flood Control Project was dedicated in spring of 2004. The 300-foot wide diversion channel diverts excess water from the Wood River and Warm Slough to the east into the Platte River. This project provides flood control protection for 1,500 homes and businesses. The project was tested by a flood event one year later on May 11, 2005, when 7.21 inches of rain fell in a 24-hour period. From a hydrological standpoint, this event would have resulted in a flood similar to the devastating 1967 flood; however, the Project functioned as designed, and flood damages were minimal for the protected area. The Central Platte Natural Resources District estimated that the $17 million project paid for itself in this event, less than one year after dedication. The project was sponsored by CPNRD and was funded 65% federally and 35% locally. The project was constructed by the US Army Corps of Engineers, and the Natural Resources Development Fund (administered by the Nebraska Department of Natural Resources) provided the 60% of the non-federal share of the required planning phase dollars.

4.2.3.2 Prairie/Silver/Moores Creek Flood Control Project

In May of 2000, the CPNRD and City of Grand Island contracted out a detailed hydrologic analysis of northern and western Grand Island. The analysis was also to evaluate options for reducing flood damages and to present the preferred alternative. An engineering firm was selected in September of 2005 to provide engineering services for the design and oversight of the flood control project. The flood control project is designed in three phases, expecting to be completed in 2015. Construction of Phase 1 began in January of 2007. The phases are described below.

4.2.3.2.1 Phase 1 – Silver Creek Low Land Stormwater Detention Cells

The first phase of the project is the construction of four large floodwater detention cells along the Silver Creek channel with a total excavation near 4.5 million cubic yards of material. The cell design includes the lowering and re-grading of Silver Creek for more then two miles. The detention cells will detain stormwater runoff in excess of the 2-year storm. A 3' x 3' concrete box culvert will be used as the outlet and will release the water from the cells at a rate equal to the 2-year storm. A second 3' x 6' gated box culvert will be used for rapid draw down of the cells. A berm is being placed around the cells, approximately 2 foot above existing ground, to provide sufficient capacity to detain runoff from the 100-year storm with a 1-foot freeboard.

4.2.3.2.2 Phase 2 – Basin Divide and Silver/Moores Creek Diversion Channel

A diversion channel that will connect Silver Creek to Moores Creek and a levee that will prevent flood water from flowing from one basin the adjacent basin. The stormwater released from the cells when combined with runoff excess, flows from the Prairie Creek and will cause flooding within the city of Grand Island. This levee will be designed to meet the requirements set forth by FEMA. A diversion channel will be constructed to divert water from Silver Creek to the Moores Creek floodway.

4.2.3.2.3 Phase 3 – Upland Dams and Prairie/Silver Creek Channel

A series of upland detention dams and an overflow channel from Prairie Creek to Silver Creek. The exact locations of the detention sites will be finalized in the final design phase of this project. Several sites are available and will be evaluated after geological investigations have been completed. The channel between Prairie and Silver Creek will serve to carry excess flows from Prairie Creek to Silver Creek.

4.2.3.3 Prairie Creek Clearing

Although the Prairie Creek Flood Control Project had a local effect, damages could be reduced on Prairie Creek by keeping the channel clear. Projects have been completed from the mouth of Prairie Creek in Merrick County to the Hall-Buffalo county line. Annual maintenance cost to CPNRD is $10,000.

4.2.3.4 Dry Creek Clearing

After a windstorm/tornado in 1998, landowners requested CPNRD to clear a channel northeast of Cairo. The project was completed in 1998, however, area landowners petitioned the NRD to clear an additional 21,000 feet. That project is scheduled to be completed in 2008. Maintenance is done by the NRD.

4.2.2.4 Lower Warm Slough Prairie

In 2002, CPNRD spent $110,000 to complete snagging and clearing from Grand Island to Central City.

4.2.3.5 Moores Creek Flood Control Project

Project sponsors of the feasibility study for the flood control on Moores Creek include CPNRD, the City of Grand Island, Merrick County and Hall County. The three-phase project consisted of channel improvements, construction of three detention/retention and wildlife habitat enhancement cells, and construction of waterways and bridges to enable storm runoff. Annual maintenance cost is estimated at $20,000.

SECTION 5: METHODS

5.1 Data Collection

5.1.1 Flood Hazard Area and Flood Elevation

Flood hazard zones and BFE data were collected from the Hall County effective FIRM maps as of the time of this report. It is recognized that the County is going through the conversion to FEMA's updated Countywide DFIRM format; however no new detailed studies and/or significant changes to the FIRM are being presented for this conversion. This data was collected and processed in digital format and is available on the provided data disk as Exhibit 3.

5.1.2 Ground Elevation

Ground elevation for this project was derived from a number of sources in the following order of superiority:

1. LOMA data (if available)
2. GPS survey (structures identified as potentially floodprone)
3. 1-ft contours (collected from Hall County GIS for the Grand Island area)
4. tagged vector contours (USGS quad sheet) (for areas outside of other elevation data sources)

These ground elevation data sources were used to assign a ground elevation to each of the structure points used in the study. The data obtained through these methods represents the best available data for these study purposes, but should not be used in place of more rigorous data collection methods or for purposes related to elevation certificates. These methods were identified as the most cost effective of providing elevation data for the jurisdiction. These methods do not account for basements, flood proofed structures, and/or elevation. This data was collected and processed in digital format and is available on the provided data disk as Exhibit 4.

5.1.3 Structure Location

Structure location information was collected from the Hall County GIS office. The initial shapefiles used for this study were the A_rural.shp and A_gi.shp. These files are used by the GIS office to identity address locations (add_ID points). This data is continually updated by the Hall County GIS office, the copy used in this study was obtained 6/14/2007.

In order to more accurately represent the structure locations within the county these shapefiles were merged and edited in the following ways:

1. In rural areas some of the data points were moved from the location of the driveway entrance to the location of the pertinent structure.
2. For land parcels which showed a structure value but did not have an add_ID point within the feature area a point was added at the centroid of the parcel.
3. Additional points were added to represent critical facilities which did not have an add_ID point.

This data was collected and processed in digital format and available on the provided data disk as Exhibit 5.

5.1.4 Critical Facilities

Critical Facilities were identified as per FEMA 386-2 "Understanding Your Risks: Identifying hazards and estimating losses". Additional critical facilities were identified by the community. In total 151 critical facilities were identified.

This data was collected and processed in digital format and available on the provided data disk as Exhibit 6.

5.1.5 Repetitive Loss Structures

Repetitive loss structures were incorporated in the critical facilities inventory.

5.1.6 Property Value

Property values were obtained from the Hall County GIS office in the form of 3 parcels shapefiles. These files incorporate data developed and used by the Hall County Assessors office and are regularly updated. This data was obtained 7/23/2007.

To supplement these data sets additional information was collected regarding mobile homes and critical facilities. The Hall County Assessors office maintains a database of mobile home values which are loosely associated with parcel ID numbers; these parcel ID values were associated with the data and reviewed. In some situations the value of the mobile home had already been incorporated in the parcels data as an improvement, in these situations the value was not incorporated. The Hall County Assessors office does not currently maintain property value information for a number of publicly owned structures. A number of critical facilities were identified which were potentially flood prone, property values for these structures were collected from the Hall County Planning office from a number of data sources.

Following the incorporation of all necessary property values, the damageable property value was identified (non-land value) for each parcel, and divided evenly upon the number of structure points (add_ID_points) identified in the parcel. This data was collected and processed in digital format and available on the provided data disk as Exhibit 7.

5.1.7 Jurisdiction Location

The study area for this project was broken down into six jurisdictions. These jurisdictions were established using the S_POL_AR shapefile associated with the ongoing DFIRM project for Hall County. This data was collected in digital format and available on the provided data disk as Exhibit 8.

5.2 Data Analysis

Section 5.2 outlines the data analysis method used to associate regulatory flooding information, flood depths, property values, and flood hazard mitigation recommendations to each of the structure points. The result of these steps is a point shapefile containing the overall results. This data was processed in digital format and is available on the provided data disk as Exhibit 9.

5.2.1 Review of Structure Locations against Effective FIRM

The first method of flood hazard review was to identify the NFIP flood zone designation for each of the structure points. This review was completed for all of the structure points and was defined as part of the limited detail flood hazard mitigation review.

5.2.2 Review of Ground Elevation against Effective BFE

The second method of flood hazard mitigation review was to compare the ground elevation against the regulatory base flood elevation (BFE) at structure points which fell within the detailed flood hazard mitigation review boundaries. This review was defined as part of the detailed flood hazard mitigation review. This process identified the depth of flooding which would be experienced by the identified structures.

5.2.3 Incorporation of Structure Values

Structure values were associated with each of the structure points. These values were taken from the parcels information collected from the Hall County Assessors office. The value associated with each structure point represents the damageable value (non-land value) of the parcel divided evenly by the number of structure points located within the parcel.

5.2.4 Nonstructural Flood Hazard Mitigation Recommendations

Flood hazard mitigation recommendations were made for each structure point. These recommendations considered the structures flood zone designation as well as calculated depth. These mitigation recommendations are directed at facility based non-structural measures. Community based non-structural measures such as flood warning, flood preparedness planning, and floodplain regulations are not covered by this study, but recommended and/or required for all communities. This study assesses the risk to the community based on the best available data; no new flood hazard data (hydrology or hydraulics) were developed. As such, structural recommendations are beyond the scope of this project. The project does identify the flood risk which could assist in the direction of future efforts aimed at structural flood hazard mitigation measures.

Flood hazard mitigation is defined as structural and/or nonstructural measures undertaken to limit the adverse impact of flood hazards. Structural flood hazard mitigation measures reduce flood damages by changing the characteristics of the flood at the protected area. Nonstructural flood hazard mitigation measures reduce flood damages by modifying the property or activities that are at risk from flooding.

Nonstructural measures are classified for the purposes of this flood hazard mitigation review as Type I and Type II. Type II nonstructural measures are recommended for

structures 3 ft or more below the BFE. Type I nonstructural measures are recommended for structures less than 3ft below the BFE. The following table lists flood proofing measures for each classification.

Table 5-1: Classification of Nonstructural Flood Proofing Measures

Type II (3ft or more below the BFE)
Elevation (up to 12 feet)
Buyout/Acquisition
Relocation
Type I (less than 3ft below the BFE)
Dry Flood Proofing
Wet Flood Proofing
Elevation (up to 12 feet)
Buyout
Relocation

Dry floodproofing is defined as sealing a building to ensure that a building is watertight or impermeable to floodwaters. Normally dry floodproofing is applied to building entrances, windows and equipment rooms located inside a building for protection from flooding. Flood panels are the most effective form of flood protection for interior spaces, equipment and the contents of a building.

Wet Flood Proofing allows flood waters to enter the enclosed areas of a house. The benefit of wet floodproofing is that if flood waters are allowed to enter the enclosed areas of the house and to quickly reach the same level as the flood waters outside, the effects of hydrostatic pressure, including buoyancy, are greatly reduced. As a result, the loads imposed on the house during a flood, and therefore the likelihood of structural damage, may be greatly reduced. Wet floodproofing is generally used to limit damages to enclosures below elevated buildings, walkout-on-grade basements, below-grade basements, crawlspaces, or attached garages. It is not practical for areas that are to be used as living space

Elevation involves raising the building in place so that the lowest floor is above the flood level for which flood proofing protection is provided. The building is jacked up and set on a new or extended foundation. Almost any structurally sound building can be elevated. Typically, the least expensive and easiest building to elevate is a one-story frame building built over a crawl space that is 18 inches or higher. The process becomes more difficult and expensive as different factors are added, such as a building with a basement, a slab-on-grade building, a building constructed of brick or block, a multi-story building, or a building with additions.

Property acquisitions are commonly referred to as 'buyouts'. A buyout is the elimination of potential flood damage to houses or other structures by acquiring and removing them.

Both FEMA and the USACE have programs for acquisition. This form of flood proofing removes/eliminates the structure of concern and thus eliminates the underlying flood risk.

Relocating a building is the most dependable, but generally the most expensive, way to flood proof. This method involves moving the building to another location away from flood hazards, either to a higher elevation on the existing lot or to a new site. Relocating a building out of the flood plain is appropriate if the building is in an area where flood hazards are such that continued occupation is unsafe. It is also an option for the property owner who wants to be free from the damages, fear, and worry associated with flooding. This procedure involves raising the building, as described in the above section on '"elevation" and placing it on wheels. The building is then transported to a new location and placed on a new foundation.

Documentation on flood proofing techniques and selection is provided as Exhibit 10. For further information on flood proofing visit the website of the national nonstructural/flood proofing committee (https://www.nwo.usace.army.mil/nfpc/)

5.2.4.1 Structures outside of Detailed Study Boundaries

For structures located outside of the detailed flood hazard mitigation review boundaries recommendations were made based on the structure location in relation to designated Special Flood Hazard Areas (SFHA). Due to the flat terrain that exists throughout a majority of Hall County, and the lack of detailed terrain information it is likely that the current effective Zone A designations are in accurate. A 500ft buffer was placed around the Zone A areas and identified as areas where site specific review of ground elevations in comparison to stream locations would be helpful in assessing the true flood hazard potential. This led to five possible recommendations:

1. Located inside a SFHA (Zone A) - Flood Insurance
2. Located in an area protected by levee - Flood Insurance at a reduced rate (Protected by Levee)
3. Located in a 500-yr floodplain - Flood Insurance at a reduced rate (Zone X - 500yr)
4. Located out of but within 500ft of a SFHA - Possible Flood Insurance at a reduced rate
5. Located more than 500ft from a SFHA - No Recommendations

5.2.4.2 Structures within Detailed Study Boundaries

For structures located within the detailed flood hazard mitigation review boundaries recommendations were made based on the structure location in relation to designated Special Flood Hazard Areas (SFHA) and calculated flood depth. For structures which were calculated as being above the base flood elevation (negative BFE depth) the following recommendations were made:

1. Located within a SFHA - Flood Insurance at a reduced rate (LOMA-F or Elevation Certificate)
2. Located within a 500-yr floodplain - Flood Insurance at a reduced rate (Zone X - 500yr)
3. Located in a unshaded Zone X - No recommendations

For structures which were calculated as being below the base flood elevation (positive BFE depth) the following recommendations were made:

1. Located within a SFHA and calculated as being 3 or more feet below the BFE - Flood Insurance & Type II Nonstructural Measures
2. Located outside of a SFHA and calculated as being 3 or more feet below the BFE - Flood Insurance at a reduced rate (Zone X) & Type II Nonstructural Measures
3. Located within a SFHA and calculated as being between 0 and 3 feet below the BFE - Flood Insurance & Type I Nonstructural Measures
4. Located outside of a SFHA and calculated as being between 0 and 3 feet below the BFE - Flood Insurance at a reduced rate (Zone X) & Type II Nonstructural Measures

SECTION 6: RESULTS

6.1 Results: Alda

6.1.1 Flood Zone Designation Inventory

Table 6-1 summarizes the review of structure locations against effective flood zone designations for the jurisdiction of Alda, NE. The table shows that in the jurisdiction of Alda there are 7 structures which are identified as being within a regulatory floodplain, and that the total value of these structures is $518,285.

Table 6-1a: Inventory of Structure Locations against Effective Flood Zones for Alda (Structure Count)

Number of Structures in Jurisdiction	343	**% of Community**
Number of Structures in Designated Flood Zones		
Zone A	2	0.58%
Zone AE Floodway		
Zone AE	5	1.46%
Zone X - 500yr		
Zone X - Protected by Levee		
Zone X - NSFHA	336	97.96%

Table 6-1b: Inventory of Structure Locations against Effective Flood Zones for Alda (Structure Value)

Total Value of Structures in Jurisdiction	$20,723,068	**% of Community**
Total Value of Structures in Designated Flood Zones		
Zone A	$107,019	0.5%
Zone AE Floodway		
Zone AE	$411,266	2.0%
Zone X - 500yr		
Zone X - Protected by Levee		
Zone X - NSFHA	$20,204,783	97.5%

Table 6-1c: Inventory of Structure Locations against Effective Flood Zones for Alda (Critical Facilities)

List of Critical Facilities in Designated Flood Zones
None

6.1.2 BFE Depth Inventory

Table 6-2 summarizes the review of base flood depths for structures located within the detailed flood hazard mitigation review limits for the jurisdiction of Alda, NE. The table shows that in the jurisdiction of Alda there are 4 structures which are identified as being located below the regulatory base flood elevation of streams with BFE information and that the total value of these structures is $317,550.

Table 6-2a: Inventory of Structure Locations against Base Flood Depths for Alda (Structure Count)

Number of Structures within Detailed Flood Hazard Review Limits	7	**% of Detailed Review**
Number of Structures at Flood Depth Ranges		
> 1 ft Above BFE	2	28.6%
0-1 ft Above BFE	1	14.3%
0-1 ft Below BFE	2	28.6%
1-2 ft Below BFE	1	14.3%
2-3 ft Below BFE		
3-5 ft Below BFE	1	14.3%
> 5 ft Below BFE		

Table 6-2b: Inventory of Structure Locations against Base Flood Depths for Alda (Structure Value)

Value of Structures within Detailed Flood Hazard Review Limits	$543,991	**% of Detailed Review**
Value of Structures at Flood Depth Ranges		
> 1 ft Above BFE	$200,735	36.9%
0-1 ft Above BFE	$25,706	4.7%
0-1 ft Below BFE	$131,047	24.1%
1-2 ft Below BFE	$79,484	14.6%
2-3 ft Below BFE		
3-5 ft Below BFE	$107,019	19.7%
> 5 ft Below BFE		

Table 6-2c: Inventory of Structure Locations against Base Flood Depths for Alda (Critical Facilities)

List of Critical Facilities within Detailed Flood Hazard Review Limits
None

6.1.3 Review of Flood Zone Designations against BFE Depths

Table 6-3 summarizes the flood zone designations in comparison with calculated base flood depths for the structure points located within the detailed flood hazard mitigation review limits for the jurisdiction of Alda. The table shows that the flood designations for 5 of the 7 structures are properly identified and that the designations for the remaining 2 structures may be incorrect in a conservative manner based on the terrain data used in this study.

Table 6-3: Review of Effective Flood Zones and Base Flood Depths at Detailed Flood Hazard Review Structure Points for Alda

		Recognized as within a 100-yr flood zone on FIRM Map	
		TRUE	**FALSE**
Below 100-yr BFE based on Terrain Data	**TRUE**	4	0
	FALSE	2	1

6.1.4 Critical Facilities Inventory

Tables 6-1 and 6-2 show that there are no critical facilities located in a designated flood zone or within the detailed flood hazard mitigation review area limits for the jurisdiction of Alda.

6.1.5 Potential Flood Hazard Mitigation Measures

Table 6-4 summarizes the flood hazard mitigation measures recommended for the structure points in Alda. For structure specific recommendations see the provided shapefiles on the attached Data CD.

Table 6-4: Flood Hazard Mitigation Measure Recommendations for Alda

Number of Structures in Jurisdiction	343	**% of Community**
Number of Structures with Specified Flood Hazard Mitigation Measure Recommendations		
Flood Insurance	1	0.3%
Flood Insurance & Type I Nonstructural Measures	3	0.9%
Flood Insurance & Type II Nonstructural Measures	1	0.3%
Flood Insurance at reduced rate (LOMA-F or Elevation Certificate)	2	0.6%
Flood Insurance at reduced rate (Zone X-500yr)		
Flood Insurance at reduced rate (Zone X) & Type I Nonstructural measures		
Flood Insurance at reduced rate (Zone X) & Type II Nonstructural measures		
Flood Insurance at reduced rate (Protected by Levee)		
No Recommendations (Outside of Detailed Study Area)	332	96.8%
No Recommendations (Inside of Detailed Study Area)	1	0.3%
Possible Flood Insurance at reduced rate (within 500ft of Zone A)	3	0.9%

6.2 Results: Cairo

6.2.1 Flood Zone Designation Inventory

Table 6-5 summarizes the review of structure locations against effective flood zone designations for the jurisdiction of Cairo, NE. The table shows that in the jurisdiction of Cairo there are 13 structures which are identified as being within a regulatory floodplain, and that the total value of these structures is $650,447.

Table 6-5a: Inventory of Structure Locations against Effective Flood Zones for Cairo (Structure Count)

Number of Structures in Jurisdiction	488	**% of Community**
Number of Structures in Designated Flood Zones		
Zone A	13	2.7%
Zone AE Floodway		
Zone AE		
Zone X - 500yr		
Zone X - Protected by Levee		
Zone X - NSFHA	475	97.3%

Table 6-5b: Inventory of Structure Locations against Effective Flood Zones for Cairo (Structure Value)

Total Value of Structures in Jurisdiction	$30,715,809	**% of Community**
Total Value of Structures in Designated Flood Zones		
Zone A	$650,447	2.1%
Zone AE Floodway		
Zone AE		
Zone X - 500yr		
Zone X - Protected by Levee		
Zone X - NSFHA	$30,065,362	97.9%

Table 6-5c: Inventory of Structure Locations against Effective Flood Zones for Cairo (Critical Facilities)

List of Critical Facilities in Designated Flood Zones
None

6.2.2 BFE Depth Inventory

The jurisdiction of Cairo does not contain any structure points located within the boundary of the detailed flood hazard mitigation review. No flood depth review was completed.

6.2.3 Review of Flood Zone Designations against BFE Depths

The jurisdiction of Cairo does not contain any structure points located within the boundary of the detailed flood hazard mitigation review. No flood depth review was completed.

6.2.4 Critical Facilities Inventory

Table 6-5 shows that there are no critical facilities located in a designated flood zones for the jurisdiction of Cairo

6.2.5 Potential Flood Hazard Mitigation Measures

Table 6-6 summarizes the flood hazard mitigation measures recommended for the jurisdiction of Cairo. This table shows that while there are only 13 structures located in floodplain there are an additional 61 structures located within 500 ft of a Zone A. Site specific investigations for these structures may reveal unidentified flood hazards and the need for flood insurance. For structure specific recommendations see the provided shapefiles on the attached Data CD.

Table 6-6: Flood Hazard Mitigation Measure Recommendations for Cairo

Number of Structures in Jurisdiction	488	**% of Community**
Number of Structures with Specified Flood Hazard Mitigation Measure Recommendations		
Flood Insurance	13	2.7%
Flood Insurance & Type I Nonstructural Measures		
Flood Insurance & Type II Nonstructural Measures		
Flood Insurance at reduced rate (LOMA-F or Elevation Certificate)		
Flood Insurance at reduced rate (Zone X-500yr)		
Flood Insurance at reduced rate (Zone X) & Type I Nonstructural measures		
Flood Insurance at reduced rate (Zone X) & Type II Nonstructural measures		
Flood Insurance at reduced rate (Protected by Levee)		
No Recommendations (Outside of Detailed Study Area)	414	84.8%
No Recommendations (Inside of Detailed Study Area)		
Possible Flood Insurance at reduced rate (within 500ft of Zone A)	61	12.5%

6.3 Results: Doniphan

6.3.1 Flood Zone Designation Inventory

Table 6-7 summarizes the review of structure locations against effective flood zone designations for the jurisdiction of Doniphan, NE. The table shows that in the jurisdiction of Doniphan there are no structures which are identified as being within a regulatory floodplain.

Table 6-7a: Inventory of Structure Locations against Effective Flood Zones for Doniphan (Structure Count)

Number of Structures in Jurisdiction	435	**% of Community**
Number of Structures in Designated Flood Zones		
Zone A		
Zone AE Floodway		
Zone AE		
Zone X - 500yr		
Zone X - Protected by Levee		
Zone X - NSFHA	435	100.0%

Table 6-7b: Inventory of Structure Locations against Effective Flood Zones for Doniphan (Structure Value)

Total Value of Structures in Jurisdiction	$35,586,417	**% of Community**
Total Value of Structures in Designated Flood Zones		
Zone A		
Zone AE Floodway		
Zone AE		
Zone X - 500yr		
Zone X - Protected by Levee		
Zone X - NSFHA	$35,586,417	100.0%

Table 6-7c: Inventory of Structure Locations against Effective Flood Zones for Doniphan (Critical Facilities)

List of Critical Facilities in Designated Flood Zones
None

6.3.2 BFE Depth Inventory

Table 6-8 summarizes the review of base flood depths for structures located within the detailed flood hazard mitigation review limits for the jurisdiction of Doniphan, NE. The table shows that in the jurisdiction of Doniphan there are no structures which are identified as being located below the regulatory base flood elevation.

Table 6-8a: Inventory of Structure Locations against Base Flood Depths for Doniphan (Structure Count)

Number of Structures within Detailed Flood Hazard Review Limits	8	**% of Detailed Review**
Number of Structures at Flood Depth Ranges		
> 1 ft Above BFE	8	100.00%
0-1 ft Above BFE		
0-1 ft Below BFE		
1-2 ft Below BFE		
2-3 ft Below BFE		
3-5 ft Below BFE		
> 5 ft Below BFE		

Table 6-8b: Inventory of Structure Locations against Base Flood Depths for Doniphan (Structure Value)

Value of Structures within Detailed Flood Hazard Review Limits	$1,236,919	**% of Detailed Review**
Value of Structures at Flood Depth Ranges		
> 1 ft Above BFE	$1,236,919	100.00%
0-1 ft Above BFE		
0-1 ft Below BFE		
1-2 ft Below BFE		
2-3 ft Below BFE		
3-5 ft Below BFE		
> 5 ft Below BFE		

Table 6-8c: Inventory of Structure Locations against Base Flood Depths for Doniphan (Critical Facilities)

List of Critical Facilities within Detailed Flood Hazard Review Limits
None

6.3.3 Review of Flood Zone Designations against BFE Depths

Table 6-9 summarizes the review flood zone designations in comparison with calculated base flood depths for the structure points located within the detailed flood hazard mitigation review limits in jurisdiction of Doniphan. The table shows that the flood designations for all 8 of the structures are properly identified based on the terrain data used in this study.

Table 6-9: Review of Effective Flood Zones and Base Flood Depths at Detailed Flood Hazard Review Structure Points for Doniphan

		Recognized as within a 100-yr flood zone on FIRM Map	
		TRUE	**FALSE**
Below 100-yr BFE based on Terrain Data	**TRUE**	0	0
	FALSE	0	8

6.3.4 Critical Facilities Inventory

Tables 6-7 and 6-8 show that there are no critical facilities located in a designated flood zone or within the detailed flood hazard review limits for the jurisdiction of Doniphan.

6.3.5 Potential Flood Hazard Mitigation Measures

Table 6-10 summarizes the flood hazard mitigation measures recommended for the structure points in Doniphan. This table shows that while there are no structures located in floodplain there are an additional 2 structures located within 500ft of a Zone A. Site specific investigations for these structures may reveal unidentified flood hazards and the need for flood insurance. For structure specific recommendations see the provided shapefiles on the attached Data CD.

Table 6-10: Flood Hazard Mitigation Measure Recommendations for Doniphan

Number of Structures in Jurisdiction	435	**% of Community**
Number of Structures with Specified Flood Hazard Mitigation Measure Recommendations		
Flood Insurance		
Flood Insurance & Type I Nonstructural Measures		
Flood Insurance & Type II Nonstructural Measures		
Flood Insurance at reduced rate (LOMA-F or Elevation Certificate)		
Flood Insurance at reduced rate (Zone X-500yr)		
Flood Insurance at reduced rate (Zone X) & Type I Nonstructural measures		
Flood Insurance at reduced rate (Zone X) & Type II Nonstructural measures		
Flood Insurance at reduced rate (Protected by Levee)		
No Recommendations (Outside of Detailed Study Area)	425	97.7%
No Recommendations (Inside of Detailed Study Area)	8	1.8%
Possible Flood Insurance at reduced rate (within 500ft of Zone A)	2	0.5%

6.4 Results: Grand Island

6.4.1 Flood Zone Designation Inventory

Table 6-11 summarizes the review of structure locations against effective flood zone designations for the jurisdiction of Grand Island, NE. The table shows that in the jurisdiction of Grand Island there are 1045 structures which are identified as being within a regulatory floodplain, and that the total value of these structures is $109,872,642. There are an additional 297 structures located within shaded Zone X areas, with a value of $62,514,807.

Table 6-11a: Inventory of Structure Locations against Effective Flood Zones for Grand Island (Structure Count)

Number of Structures in Jurisdiction	22400	**% of Community**
Number of Structures in Designated Flood Zones		
Zone A	88	0.4%
Zone AE Floodway	42	0.2%
Zone AE	915	4.1%
Zone X - 500yr	88	0.4%
Zone X - Protected by Levee	209	0.9%
Zone X - NSFHA	21058	94.0%

Table 6-11b: Inventory of Structure Locations against Effective Flood Zones for Grand Island (Structure Value)

Total Value of Structures in Jurisdiction	$1,870,749,797	**% of Community**
Total Value of Structures in Designated Flood Zones		
Zone A	$3,335,464	0.2%
Zone AE Floodway	$2,780,190	0.1%
Zone AE	$103,756,988	5.5%
Zone X - 500yr	$21,653,967	1.2%
Zone X - Protected by Levee	$40,860,840	2.2%
Zone X - NSFHA	$1,698,362,348	90.8%

Table 6-11c: Inventory of Structure Locations against Effective Flood Zones for Grand Island (Critical Facilities)

List of Critical Facilities in Designated Flood Zones			
Critical Facility	**Critical ID**	**Zone**	**Value**
Cedar Hollow Public School	112	AE	Future Data Needed
Grand Island Fire Station Four	100	X-500yr	$36,834
Veterans Admin Medical Center	97	AE	Future Data Needed
Berean Bible Church	22	AE	$829,234
G.I. Wastewater Treatment Plant	13	AE	$15,000,000

6.4.2 BFE Depth Inventory

Table 6-12 summarizes the review of base flood depths for structures located within the detailed flood hazard review limits for the jurisdiction of Grand Island, NE. The table shows that in the jurisdiction of Grand Island there are 897 structures which are identified as being located below the regulatory base flood elevation, and that the total value of these structures is $100,028,295.

Table 6-12a: Inventory of Structure Locations against Base Flood Depths for Grand Island (Structure Count)

Number of Structures within Detailed Flood Hazard Review Limits	2464	**% of Detailed Review**
Number of Structures at Flood Depth Ranges		
> 1 ft Above BFE	1169	47.4%
0-1 ft Above BFE	398	16.2%
0-1 ft Below BFE	251	10.2%
1-2 ft Below BFE	315	12.8%
2-3 ft Below BFE	193	7.8%
3-5 ft Below BFE	112	4.5%
> 5 ft Below BFE	26	1.1%

Table 6-12b: Inventory of Structure Locations against Base Flood Depths for Grand Island (Structure Value)

Value of Structures within Detailed Flood Hazard Review Limits	$270,591,442	**% of Detailed Review**
Value of Structures at Flood Depth Ranges		
> 1 ft Above BFE	$133,832,767	49.5%
0-1 ft Above BFE	$36,730,380	13.6%
0-1 ft Below BFE	$43,808,534	16.2%
1-2 ft Below BFE	$29,384,125	10.9%
2-3 ft Below BFE	$18,001,399	6.7%
3-5 ft Below BFE	$7,139,559	2.6%
> 5 ft Below BFE	$1,694,678	0.6%

Table 6-12c: Inventory of Structure Locations against Base Flood Depths for Grand Island (Critical Facilities)

List of Critical Facilities within Detailed Flood Hazard Review Limits			
Critical ID	**Critical ID**	**BFE Depth**	**Value**
Northwest High School	135	0.65	$20,000,000
Grand Island Senior High	124	-4.37	Future Data Needed
Cedar Hollow Public School	112	-0.13	Future Data Needed
Veterans Admin Medical Center	97	-0.07	Future Data Needed
Third City Christian Church	77	0.57	$474,624
Seventh Day Adventist Church	74	-0.05	$471,237
First United Methodist Church	47	-3.64	$395,060
Community Bible Church of the	35	-2.22	Future Data Needed
Church of Christ	33	-2.10	$2,568,253
Berean Bible Church	22	-0.84	$829,234
G.I. Wastewater Treatment Plant	13	-2.56	$15,000,000
Platte Generation Station	11	-2.71	Future Data Needed

6.4.3 Review of Flood Zone Designations against BFE Depths

Table 6-13 summarizes the flood designations in comparison with calculated base flood depths for the structure points within the detailed flood hazard mitigation review limits located within the jurisdiction of Grand Island. The table shows that, based on the terrain data used in this study, the flood designations for 371 structures may be incorrect in a non-conservative manner, while there are 441 structures located within a floodplain that are located above the base flood elevation. These discrepancies are discussed further in section 7.1.1

Table 6-13: Review of Effective Flood Zones at Detailed Flood Hazard Review Structure Points for Grand Island

		Recognized as within a 100-yr flood zone on FIRM Map	
		TRUE	**FALSE**
Below 100-yr BFE based on Terrain Data	**TRUE**	526	371
	FALSE	441	1126

6.4.4 Critical Facilities Inventory

Tables 6-11 and 6-12 show that there are numerous critical facilities located in designated flood zones and/or within the detailed flood hazard review limits for the jurisdiction of Grand Island. The results of the flood depth review showed that for the structures identified as within a SFHA the facilities were located above the base flood elevation. However, there may be flooding issues for critical facilities located outside of the designated flood hazard area; Northwest High School as well as the Third City Christian Church are located outside of any SFHA but may be located below the base flood elevation.

6.4.5 Potential Flood Hazard Mitigation Measures

Table 6-14 summarizes the Flood Hazard Mitigation Measures recommended for the structure points in Grand Island. For structure specific recommendations see the provided shapefiles on the attached Data CD.

Table 6-14: Flood Hazard Mitigation Measure Recommendations for Grand Island

Number of Structures in Jurisdiction	22400	**% of Community**
Number of Structures with Specified Flood Hazard Mitigation Measure Recommendations		
Flood Insurance	78	0.3%
Flood Insurance & Type I Nonstructural Measures	469	2.1%
Flood Insurance & Type II Nonstructural Measures	57	0.3%
Flood Insurance at reduced rate (LOMA-F or Elevation Certificate)	441	2.0%
Flood Insurance at reduced rate (Zone X-500yr)	56	0.3%
Flood Insurance at reduced rate (Zone X) & Type I Nonstructural measures	290	1.3%
Flood Insurance at reduced rate (Zone X) & Type II Nonstructural measures	81	0.4%
Flood Insurance at reduced rate (Protected by Levee)	209	0.9%
No Recommendations (Outside of Detailed Study Area)	19194	85.7%
No Recommendations (Inside of Detailed Study Area)	1111	5.0%
Possible Flood Insurance at reduced rate (within 500ft of Zone A)	414	1.8%

6.5 Results: Wood River

6.5.1 Flood Zone Designation Inventory

Table 6-15 summarizes the review of structure locations against effective flood zone designations for structures in the jurisdiction of Wood River, NE. The table shows that in the jurisdiction of Wood River there are 5 structures which are identified as being within a regulatory floodplain, and that the total value of these structures is $97,153. There are also 512 structures located within the 500-yr delineation, with a value of $32,299,820.

Table 6-15a: Inventory of Structure Locations against Effective Flood Zones for Wood River (Structure Count)

Number of Structures in Jurisdiction	661	**% of Community**
Number of Structures in Designated Flood Zones		
Zone A	1	0.2%
Zone AE Floodway	4	0.6%
Zone AE		
Zone X - 500yr	512	77.5%
Zone X - Protected by Levee		
Zone X - NSFHA	144	21.8%

Table 6-15b: Inventory of Structure Locations against Effective Flood Zones for Wood River (Structure Value)

Total Value of Structures in Jurisdiction	$43,615,189	**% of Community**
Total Value of Structures in Designated Flood Zones		
Zone A	$0	0.0%
Zone AE Floodway	$97,153	0.2%
Zone AE		
Zone X - 500yr	$35,299,820	80.9%
Zone X - Protected by Levee		
Zone X - NSFHA	$8,218,216	18.8%

Table 6-15c: Inventory of Structure Locations against Effective Flood Zones for Wood River (Critical Facilities)

List of Critical Facilities in Designated Flood Zones			
Critical ID	**Critical ID**	**Zone**	**Value**
Former Wood River Firehall	141	Zone X - 500yr	$106,000
Good Samaritan Center	140	Zone X - 500yr	$1,233,596
Wood River Elementary	120	Zone X - 500yr	Future Data Needed
Wood River Police Department	108	Zone X - 500yr	$206,000
Saint Mary's Catholic Church	69	Zone X - 500yr	$876,478
Grace Lutheran Church	53	Zone X - 500yr	$102,413
First United Presbyterian Church	49	Zone X - 500yr	$52,596
First United Methodist Church	48	Zone X - 500yr	$290,751
Wood River Water Treatment	18	Zone X - 500yr	$750,000
Wood River Water Tower	16	Zone X - 500yr	$225,000

6.5.2 BFE Depth Inventory

Table 6-16 summarizes the review of base flood depths for structures located within the detailed flood hazard review limits for the jurisdiction of Wood River. The table shows that in the jurisdiction of Wood River there are 3 structures which are identified as being located below the regulatory base flood elevation, and that the total value of these structures is $194,932.

Table 6-16a: Inventory of Structure Locations against Base Flood Depths for Wood River (Structure Count)

Number of Structures within Detailed Flood Hazard Review Limits	11	**% of Detailed Review**
Number of Structures at Flood Depth Ranges		
> 1 ft Above BFE	5	45.5%
0-1 ft Above BFE	3	27.3%
0-1 ft Below BFE	1	9.1%
1-2 ft Below BFE		
2-3 ft Below BFE	1	9.1%
3-5 ft Below BFE		
> 5 ft Below BFE	1	9.1%

Table 6-16b: Inventory of Structure Locations against Base Flood Depths for Wood River (Structure Value)

Value of Structures within Detailed Flood Hazard Review Limits	$778,068	**% of Detailed Review**
Value of Structures at Flood Depth Ranges		
> 1 ft Above BFE	$429,962	55.3%
0-1 ft Above BFE	$143,945	18.5%
0-1 ft Below BFE	$9,238	1.2%
1-2 ft Below BFE		
2-3 ft Below BFE	$144,619	18.6%
3-5 ft Below BFE		
> 5 ft Below BFE	$50,304	6.5%

Table 6-16c: Inventory of Structure Locations against Base Flood Depths for Wood River (Critical Facilities)

List of Critical Facilities within Detailed Flood Hazard Review Limits
None

6.5.3 Review of Flood Zone Designations against BFE Depths

Table 6-17 summarizes the review flood designation in comparison with calculated base flood depths for the structure points located within the jurisdiction of Wood River. The table shows that, based on the terrain data used in this study, the flood designation for 1 structure may be incorrect in a non-conservative manner, while there are 2 structures located within a floodplain that may be located above the base flood elevation.

Table 6-17: Review of Effective Flood Zones at Detailed Flood Hazard Review Structure Points for Wood River

		Recognized as within a 100-yr flood zone on FIRM Map	
		TRUE	**FALSE**
Below 100-yr BFE based on Terrain Data	**TRUE**	2	1
	FALSE	2	6

6.5.4 Critical Facilities Inventory

Tables 6-15 and 6-16 show that there are no critical facilities located in special flood hazard area and/or within the detailed study area limits for the jurisdiction of Wood River. There area number of facilities located within the 500-yr delineation.

6.5.5 Potential Flood Hazard Mitigation Measures

Table 6-18 summarizes the flood hazard mitigation measures recommended for the structure points in Wood River. For structure specific recommendations see the provided shapefiles on the attached Data CD.

Table 6-18: Flood Hazard Mitigation Measure Recommendations for Wood River

Number of Structures in Jurisdiction	661	**% of Community**
Number of Structures with Specified Flood Hazard Mitigation Measure Recommendations		
Flood Insurance	1	0.2%
Flood Insurance & Type I Nonstructural Measures	1	0.2%
Flood Insurance & Type II Nonstructural Measures	1	0.2%
Flood Insurance at reduced rate (LOMA-F or Elevation Certificate)	2	0.3%
Flood Insurance at reduced rate (Zone X-500yr)	511	77.3%
Flood Insurance at reduced rate (Zone X) & Type I Nonstructural measures	1	0.2%
Flood Insurance at reduced rate (Zone X) & Type II Nonstructural measures		
Flood Insurance at reduced rate (Protected by Levee)		
No Recommendations (Outside of Detailed Study Area)	136	20.6%
No Recommendations (Inside of Detailed Study Area)	1	0.2%
Possible Flood Insurance at reduced rate (within 500ft of Zone A)	7	1.1%

6.6 Results: Hall County Unincorporated Areas

6.6.1 Flood Zone Designation Inventory

Table 6.-19 summarizes the review of structure locations against effective flood zone designations for Hall County unincorporated areas. The table shows that in the Hall County unincorporated areas there are 408 structures which are identified as being within a regulatory floodplain, and that the total value of these structures is $34,741,679. There are also 75 structures located within the 500-yr floodplain, with a value of $7,927,287.

Table 6-19a: Inventory of Structure Locations against Effective Flood Zones for Hall County Unincorporated Areas (Structure Count)

Number of Structures in Jurisdiction	1911	**% of Community**
Number of Structures in Designated Flood Zones		
Zone A	295	15.4%
Zone AE Floodway	23	1.2%
Zone AE	90	4.7%
Zone X - 500yr	75	3.9%
Zone X - Protected by Levee		
Zone X - NSFHA	1428	74.7%

Table 6-19b: Inventory of Structure Locations against Effective Flood Zones for Hall County Unincorporated Areas (Structure Value)

Total Value of Structures in Jurisdiction	$177,130,686	**% of Community**
Total Value of Structures in Designated Flood Zones		
Zone A	$20,547,723	11.6%
Zone AE Floodway	$5,069,728	2.9%
Zone AE	$9,124,228	5.2%
Zone X - 500yr	$7,927,287	4.5%
Zone X - Protected by Levee		
Zone X - NSFHA	$134,461,720	75.9%

Table 6-19c: Inventory of Structure Locations against Effective Flood Zones for Hall County Unincorporated Areas (Critical Facilities))

List of Critical Facilities in Designated Flood Zones			
Critical ID	**Critical ID**	**Zone**	**Value**
District 501 - Hall County	113	A	$279,640
Emmanuel Church	37	A	$81,303
Cameron Church	30	A	$80,000
I-80 Exit #300 Eastbound	10	X - 500yr	$1,200,000
I-80 Exit #314 Westbound	5	AE Floodway	$3,500,000
I-80 Exit #314 Eastbound	7	AE	$1,200,000

6.6.2 BFE Depth Inventory

Table 6-20 summarizes the review of base flood depths for structures for the Hall County unincorporated areas. The table shows that in the Hall County unincorporated areas there are 182 structures which are identified as being located below the regulatory base flood elevation, and that the total value of these structures is $24,280,592.

Table 6-20a: Inventory of Structure Locations against Base Flood Depths for the Hall County Unincorporated Areas (Structure Count)

Number of Structures within Detailed Flood Hazard Review Limits	489	**% of Detailed Review**
Number of Structures at Flood Depth Ranges		
> 1 ft Above BFE	264	54.0%
0-1 ft Above BFE	43	8.8%
0-1 ft Below BFE	45	9.2%
1-2 ft Below BFE	57	11.7%
2-3 ft Below BFE	45	9.2%
3-5 ft Below BFE	29	5.9%
> 5 ft Below BFE	6	1.2%

Table 6-20b: Inventory of Structure Locations against Base Flood Depths for the Hall County Unincorporated Areas (Structure Value)

Value of Structures within Detailed Flood Hazard Review Limits	$63,666,998	**% of Detailed Review**
Value of Structures at Flood Depth Ranges		
> 1 ft Above BFE	$34,530,911	54.2%
0-1 ft Above BFE	$4,855,495	7.6%
0-1 ft Below BFE	$5,884,099	9.2%
1-2 ft Below BFE	$7,678,627	12.1%
2-3 ft Below BFE	$8,160,161	12.8%
3-5 ft Below BFE	$1,861,758	2.9%
> 5 ft Below BFE	$695,947	1.1%

Table 6-20c: Inventory of Structure Locations against Base Flood Depths for the Hall County Unincorporated Areas (Critical Facilities)

List of Critical Facilities within Detailed Flood Hazard Review Limits			
Critical ID	**Critical ID**	**BFE Depth**	**Value**
Unnamed Critical Facility Point	138	3.06	$96,814
I-80 Exit #300 Eastbound	10	1.13	$1,200,000
I-80 Exit #300 Westbound	9	1.48	$1,200,000
I-80 Exit #314 Eastbound	7	0.33	$1,200,000
I-80 Exit #314 Westbound	5	2.89	$3,500,000
I-80 Exit #312 Eastbound	4	-5.69	Future Data Needed
I-80 Exit #312 Westbound	3	-2.52	Future Data Needed

6.6.3 Review of Flood Zone Designations against BFE Depths

Table 6-21 summarizes the review flood zone designations in comparison with calculated base flood depths for the structure points located within the detailed flood hazard mitigation review limits for the Hall County unincorporated areas. The table shows that, based on the terrain data used in this study, the flood designations for 121 structures may be incorrect in a non-conservative manner, while there are 56 structures located within a floodplain that may be located above the base flood elevation.

Table 6-21: Review of Effective Flood Zones at Detailed Study Structure Points for the Hall County unincorporated areas

		Recognized as within a 100-yr flood zone on FIRM Map	
		TRUE	**FALSE**
Below 100-yr BFE based on Terrain Data	**TRUE**	61	121
	FALSE	56	251

6.6.4 Critical Facilities Inventory

Tables 6-19 and 6-20 show that there are a number of critical facilities located in special flood hazard area and/or within the detailed flood hazard mitigation review limits for the Hall County unincorporated areas. These facilities include one school two churches and 6 Interstate on-ramps.

6.6.5 Potential Flood Hazard Mitigation Measures

Table 6-22 summarizes the flood hazard mitigation measures recommended for the structure points in the Hall County unincorporated areas. For structure specific recommendations see the provided shapefiles on the attached Data CD.

Table 6-22: Flood Hazard Mitigation Measure Recommendations for the Hall County unincorporated areas

Number of Structures in Jurisdiction	1911	**% of Community**
Number of Structures with Specified Flood Hazard Mitigation Measure Recommendations		
Flood Insurance	291	15.2%
Flood Insurance & Type I Nonstructural Measures	49	2.6%
Flood Insurance & Type II Nonstructural Measures	12	0.6%
Flood Insurance at reduced rate (LOMA-F or Elevation Certificate)	56	2.9%
Flood Insurance at reduced rate (Zone X-500yr)	44	2.3%
Flood Insurance at reduced rate (Zone X) & Type I Nonstructural measures	98	5.1%
Flood Insurance at reduced rate (Zone X) & Type II Nonstructural measures	23	1.2%
Flood Insurance at reduced rate (Protected by Levee)		
No Recommendations (Outside of Detailed Study Area)	966	50.5%
No Recommendations (Inside of Detailed Study Area)	214	11.2%
Possible Flood Insurance at reduced rate (within 500ft of Zone A)	158	8.3%

6.7 Results: All Jurisdictions

6.7.1 Flood Zone Designation Inventory

Table 6-23 summarizes the review of structure locations against effective flood zone designations for all jurisdictions within Hall County.

Table 6-23a: Inventory of Structure Locations against Effective Flood Zones for all jurisdictions within Hall County (Structure Location)

Number of Structures in Jurisdiction	26238	**% of Community**
Number of Structures in Designated Flood Zones		
Zone A	399	1.5%
Zone AE Floodway	69	0.3%
Zone AE	1010	3.8%
Zone X - 500yr	675	2.6%
Zone X - Protected by Levee	209	0.8%
Zone X - NSFHA	23876	91.0%

Table 6-23b: Inventory of Structure Locations against Effective Flood Zones for all jurisdictions within Hall County (Structure Value)

Total Value of Structures in Jurisdiction	$2,178,520,966	**% of Community**
Total Value of Structures in Designated Flood Zones		
Zone A	$24,640,653	1.1%
Zone AE Floodway	$7,947,071	0.4%
Zone AE	$113,292,482	5.2%
Zone X - 500yr	$64,881,074	3.0%
Zone X - Protected by Levee	$40,860,840	1.9%
Zone X - NSFHA	$1,926,898,846	88.4%

Table 6-23c: Inventory of Structure Locations against Effective Flood Zones for all jurisdictions within Hall County (Critical Facilities)

List of Critical Facilities in Designated Flood Zones			
Critical ID	**Critical ID**	**Zone**	**Value**
Former Wood River Firehall	141	X - 500yr	$106,000
Good Samaritan Center	140	X - 500yr	$1,233,596
Wood River Elementary	120	X - 500yr	Future Data Needed
Wood River Police Department	108	X - 500yr	$206,000
Saint Marys Catholic Church	69	X - 500yr	$876,478
Grace Lutheran Church	53	X - 500yr	$102,413
First United Presbyterian Chur	49	X - 500yr	$52,596
First United Methodist Church	48	X - 500yr	$290,751
Wood River Water Treatment	18	X - 500yr	$750,000
Wood River Water Tower	16	X - 500yr	$225,000
Cedar Hollow Public School	112	AE	Future Data Needed
Grand Island Fire Station Four	100	X - 500yr	$36,834
Veterans Admin Medical Center	97	AE	Future Data Needed
Berean Bible Church	22	AE	$829,234
G.I. Wastewater Treatment Plant	13	AE	$15,000,000
District 501 - Hall County	113	A	$279,640
Emmanuel Church	37	A	$81,303
Cameron Church	30	A	$80,000
I-80 Exit #300 Eastbound	10	X - 500yr	$1,200,000
I-80 Exit #314 Westbound	5	AE Floodway	$3,500,000
I-80 Exit #314 Eastbound	7	AE	$1,200,000

6.7.2 BFE Depth Inventory

Table 6-24 summarizes the review of base flood depths for all structures within the detailed flood hazard review boundaries.

Table 6-24a: Inventory of Structure Locations against Base Flood Depths for all jurisdictions within Hall County (Structure Count)

Number of Structures within Detailed Flood Hazard Review Limits	2979	**% of Detailed Review**
Number of Structures at Flood Depth Ranges		
> 1 ft Above BFE	1448	48.6%
0-1 ft Above BFE	445	14.9%
0-1 ft Below BFE	299	10.0%
1-2 ft Below BFE	373	12.5%
2-3 ft Below BFE	239	8.0%
3-5 ft Below BFE	142	4.8%
> 5 ft Below BFE	33	1.1%

Table 6-24b: Inventory of Structure Locations against Base Flood Depths for all jurisdictions within Hall County (Structure Value)

Value of Structures within Detailed Flood Hazard Review Limits	$336,817,418	**% of Detailed Review**
Value of Structures at Flood Depth Ranges		
> 1 ft Above BFE	$170,231,294	50.5%
0-1 ft Above BFE	$41,755,526	12.4%
0-1 ft Below BFE	$49,832,918	14.8%
1-2 ft Below BFE	$37,142,236	11.0%
2-3 ft Below BFE	$26,306,179	7.8%
3-5 ft Below BFE	$9,108,336	2.7%
> 5 ft Below BFE	$2,440,929	0.7%

Table 6-24c: Inventory of Structure Locations against Base Flood Depths for all jurisdictions within Hall Count (Critical Facilities)

List of Critical Facilities within Detailed Flood Hazard Review Limits			
Critical ID	**Critical ID**	**BFE Depth**	**Value**
Northwest High School	135	0.65	$20,000,000
Grand Island Senior High	124	-4.37	Future Data Needed
Cedar Hollow Public School	112	-0.13	Future Data Needed
Veterans Admin Medical Center	97	-0.07	Future Data Needed
Third City Christian Church	77	0.57	$474,624
Seventh Day Adventist Church	74	-0.05	$471,237
First United Methodist Church	47	-3.64	$395,060
Community Bible Church of the	35	-2.22	Future Data Needed
Church of Christ	33	-2.1	$2,568,253
Berean Bible Church	22	-0.84	$829,234
G.I. Wastewater Treatment Plant	13	-2.56	$15,000,000
Platte Generation Station	11	-2.71	Future Data Needed
Unnamed Critical Facility Point	138	3.06	$96,814
I-80 Exit #300 Eastbound	10	1.13	$1,200,000
I-80 Exit #300 Westbound	9	1.48	$1,200,000
I-80 Exit #314 Eastbound	7	0.33	$1,200,000
I-80 Exit #314 Westbound	5	2.89	$3,500,000
I-80 Exit #312 Eastbound	4	-5.69	Future Data Needed
I-80 Exit #312 Westbound	3	-2.52	Future Data Needed

6.7.3 Review of Flood Zone Designations against BFE Depths

Table 6-25 summarizes the review flood designation in comparison with calculated base flood depths for the structure points for all jurisdictions within Hall County the table shows that, based on the terrain data used in this study, the flood designations for 493 structure may be incorrect in a non-conservative manner, while there is 501 structures located within a floodplain which may be located above the base flood elevation. These discrepancies are discussed further in section 7.1.1.

Table 6-25: Review of Effective Flood Zones at Detailed Study Structure Points for all jurisdictions within Hall County

		Recognized as within a 100-yr flood zone on FIRM Map	
		TRUE	**FALSE**
Below 100-yr BFE based on Terrain Data	**TRUE**	593	493
	FALSE	501	1392

6.7.4 Review of Critical Facilities

Tables 6-23 and 6-24 summarize the critical facilities identifications for all jurisdictions within Hall County

6.7.5 Potential Flood Hazard Mitigation Measures

Table 6-26 summarizes the flood hazard mitigation measures recommended for all jurisdictions within Hall County. For structure specific recommendations see the provided shapefiles on the attached Data CD.

Table 6-26 Flood Hazard Mitigation Measure Recommendations for all jurisdictions within Hall County

Number of Structures in Jurisdiction	26238	
Number of Structures with Specified Flood Hazard Mitigation Measure Recommendations		
Flood Insurance	384	1.5%
Flood Insurance & Type I Nonstructural Measures	522	2.0%
Flood Insurance & Type II Nonstructural Measures	71	0.3%
Flood Insurance at reduced rate (LOMA-F or Elevation Certificate)	501	1.9%
Flood Insurance at reduced rate (Zone X-500yr)	611	2.3%
Flood Insurance at reduced rate (Zone X) & Type I Nonstructural measures	389	1.5%
Flood Insurance at reduced rate (Zone X) & Type II Nonstructural measures	104	0.4%
Flood Insurance at reduced rate (Protected by Levee)	209	0.8%
No Recommendations (Outside of Detailed Study Area)	21467	81.8%
No Recommendations (Inside of Detailed Study Area)	1335	5.1%
Possible Flood Insurance at reduced rate (within 500ft of Zone A)	645	2.5%

SECTION 7: CONCLUSIONS

7.1 Recognized Issues

7.1.1 Discrepancies between Terrain Data and Flood Hazard Boundaries

Due to Hall County's relatively flat terrain and historical lack of detailed terrain data identification of flood hazards for the county has been a challenge. Table 6-25 recognizes that the flood designations for 493 structures may be incorrect in a non-conservative manner, while there are 501 structures located within a floodplain which may be located above the base flood elevation. These numbers are off the same order of magnitude of the properly identified flood prone structures (593).

7.1.2 Developments near Amick Acres

Amick Acres is a development on the Platte River near Doniphan located on a series of abandoned sandpits. The development is primarily residential and contains homes ranging from below $100,000 to above $500,000. Calculated flood depths for this area are predominately below 3ft but include 20 points with calculated flood depths greater than 3ft including a maximum depth of 8.92 ft. The number, value, and exposure to flood depths of these structures present a localized and significant flood risk.

7.1.3 Developments in Northwest Grand Island

The area of Northwest Grand Island is a developing area, flood risks in this region are presented by a number of flooding sources including Silver Creek, Prairie Creek, and Moore's Creek. The area is combination of residential, agricultural, commercial and industrial. Property values in this area range drastically from below $100,000 to $20M (Northwest Highschool), and contain 23 points with above $500,000 of value. The number, value, and exposure to flood depths of these structures present a localized and significant flood risk.

7.2 Recommended Future Efforts

7.2.1 Delineation of Flood Hazard Boundaries

Section 7.1.1 of this report outlined the discrepancies that exist between the delineations on the current effective maps and the best available terraine data. Due to Hall County's generally flat terrain, old delineations are likely not accurate. With updated terrain data, LiDAR, updated delineations will provide a more accurate representation of the actual flood risk in the community.

7.2.1.1 Northwest Grand Island

For Northwest Grand Island LiDAR data is currently available within the city jurisdiction. The Nebraska GIS steering community has also expressed a desire to collect LiDAR on a statewide basis. The use of the current data and/or future LiDAR data should be considered for redlineation or restudy of the flood hazard areas present in Northwest Grand Island.

7.2.1.2 Amick Acres

For Amick Acres, new LiDAR will be available in the future as part of the statewide LiDAR collection. Other options available to improve this delineation could be the use

of terrestrial LiDAR due to the relatively small area of concern or RTK-GPS survey to establish further terrain data for the area of concern. The use of enhanced terrain data should be considered for redelineation of the flood hazard areas present in area of Amick Acres

7.2.1.3 Hall County Unincorporated Areas

For the Unincorporated areas of Hall County updated zone A areas would be beneficial. Efforts were undertaken in connection with the recent DFIRM conversion to use the NDNR NFACT hydrologic computation and mapping tool to develop new zone A delineations. Due to the use of 10 foot contour data this effort was largely unsuccessful. The use of smaller contour interval data generated from LiDAR (1 foot - 3 foot) could be used in connection with the NFACT tool to create more detailed and accurate flood hazard delineations in the future.

7.2.2 Enhanced Floodplain Management Requirements

Section 7.1.1 of this report documents the challenges involving the reliability of the current flood hazard delineations. Efforts outlined in section 7.2.1 of this report are aimed at improving these delineations, however due to the lack of relief throughout the county uncertainty in flood hazard boundaries are likely to remain a concern. As such, it is recommended that the community require elevation certificates for areas located outside but within a 500 foot distance of the effective flood hazard areas.

7.2.3 Further Review at Amick Acres

This study has identified the area of Amick Acres as a potential area of flood hazard concern. Due to the proximity to the Platte River, above average property values, and distance from typical emergency response centers, this area represents a location of enhanced flood risk. As such, it is recommended that this area be further reviewed for appropriate methods of flood damage reduction. Appropriate methods could include emergency flood warning, response, and evacuation plans, to nonstructural measures, structural flood damage reduction. As part of this study ground elevation data was collected for analysis the flood hazard for a number of structures in the area. The results of this analysis indicate that further data of this type should be collected; these efforts could be incorporated into the efforts outlined in 7.2.1.2. Additionally, structure type information should be included to assess the potential flood damages. Following these efforts the community will be able to assess the true flood risk in the area and address it appropriately either through structural and/or nonstructural flood damage reduction methods.

7.2.4 Continued Efforts in Northwest Grand Island

This study has identified the area of Northwest Grand Island as a potential area of flood hazard concern. This concern has previously been identified by the community, section 4.2.3.2 of this report documents the current efforts being undertaken in this area to reduce flood risk. In addition to these efforts it is recommended that redlineation of this area be undertaken to assist in the assessment of the true flood hazard risk. While ongoing efforts are designed to provide flood damage reduction the technical aspects of these

plans should be reviewed by FEMA in the form of a Conditional Letter of Map Revision (CLOMR) to ensure that the final result is revised regulatory flood hazard boundary.

7.2.5 Further Review of Critical Facilities

This study has identified a number of critical facilities which may be at flood risk. Further review of these facilities should be undertaken to assess the overall flood risk. The following critical facilities are identified as being located below the regulatory base flood elevation: Northwest High School, Third City Christian Church, and Critical Facility 138. Additionally, the following facilities have been identified as being located close to the regulatory base flood elevation: 7th Day Adventist Church, Veterans Administration, and Cedar Hollow Public School.

7.2.6 Homeowner Notification

This study was completed with the use of data obtained from the Hall County Assessors office. As such, the results of this study can be linked back to information stored by the Hall County Assessor including mailing addresses. Using this resource notification letters could be prepared for the owners of the floodprone structures indicating their potential flood risk, how to further investigate their risk, and methods that could be taken to reduce their risk.

7.3 Assistance Programs and Funding Sources

7.3.1 Flood Mitigation Assistance Program

The Flood Mitigation Assistance Program is administered by the Nebraska Department of Natural Resources (NDNR). This program provides funds for 75% of the cost associated with mitigation projects such as voluntary acquisition, relocation, flood proofing, or small structural projects.

7.3.2 FEMA Grant Programs

The Pre-Disaster Mitigation (PDM) program is a nationwide competitive grant program that was created to assist state and local governments, including Indian Tribe governments, to implement cost-effective hazard mitigation activities prior to disasters. The intent of this program is to reduce overall risk to people and property, while also minimizing the cost of disaster recovery.

The Hazard Mitigation Grant Program (HMGP) is sponsored by FEMA and is administered by the Nebraska Emergency Management Agency (NEMA). The HMGP is a post-disaster program which requires that a county be declared a federal disaster area before funds become available. The cost sharing for the HMGP is 25% local and 75% federal.

7.3.3 Central Platte Natural Resources District

The Central Platte Natural Resources District (CPNRD) is a local agency responsible for water resources problems in the study area. The CPNRD has participated in both structural and nonstructural flood reduction projects in the project area. Proposed projects may receive funding assistance.

7.3.4 Nebraska Environmental Trust Fund

The Nebraska Environmental Trust Fund provides funds to environmentally beneficial projects with proceeds from the Nebraska Lottery. Some elements of mitigation plan that enhance the environment, such as acquiring flood-prone properties and converting the land to open space or habitat, may be eligible for funding from this source.

7.3.5 United States Army Corps of Engineers

The United States Army Corps of Engineers (USACE) administers several programs aimed towards reducing flood damages. Most Corps- constructed flood protection projects are owned and operated by sponsoring cities, towns, and/or agricultural districts.

The General Investigations Program involves construction of large Federally funded projects (typically greater than $15 million in construction cost) to reduce flood damages. The first $100,000 and 50% of the total study costs are provided by the Federal Government. The feasibility report is submitted to Congress upon completion for authorization of construction. The local project sponsor is required to provide 35% of the total project cost.

The Section 205 Flood Damage Reduction Program focuses on solving local flood problems in urban areas, towns and villages. Both structural and nonstructural projects are considered for implantation. The first $100,000 of the feasibility study cost and 50% of the remaining study costs are funded entirely by the federal government with the total project cost, of up to $15 million, cost-shared with a local project sponsor on a 50% basis. The local project sponsor is required to provide 35% of the total project cost.

The Planning Assistance to States (Section 22) Program involves the preparation of plans for the development, utilization and conservation of water and related land resources. Assistance is limited to $500,000 in federal funds per state per year, based on available appropriations. Study costs are shared 50-50 with the local sponsor.

The Flood Plain Management Services Program provides a full range of information, technical services and planning guidance needed to support and promote effective floodplain management and flood risk assessment. Services offered under this authorization are floodplain and floodway delineation, flood depths and velocities assessments, as well as inventorying flood prone structures and providing flood hazard mitigation. This program is entirely funded by the Federal government, depending upon availability of funds.

Exhibit 1 - Current and Historic FIRM Maps

See attached Data CD

Exhibit 2 - Letter of Exemption to Section 1910.3(c)(2) of the NFIP

Copy. Council / Pub. Works / Reg. Planning — Zeige

FEDERAL EMERGENCY MANAGEMENT AGENCY
Washington D.C. 20472

JUL 29 1980

RECEIVED
AUG 4 1980
MAYOR'S OFFICE

Honorable Robert Kriz
Mayor, City of Grand Island
Box 1968, City Hall
Grand Island, Nebraska 68801

Dear Mayor Kriz:

I am pleased to report that the Federal Insurance Administration (FIA) has approved the City of Grand Island's request for an exception to Section 1910.3(c)(2) of the National Flood Insurance Program (NFIP) regulations. This exception will allow you to grant permits for the construction of floodproofed residential basements below the base flood elevation in your community.

For insurance purposes, a basement structure will be rated as a structure without a basement having the first floor elevation taken as the floodproofed elevation minus one foot, rounded to the nearest foot. To qualify for this rating, the basement must be floodproofed (watertight with walls substantially impermeable to the passage of water, without human intervention) to at least the elevation of the base flood.

Please keep in mind that each floodproofed residential basement design must be certified by a registered engineer or architect to be capable of withstanding the hydrostatic and dynamic loads of the 100-year flood and to remain watertight. As an alternative to individual floodproofing certification, the City may submit a standard design to FIA which has been certified by a registered engineer or architect to meet FIA's requirements, then ensure that each floodproofed residential basement is constructed according to that approved design.

I have enclosed a copy of the Manual for the Construction of Residential Basements in Non-Coastal Flood Environs which you may find useful. If there is any other information I can provide concerning the NFIP, please do not hesitate to contact me.

Sincerely,

Gloria M. Jimenez
Federal Insurance Administrator

Enclosure

Exhibit 3 - Digital Regulatory Flooding Data

See attached Data CD

Exhibit 4 - Digital Terrain Data

See attached Data CD

Exhibit 5 - Digital Structure Location Data

See attached Data CD

Exhibit 6 - Digital Critical Facilities Identification

See attached Data CD

Exhibit 7 - Digital Structure Value Data

See attached Data CD

Exhibit 8 - Digital Jurisdiction Data

See attached Data CD

Exhibit 9 - Digital Results Data

See attached Data CD

Exhibit 10 - Further Information on Floodproofing

See attached Data CD

Exhibit 11 - Flood Hazard Mitigation Maps

See enclosed maps and attached Data CD

Map 1 - Alda
Map 2 - Cario
Map 3 - Doniphan
Map 4 - Grand Island
Map 5 - Grand Island
Map 6 - Grand Island
Map 7 - Grand Island
Map 8 - Grand Island
Map 9 - Grand Island
Map 10 - Grand Island
Map 11 - Grand Island
Map 12 - Wood River
Map 13 - Amick Acres

APPENDIX B – SAMPLE PLAN UPDATE WORKSHEETS

Worksheet # 1: Progress Report

Progress Report Period: _____ (Date) to _____ (Date)

Project Title: _____ Project ID#: _____

Responsible Agency: _____

Address: _____

City/County: _____

Contact Person: _____ Title: _____

Phone #(s): _____ e-mail address: _____

List Supporting Agencies and Contacts: _____

_____

Total Project Cost: $_____ Anticipated Cost Overrun/Under run: _____

Date of Project Approval: _____ Start date of the project: _____

Anticipated completion date: _____

Description of the Project (include a description of each phase, if applicable, and the time frame for completing each phase).

_____
_____
_____
_____
_____

Milestones	Complete	Projected Date of Completion

Plan Goal(s)/Objective(s) Addressed:

Goal: _____

Objective: _____

Indicator of Success (e.g., losses avoided as a result of the acquisition program):
In most cases, you will list losses avoided as the indicator. In cases where it is difficult to quantify the benefits in dollar amounts, you will use other indicators, such as the number of people who now know about mitigation or who are taking mitigation actions to reduce their vulnerability to hazards.

_____
_____
_____

Status *(Please checks pertinent information and provide explanations for items with an asterisk. For completed or canceled projects, see Worksheet #2 — to complete a project evaluation):*

Project Status	Project Cost Status
(1) ☐ Project on schedule	(1) ☐ Cost unchanged
(2) ☐ Project completed	(2) ☐ Cost overrun* *explain: _____ _____
(3) ☐ Project delayed* *explain: _____ _____	(3) ☐ Cost under run* *explain: _____ _____
(4) ☐ Project canceled	

Summary of progress on project for this report:

A. What was accomplished during this reporting period?

B. What obstacles, problems, or delays did you encounter, if any?

C. How was each problem resolved?

Next Steps: What is/are the next step(s) to be accomplished over the next reporting period?

Other comments:

Worksheet #2: Evaluating Your Planning Team

When gearing up for the plan evaluation, the planning team should reassess its composition and ask the following questions:

	YES	NO
Have there been local staffing changes that would warrant inviting different members to the planning team? **Comments/Proposed Action:**		
Are there organizations that have been invaluable to the planning process or to project implementation that should be represented on the planning team? **Comments/Proposed Action:**		
Are there any representatives of essential organizations who have not fully participated in the planning and implementation of actions? If so, can someone else from this organization commit to the planning team? **Comments/Proposed Action:**		
Are there procedures (e.g., signing of MOAs, commenting on submitted progress reports, distributing meeting minutes, etc.) that can be done more efficiently? **Comments/Proposed Action:**		
Are there ways to gain more diverse and widespread cooperation? **Comments/Proposed Action:**		
Are there different or additional resources (financial, technical, and human) that are now available for mitigation planning? **Comments/Proposed Action:**		

If the planning team determines the answer to any of these questions is “yes,” some changes may be necessary.

Worksheet #3: Evaluate Your Project Results

Project Name and Number:

Project Budget:

Project Description:

Associated Goal and Objective (s):

Indicator of Success (e.g., losses avoided):

Insert location map

include before and after photos if appropriate

Was the action implemented?

IF YES ↓

What were the results of the implemented action?

IF NO ↓

Why not?

Was there political support for the action?	**YES**	**NO**
Were enough funds available?	**YES**	**NO**
Were workloads equitably or realistically distributed?	**YES**	**NO**
Was new information discovered about the risks or community that made implementation difficult or no longer sensible?	**YES**	**NO**
Was the estimated time of implementation reasonable?	**YES**	**NO**
Were sufficient resources (for example staff and technical assistance) available?	**YES**	**NO**

Were the outcomes as expected? **YES** **NO** **Additional comments or other outcomes:**
If No, please explain:

Did the results achieve the goal and objective (s)? **YES** **NO**
Explain how:

↓

Was the action cost-effective? **YES** **NO**
Explain how or how not:

What were the losses avoided after having completed the project?

If it was a structural project, how did it change the hazard profile?

Date _____

Prepared by: _____

Worksheet #4: Revisit Your Risk Assessment

Risk Assessment Steps	Questions	YES	NO	COMMENTS
Identify hazards	Are there new hazards that can affect your community?			
Profile hazard events	Are new historical records available?			
	Are additional maps or new hazard studies available?			
	Have chances of future events (along with their magnitude, extent, etc.) changed?			
	Have recent and future development in the community been checked for their effect on hazard areas?			
Inventory assets	Have inventories of existing structures in hazard areas been updated?			
	Are future developments foreseen and accounted for in the inventories?			
	Are there any new special high-risk populations?			
Estimate losses	Have loss estimates been updated to account for recent changes?			

If you answered "Yes" to any of the above questions, review your data and update your risk assessment information accordingly.

Worksheet #5: Revise the Plan

Prepare to update the plan.

When preparing to update the plan:	Check the box when addressed ✓
1. Gather information, including project evaluation worksheets, progress reports, studies, related plans, etc. **Comments:**	☐
2. Reconvene the planning team, making changes to the team composition as necessary (see results from *Worksheet #2*). **Comments:**	☐

Consider the results of the evaluation and new strategies for the future.

When examining the community consider:	Check the box when addressed ✓
1. The results of the planning and outreach efforts. **Comments:**	☐
2. The results of the mitigation efforts. **Comments:**	☐
3. Shifts in development trends. **Comments:**	☐
4. Areas affected by recent disasters. **Comments:**	☐
5. The recent magnitude, location, and type of the most recent hazard or disaster. **Comments:**	☐
6. New studies or technologies. **Comments:**	☐

7. Changes in local, state, or federal laws, policies, plans, priorities, or funding. ☐

8. Changes in the socioeconomic fabric of the community. ☐

Comments:

9. Other changing conditions. ☐

Comments:

Incorporate your findings into the plan.

When examining the plan:	**Check the box when addressed ✓**
1. Revisit the risk assessment.	☐
Comments:	
2. Update your goals and strategies.	☐
Comments:	
3. Recalculate benefit-cost analyses of projects to prioritize action items.	☐
Comments:	

Use the following criteria to evaluate the plan:

Criteria	**YES**	**NO**	**Solution**
Are the goals still applicable?			
Have any changes in the state or community made the goals obsolete or irrelevant?			
Do existing actions need to be reprioritized for implementation?			
Do the plan's priorities correspond with state priorities?			
Can actions be implemented with available resources?			

Comments:

APPENDIX C

Compendium of Public Meeting Documentation

Hall County All-Hazards Mitigation Plan
Initial Public Meeting Attendance Sign-In Sheet

Name	Title	Agency
M NICKERSON	G.I City Council	
Tony D Kroose	USACE	
Scott Arnold	Court Board Chairman	Hall Co Supervisors
Dan O. Petsch	Supervisor Building & Gds	Grand Island Public Schools
Joyce Haase	G.I. City Council	Grand Island
Dave Harders	Village Board Chairman	Alda
Mindy Okeman	GI/HC EMA Clerk	GI/HC EMA
Larry J. Smith	Interim Director GI/HC EMA	GI/HC EMA
Chad Nabity	AICP County Regional Planning Director	Hall County RPC
harry Harnisch	Supt. Wood River Rural Schools	
Steve Riehle	City Engineer	Grand Island
BOB NIEMANN	R.P.C City of GI	G.I.
Don Snodgrass	RPC WOOD RIVER	
Debra Reynolds	RPC Hall Co	
Jay Minter	RPC - CAIRO	
Patrick O'Neill	RPC - Hall Co	
Barbara Brandt	Planning Secretary	City of G.I.
Leslie Ruge	RPC - Alda	
Duane Muller	Member RPC - Grand Island	
Scott Eriksen	RPC - Grand Island	

3/7/07

REGIONAL PLANNING COMMISSION

AGENDA AND NOTICE OF MEETING

Wednesday, March 7, 2007
6:00 p.m.

City Hall Council Chambers — Grand Island

1. **Call to Order.**

2. **Minutes of February 7, 2007.**

3. **Request Time to Speak**

4. **Public Hearing** – Concerning a change of zoning for a tract of land proposed for platting as Woodland Park Fifth Subdivision located in the west half of the southeast quarter of Section 2, Township 11 north, Range 10 from R-2 to R-3. This property is located north of Capital Avenue and east of Independence Avenue. (C-13-2007GI) (Hearing, Discussion, Action.)

   Preliminary Plat – Woodland Park Fifth Subdivision located north of Capital Avenue and east of Independence Avenue in the City of Grand Island, Hall County Nebraska (45 lots). (Discussion, Action)

5. **Public Hearing** - To receive public comment on the development of an All-Hazards Mitigation Plan. This plan will be a community-guided document that will identify the County's vulnerability to natural disasters (flood, drought, winter storm, tornado, hail, etc.) and what can be done to reduce or eliminate vulnerability to them. Public comments are encouraged. (C-14-2007HC)

6. **Planning Director's Report**

7. **Next Meeting April 4, 2007**

8. **Adjourn**

PLEASE NOTE: This meeting is open to the public, and a current agenda is on file at the office of the Regional Planning Commission, located on the second floor of City Hall in Grand Island, Nebraska.

Hall County preparing plan to deal with natural disasters

By Tracy Overstreet
tracy.overstreet@theindependent.com
Publication Date: 03/08/07

Hall County is one of the most natural disaster-prone counties in the state.

That's based on an analysis of the number of tornadoes, damaging winds, large hail, flooding rains and severe winter storms that have hit Hall County from the 1950s through this year.

Hall County's status and its relatively high area population earned it a $75,000 grant to prepare what's called an All-Hazards Mitigation Plan.

Completion of the plan will make Hall County eligible for federal funds for pre-disaster projects, like the Wood River flood control project or post-disaster repairs like those being made to utility lines damaged in the December ice storm.

"Money is out there," said Steve McMaster from the Nebraska Department of Natural Resources.

He spoke Wednesday night to the Hall County Regional Planning Commission and officials from Grand Island, Alda, Cairo, Doniphan and area school districts.

McMaster asked the officials to identify what natural disasters are most likely to occur in Hall County -- floods, tornadoes, wildfires, severe winter storms, severe summer storms, drought or others -- and what types of projects would best help prevent damages.

Those prevention projects could include:

- Levees and floodwalls.
- Drainage ditch cleanout, flood diversion channels and debris removal from channels or near bridges.
- Replacement of bad bridges.
- Raised elevations of homes and businesses.
- New tornado warning sirens.
- Burying power lines to protect them from wind and ice.
- Developing building standards that better withstand winds and snowloads or relocating homes in floodprone areas.

McMaster said data shows that every dollar spent on mitigation typically

saves $4 in future damages.

He also asked the public to identify "critical facilities" in Hall County that would need to be stay open if a disaster struck. Examples included the hospital, fire stations, utilities and major employers.

McMaster will write the mitigation plan, with flood mapping assistance from the Army Corps of Engineers. Drafts of the plan, which will include separate plans for area communities, will then be reviewed by each community and the Regional Planning Commission.

A final draft will be submitted to the Federal Emergency Management Agency, which provided the planning grant. After the plan is approved, Hall County and its villages and cities would become eligible for the pre- and post-disaster funds, McMaster said.

Regional Planning Director Chad Nabity said the plan is something that must be done to stay eligible for federal assistance programs, but because of the grant, is being done at no cost to the county or cities.

Prior to the mitigation plan discussion, the planning commission approved a rezoning and preliminary plat for 45 new lots at the Woodland Park subdivision west of Northwest High School. Thirty of those 45 lots will be part of the Woodland Park Townhomes -- a low-income, retirement community being developed by Jan Thayer's Excel Development Group.

How disaster prone is Hall County?

Here's a list of the most significant natural disasters to hit Hall County:

Tornadoes: Grand Island in 1980, Wood River in 1999, Cairo in 1997.

High winds: Doniphan in 1999, Cairo in 1996 and 2002, Wood River in 2006. The county's strongest recorded wind was 92 mph in Cairo in 1996.

Large hail: Three-inch hail in Grand Island in 2002, caused damages of $2 million in Grand Island and $1 million in Doniphan, hail in 1997 caused $150,000 in damages in Alda.

Flooding: Severe flooding 14 times in Grand Island since 1935, three times in Wood River since 1947, and three times in Alda since 1967.

Severe winter storms: In 1996, 2005, 2006, 2007.

Drought: Ongoing.

To comment

If you want to provide suggestions of threats or hazard solutions for anywhere in Hall County, contact:

Steve McMaster

Initial Public Meeting Hazard Responses
Hall County

	Likelihood				
	Yes	**No**	Ranking		
Flood	16	2	4		
Earthquake	0	18			
Tornado	18	0	3		
Landslide	0	18			
Wildfire	10	8			
Winter Storm	18	0	1		
Summer Storm	18	0	2		
Dam Failure	2	16			
Drought	18	0			

	RISK				
	High	**Medium**	**Low**		
Flood	7	**8**	2		
Earthquake			**18**		
Tornado	**17**	1			
Landslide			**18**		
Wildfire		7	**11**		
Winter Storm	**12**	6			
Summer Storm	**13**	5			
Dam Failure	2		**16**		
Drought	**12**	4	2		

	VULNERABILITY				
	Full	**Severe**	**Limited**	**Unknown**	**None**
Flood	1	**9**	6	1	1
Earthquake		1		5	**12**
Tornado	1	**14**	3		
Landslide				2	**16**
Wildfire			**12**	3	3
Winter Storm	2	**12**	4		
Summer Storm	2	**14**	2		
Dam Failure	1	2	**4**	2	9
Drought		3	**14**	1	

SAMPLE

Hazard Mitigation Plan Survey

1) Please give your name and title: Chad Nabity Hall County Regional Planning Director

2) Please list the community you are representing: Hall County Communities
Grand Island

3) Please follow the instructions given to you in filling out the boxes below. Please fill in the boxes with your community in mind.

Hazard Types	Likely to Experience?	Risk	Vulnerability
Flood	Yes	High	Severe
Earthquake	No	Low	Unknown
Tornado	Yes	High	~~Full~~ Severe
Landslide	NO	Low	None
Wildfire	NO	Low	Limited
Severe Winter Storm	Yes	Medium	Severe
Severe Summer Storm	Yes	Medium	Severe
Dam Failure	Yes	Low	Full
Drought	Yes	Medium	Severe
Other?? Ground Water Flooding	Yes	High	Severe

Likely: Yes or No
Risk values: High, Medium, Low
Vulnerability values: Full, Severe, Limited, None, Unknown

4) After the continued presentation about potential mitigation projects, please list potential projects that you would like considered for your community. Be thinking about specific infrastructure-related problems as well as known historic damage areas in your community.

Siren Replacement Drainage Culvert Upgrades + Maintenance
Underground electrical
Drainage Study SE Grand Island
Debris Removal Stormwater Mgt

5) In the space provided below, please list what you would consider to be "critical facilities" in your community. Critical facilities are those which need additional protection due to vulnerable populations, allow response and recovery in the aftermath of a disaster, are recognized disaster shelters, are your community's economic lifeblood, or others.

City Hall Platte Generating Station Burdick Power Station
St Francis Hospital/ Vets Hospital/ Heartland Events Center County Jail
Police + Fire Stations County Admin Building Swift (concagra)
Principal financial Case New Holland Platte Well fields
Water Treatment Plant

Hall County Hazard Mitigation Plan under review

By Tracy Overstreet
The Grand Island Independent
Posted May 04, 2008 @ 10:57 PM

GRAND ISLAND — Floods, hail, tornadoes and ice have been known to wreak havoc on Central Nebraska, so a new plan is being developed for how to lessen damages in Hall County.

It's called the All-Hazards Mitigation Plan.

The Regional Planning Commission will review the 93-page plan during a 7 p.m. Wednesday meeting at Grand Island City Hall, 100 E. First St. The commission is to provide input on the best projects to support.

The plan is meant to protect Hall County's $3.3 billion worth of property and its more than 50,000 residents.

That protection is crucial, considering Hall County has been hit by numerous serious storms.

Hall County has had 50 significant hail events from 1995 to 2006 and averages about $362,000 in summer storm damage a year, the plan states.

The most devastating winter storm on record came in December 2006 when thick, heavy ice downed power lines, causing $240 million in infrastructure damage across Central Nebraska.

Flooding damage was at its peak in 1967 when excessive rainfall created nearly $50 million in damages and led to three Hall County deaths.

Tornado damage was the worst in 1980 when seven tornadoes struck Grand Island, causing five deaths and $300 million in damages.

Regional Planning Director Chad Nabity said his department received a $75,000 grant to have the hazard mitigation plan prepared by the U.S. Army Corps of Engineers in Omaha.

"There's federal money to do this," Nabity said. "It also opens the doors for federal mitigation assistance in the future."

That future mitigation money could help pay for flood projects, for winter storm damage repair or housing relocation out of the floodplain.

Flood projects are the ones that have gained the top rankings in the study so far.

The plan suggests that Hall County work toward acquiring floodprone structures, continue with building stormwater detention cells in northwest Grand Island, issue floodplain permits and create zoning for low-lying land downstream of dams.

As for acquiring floodprone structures, the plan states that some Natural Resource Districts have floodway acquisition programs that seek to buy properties that have repetitively sustained losses from floods. The Central Platte Natural Resources District could initiate a similar program, with the city of Grand Island as a sponsor, the plan states.

Another high priority, as identified by the plan, is securing backup power generators.

The December 2006 ice storm is a classic example of how a storm disaster can leave entire communities without power for weeks. Such a loss of power during cold weather is of great concern when people are left without heating sources. Acquiring large emergency generators could help supply interim power to critical care facilities and serve to provide warming centers.

The plan also suggests that Hall County construct or retrofit public tornado shelters in schools, fairgrounds or parks to protect large population bases during summer months. It could also publicize and evaluate public shelters to increase awareness of good places to take shelter.

An urban tree management program is recommended -- particularly one that inventories trees in public places and ways to reduce storm damage from those trees.

Finally, the plan outlines education to the public about storm awareness, severe weather alerts and snow emergency routes as critical to reducing damages when storms do occur.

Steve McMaster of the Nebraska Department of Natural Resources will lead the plan review during Wednesday's meeting.

Hall County Projects

Priority		Social	Technical	Administrative	Political	Legal	Economical	Environmental	
	Severe Weather								
H	1. Emergency backup power for communities								
H	2. Emergency backup power inventory for critical facilities								
L	3. Emergency backup power for critical facilities						X		Not unneeded - inventory first
H	4. Weather radios for schools and other critical facilities								
L	5. Emergency snow route development and signage	X		X			X		
H	6. Require power line burial					?			Good idea, question of legality
H	7. Power line burial projects								
H	8. Urban Tree Management Plan/Tree Inventory								
M	9. Provide tree planting/selection information to citizens	X		X					
L	10. Become a Tree City USA	X		X	X				
H	11. Increase public education for severe weather								
H	12. Reverse 9-1-1 or other new technology for warnings								
L	13. Hail education	X		X					
	Flood								
H	14. Maintain good standing in National Flood Insurance Program								
L	15. Mitigate County's at-risk flood properties	X		X	X		X		
H	16. Flood control projects								
H	17. Public education for flood risk								
H	18. Drainage improvements								
L	19. Flood insurance education for homeowners	X							
	Tornado								
H	20. Public tornado shelters								
H	21. Shelter assessment								
L	22. Secure at-risk development like manufactured homes	X		X	X		X		
H	23. Offer information to public about in-home tornado safe rooms								
H	24. Tornado siren regulations for new subdivisions					?			Good idea, question of legality
H	25. NOAA weather radios for public critical facilities								
H	26. Weather radio education for non-public critical facilities								
H	27. Public education for tornado safety								
	Drought								
M	28. Water supply augmentation	X			X		X		
M	29. Local demand reduction/conservation programs	X			X		X		
L	30. Emergency response programs	X			X		X		
L	31. Contingency plans	X			X		X		

Boxes marked with an "X" denote the reasons why that option was not considered a high-priority item

APPENDIX D

Community-Specific Mitigation Planning Information

This section contains mitigation planning information specific to each participating community. Communities are listed in alphabetical order. More detailed information for each community, including: disaster history for each hazard type, structural inventory, and desired mitigation alternatives – listed in order of highest priority to lowest. Local adoption documentation is provided in **Appendix E**.

Alda

	Dam Failure	Drought	Earth-quake	Flood	Levee Failure	Summer Storm	Land-slide	Winter Storm	Tornado/ Wind	Wildfire
Probability	None	Medium	Low	Low	None	High	None	High	High	Medium
Extent	Zero	Limited	Unknown	Limited	Zero	Severe	Zero	Severe	Full	Limited
Previous Occurrence	No	Yes	No	Yes	No	Yes	No	Yes	Yes	No

Probability: Based on history, what is the likelihood this type of event will happen again?
- None, Low, Medium, or High

Extent – If this event were to happen, how extensive could the damage be?
- Zero, Limited, Severe, Full, or Unknown

Previous Occurrence: Is there an historic record of this type of hazard in the community?

The above table shows the input provided at the initial public meeting. Due to the geographical proximity, the following hazard types were not considered due to there being no likelihood of occurring in Nebraska: volcanic eruptions, avalanches, hurricanes, tidal surges, and tsunamis.

In the following sections, only the hazard types which have a significant likelihood of occurring or have a reason to potentially occur are listed. These types are: severe weather (summer and winter), tornado, flood, and drought. Although there is a small risk for earthquakes, wildfires, and landslides, the threat and associated risk for these hazards is not high enough and there are no realistic or feasible mitigation action which can be taken to reduce the level of risk. The only dam failure which has any potential of impacting Alda is Kingsley Dam, which holds back Lake McConaughy in western Nebraska. The breach route inundation maps for Kingsley Dam show that Alda would not be inundated in the unlikely event that this dam fails; therefore, dam failure is not further considered for Alda. The National Climatic Data Center lists no records of wildfire for Hall County. Additionally, the citizens did not rank these hazards high enough to warrant detailed discussion in this plan. This may change in future updates.

Disaster History

Because of its proximity between the larger communities of Wood River and Grand Island, the Village of Alda is often lost in the details of hazard events reporting. Since natural hazards are where people and weather interact, it should be expected that the larger communities will have more events recorded. This means that even if there are damaging hazard events, if damage occurred in the larger communities, it will be reported as happening there while there may be no reports for Alda.

Flood

The National Weather Service's Advanced Hydrologic Prediction Service gives the following flood categories for Wood River at the Alda gage and their impacts:

Major Flood Stage	12.2 feet	Record flooding, Highway 30 upstream of gage site acts as a constriction to flood crests
Moderate Flood Stage	11 feet	The left bank (north side) overflows, water floods lowlands and county roads
Flood Stage	10 feet	Minor lowland flooding occurs in pastures and farmlands
Action Stage	9 feet	

Torrential rainfall of 5 to 11 inches on May 11 and 12, 2005, led to widespread flash flooding throughout Hall County. This event was declared a federal disaster area by President Bush. Wood River near Alda, which had been dry for three years, tied a record with a crest of 12.2 feet early on the 12th. Records also indicate that Wood River flooded in 1967, 1968, and 1969, although no damage estimates are available – if there was any. Flood crest data indicates that the June 1968 flood was 11.7 feet and the March 1969 event was 12 feet. The National Climatic Data Center reported a flood event for Alda on February 20, 2007. No additional information was available – including no description of the event or damage estimate.

Severe Weather

On July 29, 1996, 1¾-inch diameter hail caused $2,000 in property damage and $20,000 in crop damage around town. On June 15, 1997, golf ball-sized up to tennis ball-sized hail propelled by 60 mph winds severely damaged wide areas of western Hall County. Crop and tree damage was extensive. In Alda, the magnitude of the hail was one inch, property damage was estimated at $150,000, and area crop damage was set at $1 million. On May 21, 1998, 2-inch hail caused $15,000 in property damage and an estimated $250,000 in crop damage. On May 21, 2004, 1¾-inch caused $25,000 in property damage. On June 16, 2006, thunderstorm winds of 57 mph caused property and crop damage two miles north of Alda.

On the severe winter weather side, Alda was without power as a result of the New Years Ice Storm, which hit in late December, 2006.

Tornado

There are no records which indicate that Alda has been directly impacted by a tornado in its history.

Drought

NCDC reports two drought events since 1950 for Hall County: in 2000 and 2002. Both of these droughts appear to have been agricultural droughts with the most impact to growing crops. Although Alda is situated in an area which has been directly impacted by a drought, there are no indications that the Village has ever been materially impacted by a drought.

Likelihood of Future Hazard Events

It is certain that Alda will continue to be impacted by severe weather – perhaps as often as each year. In these events, it should be expected to witness large hail, high winds, and intense rain in the summer, and large snowfalls, ice, and bitter windchills in the winter. It is less likely – but still possible – that Alda will be impacted by flooding from Wood River or by intense warm season rain events. It is also less likely, but possible, that Alda will be impacted by a tornado.

Past Hazard Mitigation Efforts

The Village of Alda participates and is in good standing in the National Flood Insurance Program (NFIP). The initial identification for Alda's floodplain map was completed on June 25, 1976 with the Village participation in the NFIP becoming effective on June 20, 1978. The floodplain map was rescinded on August 4, 1987, which means that it was later determined that the low level of flood risk did not warrant the administrative cost to maintain the maps by the Federal Emergency Management Agency. This means that there is currently no effective floodplain map; however, the old map can be used to show the most likely areas of river flooding. Despite the rescinded floodplain map, Alda continues to participate as is in good standing in the National Flood Insurance Program. Preliminary floodplain maps for all of Hall County were published on August 31, 2007. However, it is not possible to tell when these maps will become effective.

As defined by FEMA's repetitive loss list, there are no repetitive flood loss properties in Alda.

Vulnerability Assessment

According to an assessment completed by the Nebraska Department of Natural Resources in March of 2007, there are 303 total structures in Alda. **Figure 1** shows the structures broken out by type, and the count is:

259 residences
26 businesses
14 (at least) out buildings large enough to be seen on aerial photographs
3 publicly-owned structures: the municipal building and school
1 church/non-profit buildings

According to the Nebraska Department of Property Assessment and Taxation, the total assessed taxable value for Alda in 2007 was $24,047,503. Broken out by significant property types, this is:

Residential real property:	$ 13,514,869
Commercial/industrial real property:	$ 7,580,948
Commercial/industrial personal property:	$ 2,265,592
Railroad real and personal property:	$ 593,745
Public service corp. real and personal:	$ 92,349

The entire structure stock is vulnerable to the severe weather, tornado, and drought hazard. This means that, as of 2007, there is $24,047,503 in at-risk assets for these hazard types.

In the structural inventory completed by the Corps of Engineers, seven properties were found to be located in a regulated floodplain in Alda's extraterritorial zoning jurisdiction. NDNR's inventory in the corporate limits found no properties in a regulated floodplain. The valuation of the seven floodplain properties found by the Corps of Engineers is $518,285, or 2.5% of the total valuation of Alda and its zoning jurisdiction.

Figure 2 shows the critical facilities, as identified by the Village and supplemented with various federal databases. Critical facilities are those structures which will be essential for returning the Village functions to normal after a disaster ("Civic") and are vital for disaster response and sheltering ("Shelter"). Critical facilities can also be economic ("Financial") because the loss of a

major employer or the loss of the Village's main source(s) of revenue will greatly hinder recovery. The critical facilities identified are:

Civic: Village Hall/Community Center, fire hall
Sheltering: Alda Public School, United Methodist Church
Financial: Leons Manufacturing, TRIAD

Critical facilities in a floodplain: None

Figure 3 shows the potential ranges of the tornado warning sirens in Alda, with the yellow shading being a half-mile from the siren and red one mile from the siren. As shown by the figure, the entire development in the Alda corporate limits is in the yellow shaded area. It must be recognized, however, that these are outdoor warning sirens which are designed to alert residents who are outside and in close proximity to the sirens. They are not designed to warn persons indoors at-distance, traveling in vehicles, or in noisy environments. In addition, a warning system works best if there are operational redundancies – meaning that it is always safer to have additional sirens in a network in case a siren malfunctions or is destroyed. An additional consideration is that periods during which warning sirens are needed are often noisy in themselves with high wind, intense rain, and hail which all act to reduce peoples' ability to hear the sirens. It is easier to hear a warning for people who are downwind of the siren.

Figure 4 shows the areas of new development which is most likely to occur in the next five to ten years. No new development area is shown because the Village is currently landlocked by agricultural uses with no foreseeable plans for this to change. The vulnerability of all development for severe winter storms, severe summer storms, and tornadoes is the same now and will be the same in the future. The only hazard which is able to be modified by human behavior or activity is flooding. Since Alda is situated outside of a regulated floodplain, it is unlikely that new development will take place in a floodplain area. However, since Alda is in good standing in the National Flood Insurance Program, future development which does take place in a regulated floodplain will be completed in compliance with the Village's floodplain management ordinance.

Mitigation Alternatives

Alda's planning goals are the same as the goals for the county portion of the plan.

GOALS: 1) Reduce or prevent future damage from natural hazard events,
2) Increase public safety

To address these goals, mitigation alternatives were suggested in the public meeting and prioritized by the Alda Village Board.

Prioritization

Alda prioritized the mitigation alternatives according to the "STAPLE(E)" procedure (Social acceptability, Technical feasibility, Administrative capability of local government, Political acceptability, Legal authority to implement, Economic justification, and Environmental acceptability). In addition, alternatives were prioritized based on the community's goals and planning objectives.

At its discretion, Alda officials may choose to not implement any of the proposed mitigation projects at this time with the realization that future events may change this stance as well as the prioritization of projects. Projects sponsored for implementation will follow a public process.

1) Maintain good standing in the National Flood Insurance Program
   Objective 1: Continue to regulate development in floodplain areas and adopt the Hall County floodplain maps when they become effective.
   Funding sources and potential cost: No funding needed, no cost.

2) Reduce impacts of stormwater problems
   Objective 2: Complete a drainage study
   - Action 2.1: Given the extremely flat topography in the area, drainage will always be a problem – especially for intense warm weather rainfall events. A drainage study is needed in Alda to help the Village make wise land use decisions, to identify where existing drainage infrastructure is weak, and to identify ways to address these weaknesses. A drainage study has the potential to also identify good flood mitigation projects which could be funded using FEMA's mitigation programs.

   Funding sources and potential cost: Central Platte NRD, Community Development Block Grant, Village – cost varies widely on scope and community size

3) Increase public safety for tornadoes
   Objective 3: Provide emergency shelter(s) to which local residents would evacuate in the event of a tornado warning, especially those who live in vulnerable housing
   - Action 3.1: Perform an assessment of existing structures to determine their capability to be used as tornado shelters
   - Action 3.2: Create public shelters by retrofitting or new construction. FEMA has retrofitted schools and constructed all-new shelters in several places in the Midwest. However, most tornadoes occur in late-afternoon to early evening when a school might be closed for the day. Furthermore, it has been reported that public tornado shelters that are left open to the public are not used properly, with problems of vandalism and use by vagrants. At-risk structure types include mobile homes and slab-on-grade residential construction which has no basement.

   Funding sources and potential cost: FEMA's Pre-Disaster Mitigation program or Hazard Mitigation Grant Program – cost uncertain and highly variable by scope

4) Increase public safety by having emergency backup power capacity
   Objective 4: The New Years Ice Storm of December 2006 demonstrated that the redundancy in Nebraska's public power system is not adequate for major ice storm events. As a result of this event, several communities in central Nebraska were without power for over a week. When it became clear that getting power restored to these communities would take longer than expected, emergency power generators were brought in. Situations like this represent obvious public safety concerns from the inability to heat structures and critical facilities, inconvenience for residents, and the loss of property and contents from the spoiling of food, for example. Emergency generators could also be used in the aftermath of other disasters to power the critical facilities being used to guide post-disaster operations.

- Action 4.1: Purchase emergency backup generators

Funding sources and potential cost: Generators are eligible under Hazard Mitigation Grant Program 5% set-aside funds. Under the Pre-Disaster Mitigation program, generators are not an eligible project unless they are a part of a tornado shelter or another part of the eligible activity.

5) Prevent the potential injury or loss of life in manufactured homes from high winds

Objective 5: Use tie downs to secure manufactured homes to a stable foundation, preventing the potential for rolling.

- Action 5.1: The Village could pass an ordinance requiring all manufactured homes or all new manufactured homes to be securely anchored to their foundations
- Action 5.2: A non-regulatory option would be to have the Village educate the owners of these properties on the availability of techniques to make their dwelling safer.

6) Reduce the need for snow clearing in Village boundary streets

Objective 6: By installing snow fences along the corporate limits on the north and west sides of the Village, some of the wind-driven snow will be trapped and will not need to be plowed away. The less snow in town, the quicker all Village residents will be able to have access to emergency treatment. Since the corporate limit boundary may be the rear of residential property, the Village would need to obtain approval from property owners. An alternative would be to acquire an easement between the corporate limits and adjacent agricultural land.

- Action 6.1: Purchase and install a snow fence.
- Action 6.2: Acquire easement on which to build a snow fence or to plant a 'living fence' of pine trees or other shelterbelt-type of tree.

7) Ensure adequate water supply for health and safety

Objective 7: Determine ways to secure Alda's water supply during drought

- Action 7.1: Work with the Nebraska Department of Health and Human Services to secure revolving loan funding for supplementing Alda's water supply with an additional source.
- Action 7.2: Determine a method to have citizens from Alda voluntarily reduce demand for water during times of drought. This may involve instituting a moratorium on unnecessary water usage and implementing a fine/penalty system for those found in violation.

Goal: 3) Increase Public Education

There are no explicit objectives or actions for this goal; however, there is an implicit action related to this goal for above actions which will require public participation. Activities for this goal are found in the County portion of this document since the likely lead or assisting agency will be the Hall County Emergency Management Agency.

Implementation

To start implementation, determining which projects should be submitted for funding will be based on a FEMA-approved cost-benefit method. This means that proposed projects would need to be reviewed for cost effectiveness with the assistance of state emergency management or floodplain management personnel. Unless otherwise delegated, the Village Clerk will be the

person responsible for project administration of any project selected for implementation. FEMA has the authority to approve or deny mitigation projects applied for under their agency's mitigation programs.

Evaluation

In this plan, several potential mitigation projects are identified; however, it is not designed to have an all-inclusive list of projects. It is designed to be a living document which can be adapted to the landscape as conditions change. This means that this plan should be revised and updated as new projects are identified and prioritized and participating communities. There is a requirement to review and update this plan every five years. To do this, communities will follow the same procedure that Hall County will utilize in its mitigation plan updates, which is detailed starting on page 46 of the County portion of this report. There are also evaluation, update, and revision worksheets which have been included in this plan as **Appendix B** to assist with this process.

Figure 1
Alda Structural Inventory

Figure 2
Critical Facilities

Figure 3
Tornado Siren Distances

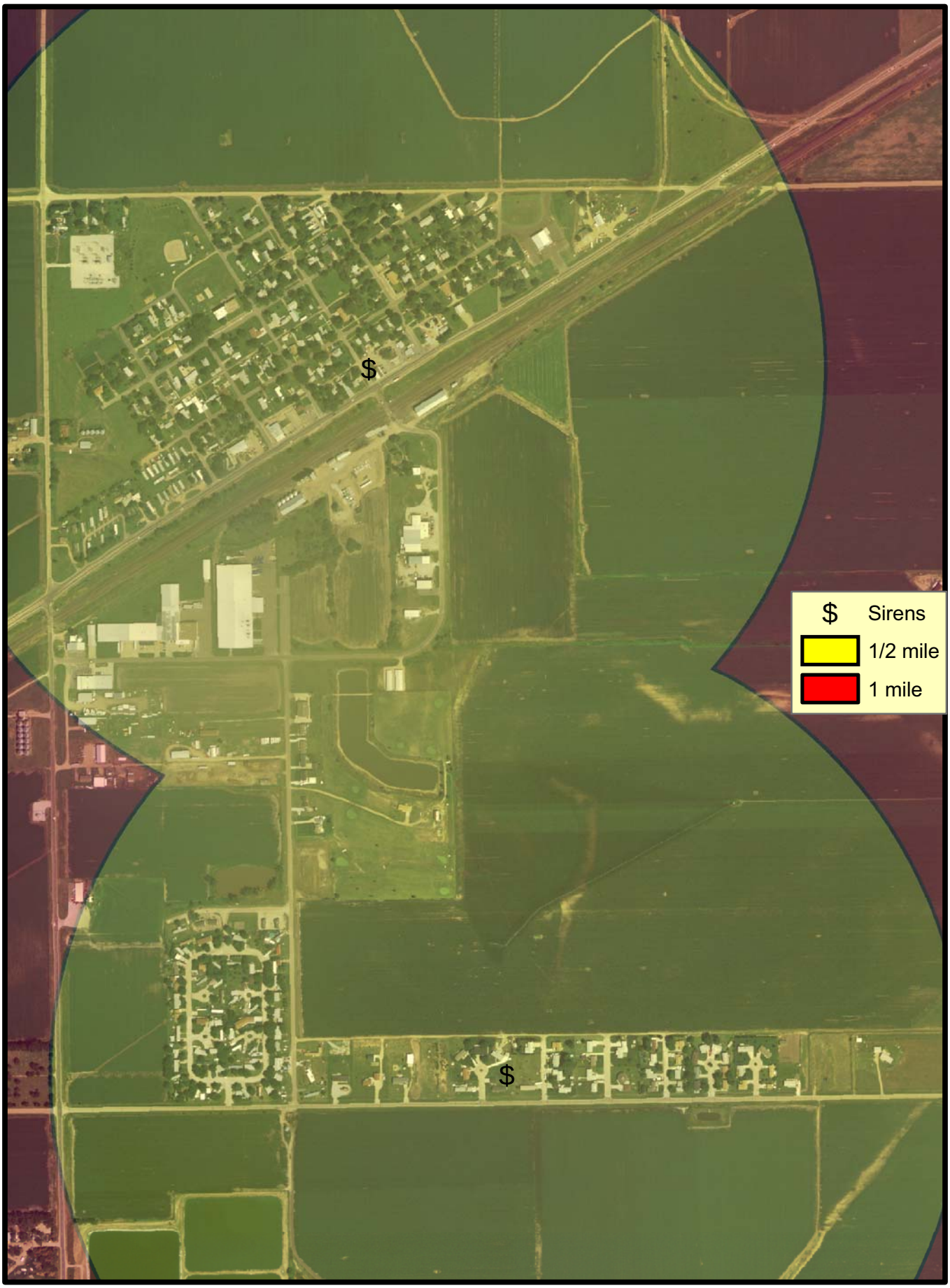


Figure 4
Alda Future Development

Cairo

	Dam Failure	Drought	Earth-quake	Flood	Levee Failure	Summer Storm	Land slide	Winter Storm	Tornado /Wind	Wildfire
Probability	None	High	None	Low	None	High	None	High	High	Low
Extent	Zero	Severe	Zero	Limited	Zero	Severe	Zero	Severe	Full	Limited
Previous Occurrence	No	Yes	No	Yes	No	Yes	No	Yes	Yes	No

Probability: Based on history, what is the likelihood this type of event will happen again?
- None, Low, Medium, or High

Extent – If this event were to happen, how extensive could the damage be?
- Zero, Limited, Severe, Full, or Unknown

Previous Occurrence: Is there an historic record of this type of hazard in the community?

The above table shows the input provided at the initial public meeting. Due to the geographical proximity, the following hazard types were not considered due to there being no likelihood of occurring in Nebraska: volcanic eruptions, avalanches, hurricanes, tidal surges, and tsunamis.

Although there is a small risk for earthquakes, wildfires, and landslides, the threat and associated risk for these hazards is not high enough and there are no realistic or feasible mitigation action which can be taken to reduce the level of risk. According to the database of dams maintained by the Nebraska Department of Natural Resources, there are no dams upstream of Cairo; therefore, dam failure is not considered further for Cairo. The National Climatic Data Center lists no records of wildfire for Hall County. Additionally, the citizens did not rank these hazards high enough to warrant detailed discussion in this plan. This may change in future updates.

Disaster History

Severe Weather

July 22, 1995: 1¾-inch hail caused $50,000 in property damage and $2.2 million in crop damage in and east of Cairo.

July 7, 1996: 92 mph (80 knots, as recorded) wind gusts in and around Cairo caused $40,000 in property damage and $1 million in crop damage.

June 15, 1997: 70 mph winds caused $30,000 in property damage and $150,000 crop damage in and around Cairo. The same event contained large hail (¾-inch), and propelled by the high winds caused $100,000 in property damage and $1 million in crop damage in, south, and west of Cairo.

June 20, 1997: 75 mph winds caused $40,000 in property damage in town, especially related to falling trees and limbs.

May 26, 2002: Very strong winds developed northwest of Grand Island and roared at nearly 80 mph through the Village of Cairo. Windows were blown out of several cars and roofs were blown off a couple of businesses. Property damage was placed at $150,000 with an additional $100,000 in surrounding crop damage.

June 19, 2002: 12 to 15 large trees were pushed over by winds of about 60 mph.

May 4, 2003: 2¾-inch hail blown by strong winds caused and estimate $200,000 in property damage in Cairo. Severe damage was noted at the golf course and to nearby houses and vehicles.

May 10, 2005: 1¾-inch hail propelled by wind gusts over 60 mph was reported north of Cairo. Baseball sized hail was reported near Centura High School. Property damage was estimated at $100,000.

Tornado

On June 11, 1997, severe thunderstorms developed in central Nebraska and moved south. These storms dropped hail up to the size of tennis balls and produced winds up to 80 mph. Damage to crops and property extended from near Ord to near Doniphan. Brief weak tornadoes were reported near Rockville and near Doniphan. A stronger F1 tornado set down near Cairo and moved southeast. A farmhouse was severely damaged. All told, property damage for these tornadoes was placed at $750,000 with an additional $100,000 in crop damage.

Flood

The Nebraska Department of Natural Resources maintains a record of historic flood events. The only flood record which lists Cairo occurred on June 25, 1968. In this event, the only available information is that Prairie Creek crested at 9.7 feet at Highway 2 east of Cairo. The current floodplain map for Cairo also shows the Village's only regulated floodplain for Dry Creek north of Highway 2 and north of Kansas Street.

As defined by FEMA's repetitive loss list, there are no repetitive flood loss properties in Cairo.

Drought

NCDC reports two drought events since 1950 for Hall County: in 2000 and 2002. Both of these droughts appear to have been agricultural droughts with the most impact to growing crops. Although Cairo is situated in an area which has been directly impacted by a drought, there are no indications that the Village has ever been materially impacted by a drought.

Likelihood of Future Hazard Events

It is certain that Cairo will continue to be impacted by severe weather – perhaps as often as each year. In these events, it should be expected to witness large hail, high winds, and intense rain in the summer, and large snowfalls, ice, and bitter windchills in the winter. Although it is certainly possible, it is less likely that Cairo will be impacted by a tornado. Given the lack of floodplain for the main population center of the town, flood damage is less likely; however, intense warm season rainfall events can cause stormwater-related problems due to the flat topography of the area.

Past Hazard Mitigation Efforts

The Village of Cairo participates and is in good standing in the National Flood Insurance Program (NFIP). The initial identification for Alda's floodplain map was completed on May 24, 1974. The Village became eligible for the Emergency Phase of the NFIP on July 24, 1975 and received its first map on December 12, 1975. The Village entered the Regular Phase of the NFIP on June 20, 1978 with the current effective floodplain map having the same date. Preliminary floodplain maps for all of Hall County were published on August 31, 2007. However, it is not

possible to tell when these maps will become effective. It appears as though the preliminary floodplain map does not change the floodplain from the current effective maps.

Vulnerability Assessment

According to an assessment completed by the Nebraska Department of Natural Resources in March of 2007, there are 375 total structures in Cairo. **Figure 1** shows the structures broken out by type, and the count is:

322 residences
30 businesses
14 (at least) out buildings large enough to be seen on aerial photographs
5 publicly-owned structures: the municipal building and school
4 church/non-profit building

According to the Nebraska Department of Property Assessment and Taxation, the total assessed taxable value for Cairo in 2007 was $31,747,159. Broken out by significant property types, this is:

Residential real property:	$ 26,000,522
Commercial real property:	$ 3,387,728
Railroad real and personal property:	$ 1,106,778
Public service corp. real and personal:	$ 685,442
Commercial personal property:	$ 536,005
Agricultural – all property types:	$ 30,684

The entire structure stock is vulnerable to the severe weather, tornado, and drought hazard. This means that, as of 2007, there is $24,047,503 in at-risk assets for these hazard types.

In the structural inventory completed by the Corps of Engineers, 13 properties were found to be located in a regulated floodplain in Cairo's extraterritorial zoning jurisdiction. NDNR's inventory in the corporate limits found five properties in a regulated floodplain. The valuation of the 13 floodplain properties found by the Corps of Engineers is $650,447, or 2.1% of the total valuation of Cairo and its zoning jurisdiction.

Figure 2 shows the floodplain of Dry Creek, as shown on the current effective floodplain maps. Using the structural inventory from Figure 1, it can be demonstrated that there are four out buildings and one business (Centura Hills Golf Course club house). Using an average valuation for the different structure types, it is estimated that the total assets vulnerable to flooding in Cairo is:

	Average Per structure	Number	Value	Approximate Damage Value
Commercial:	$ 113,000	1	$ 113,000	$ 29,380
Out buildings:	$ 30,000	4	$ 120,000	$ 124,800
TOTAL			**$ 220,000**	**$ 154,180**

For the out buildings estimate, an average value was determined based on the quality of structure and size. For the residential and apartment estimate, the City assessed value average per-structure was used. Commercial valuation is an approximation based on the size and quality of the structure. After the total at-risk value of the structures was determined, the estimated damage

value was determined by taking that value and multiplying it by 20%. Then a 30% damage to contents value was added to each figure. Both percentages are taken from the National Flood Insurance Program depth-damage curves for two-foot depth of flooding, which would be the maximum depth of flooding expected for most structures in the floodplain.

Figure 3 shows the critical facilities, as identified by the Village and supplemented with various federal databases. Critical facilities are those structures which will be essential for returning the Village functions to normal after a disaster ("Civic"), are vital for disaster response and sheltering ("Shelter"), and are essential for public health and safety ("Lifeline Utility"). Critical facilities can also be economic ("Financial") because the loss of a major employer or the loss of the Village's main source(s) of revenue will greatly hinder recovery. The critical facilities identified are:

Civic: Fire & Rescue/Village Hall building
Sheltering: Christ Lutheran Church, First Baptist Church, and United Methodist Church, old Cairo High School
Financial: Pump & Pantry, Pathway Bank
Lifeline Utility: water tower

Critical facilities in a floodplain: None

Figure 4 shows the potential ranges of the tornado warning sirens in Cairo, with the yellow shading being a half-mile from the siren and red one mile from the siren. As shown by the figure, the main town of Cairo is in the yellow shaded area. The development north of the golf course is approximately ¾ mile in a directly line from the siren. It must be recognized that these are outdoor warning sirens which are designed to alert residents who are outside and in close proximity to the sirens. They are not designed to warn persons indoors at-distance, traveling in vehicles, or in noisy environments. In addition, a warning system works best if there are operational redundancies – meaning that it is always safer to have additional sirens in a network in case a siren malfunctions or is destroyed. An additional consideration is that periods during which warning sirens are needed are often noisy in themselves with high wind, intense rain, and hail which all act to reduce peoples' ability to hear the sirens. It is easier to hear a warning for people who are downwind of the siren.

Figure 5 shows the areas of new development which is most likely to occur in the next five to ten years. The vulnerability of all development for severe winter storms, severe summer storms, and tornadoes is the same now and will be the same in the future. The only hazard which is able to be modified by human behavior or activity is flooding. Since the majority of Cairo is situated outside of a regulated floodplain, it is unlikely that new development will take place in a floodplain area. However, since Cairo is in good standing in the Regular Phase of the National Flood Insurance Program, future development which does take place in a regulated floodplain will be completed in compliance with the Village's floodplain management ordinance.

Mitigation Alternatives

Cairo's planning goals are the same as the goals for the county portion of the plan.

GOALS: 1) Reduce or prevent future damage from natural hazard events,
2) Increase public safety

To address these goals, mitigation alternatives were suggested in the public meeting and prioritized by the Cairo Village Board.

Prioritization
Cairo prioritized the mitigation alternatives according to the "STAPLE(E)" procedure (Social acceptability, Technical feasibility, Administrative capability of local government, Political acceptability, Legal authority to implement, Economic justification, and Environmental acceptability). In addition, alternatives were prioritized based on the community's goals and planning objectives.

At its discretion, Cairo may choose to not implement any of the proposed mitigation projects at this time with the realization that future events may change this stance as well as the prioritization of projects. Projects sponsored for implementation will follow a public process.

1) Maintain good standing in the National Flood Insurance Program
Objective 1: Continue to regulate development in floodplain areas and adopt the Hall County floodplain maps when they become effective.
Funding sources and potential cost: No funding needed, no cost.

2) Reduce impacts of stormwater problems
Objective 2: Complete a drainage study
- Action 2.1: Given the flat topography in the area, drainage will always be a problem – especially for intense warm weather rainfall events. A drainage study is needed in Alda to help the Village make wise land use decisions, to identify where existing drainage infrastructure is weak, and to identify ways to address these weaknesses. A drainage study has the potential to also identify good flood mitigation projects which could be funded using FEMA's mitigation programs.

Funding sources and potential cost: Central Platte NRD, Community Development Block Grant, Village – cost varies widely on scope and community size

3) Reduce damages caused by downed tree limbs
Objective 3: Reduce the duration or eliminate power outages from severe weather. Overhead power lines are vulnerable to collapse from icing in the cold weather months and from high winds or tree limbs falling on power lines in warm weather months.
- Action 3.1: Initiate a power line burying project.

Funding sources and potential cost: FEMA's Hazard Mitigation Grant Program or Pre-Disaster Mitigation Program could provide up to 75% of the project cost. The remaining cost might be shared with the Public Power District, Village, or property owners.
- Action 3.2: Write to the Nebraska Forest Service and request a tree inventory. An inventory is especially helpful in mitigation planning for communities which experience regular tree-related damages. An inventory can identify problem trees and recommend changes to the way a community administer a local tree management program (i.e., through

a Tree Board or Park Board). Problematic areas of tree limbs with power lines could be addressed as a priority.

Funding sources and potential cost: Free

- Action 3.3: The Village Board could create a regulation requiring underground utilities for all new development.

Funding sources and potential cost: No funding needed, no cost.

4) Ensure adequate severe weather notifications to critical facilities

Objective 4: Purchasing or education of a weather radio

- Action 4.1: For Village-owned critical facilities, the Village should consider purchasing a weather radio to be used in each facility for the rapid dissemination of a severe weather warning.
- Action 4.2: If the Village has noisy manufacturing facilities which may not hear tornado sirens, the Village could inform the owners of these facilities of the option that they could purchase a weather radio.

Funding sources and potential cost: Village of Cairo, local businesses. Approximate cost about $30 per radio.

Goal: 3) Increase Public Education

There are no explicit objectives or actions for this goal; however, there is an implicit action related to this goal for above actions which will require public participation. Activities for this goal are found in the County portion of this document since the likely lead or assisting agency will be the Hall County Emergency Management Agency.

Implementation

To start implementation, determining which projects should be submitted for funding will be based on a FEMA-approved cost-benefit method. This means that proposed projects would need to be reviewed for cost effectiveness with the assistance of state emergency management or floodplain management personnel. Unless otherwise delegated, the Village Clerk will be the person responsible for project administration of any project selected for implementation. FEMA has the authority to approve or deny mitigation projects applied for under their agency's mitigation programs.

Evaluation

In this plan, several potential mitigation projects are identified; however, it is not designed to have an all-inclusive list of projects. It is designed to be a living document which can be adapted to the landscape as conditions change. This means that this plan should be revised and updated as new projects are identified and prioritized and participating communities. There is a requirement to review and update this plan every five years. To do this, communities will follow the same procedure that Hall County will utilize in its mitigation plan updates, which is detailed starting on page 46 of the County portion of this report. There are also evaluation, update, and revision worksheets which have been included in this plan as **Appendix B** to assist with this process.

Figure 1
Cairo Structural Inventory

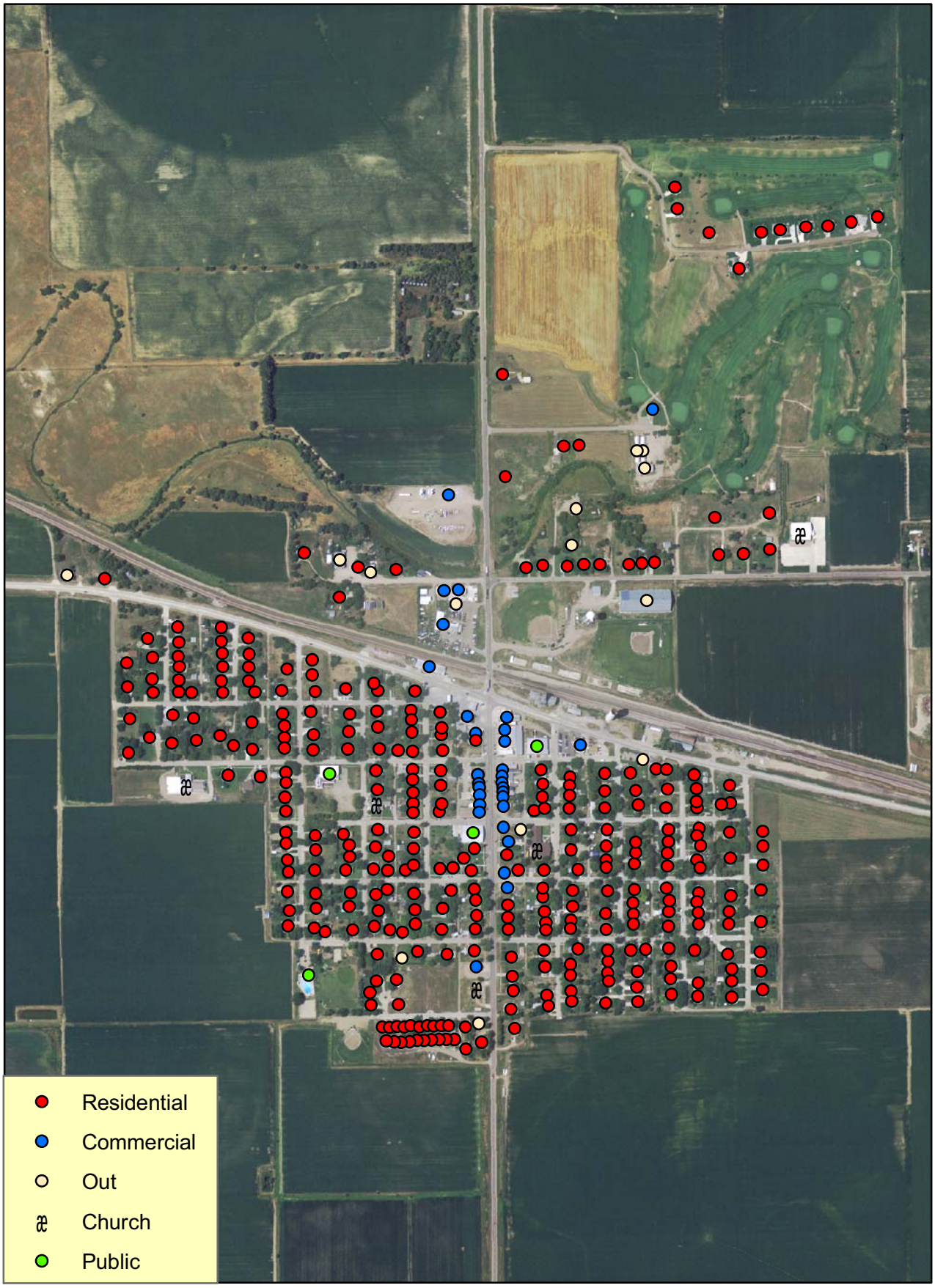


Figure 2
Floodplain Structure Inventory

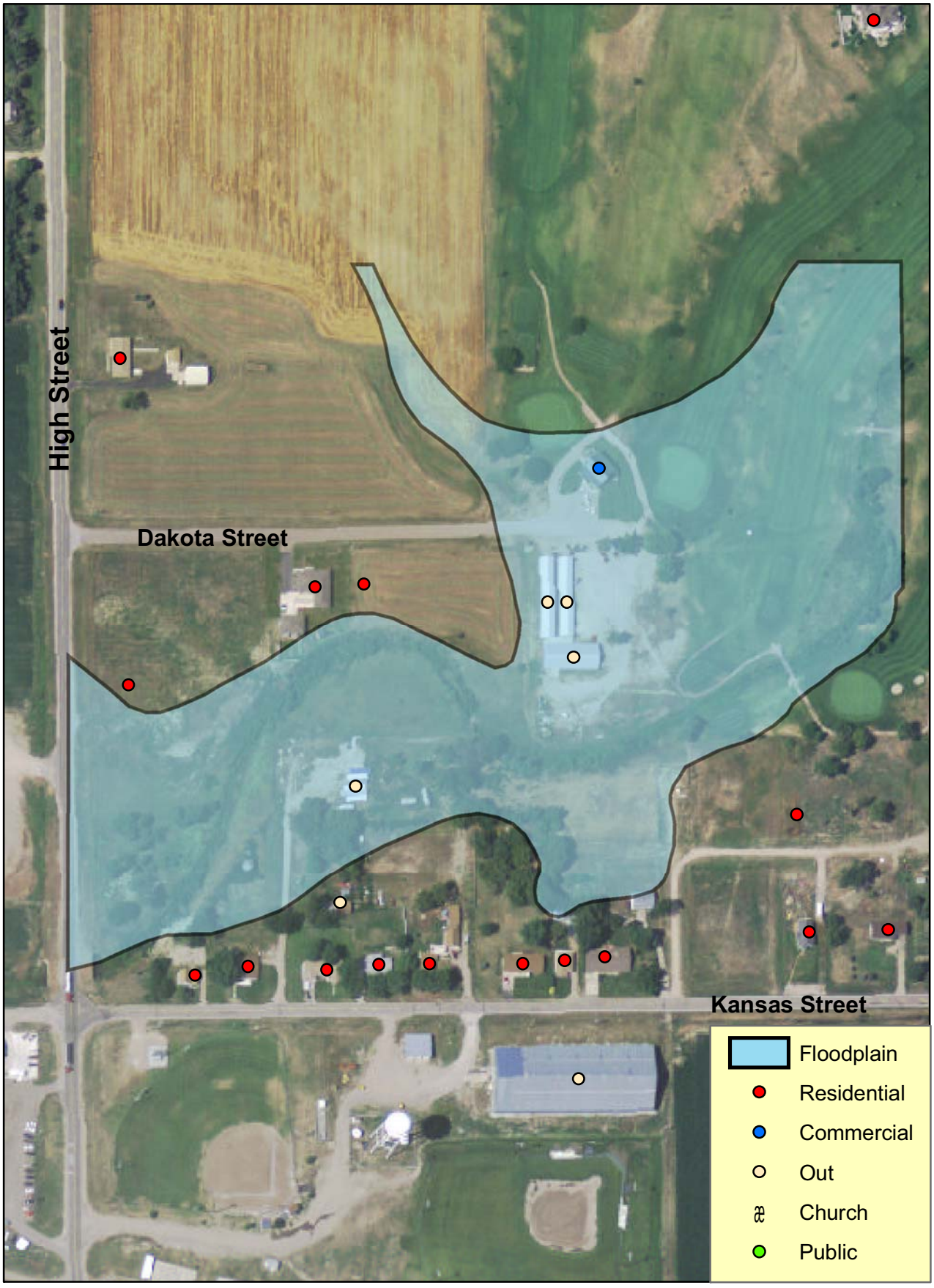


Figure 3
Cairo Critical Facilities

Figure 4
Tornado Siren Distances

Figure 5
Future Development Areas

Doniphan

	Dam Failure	Drought	Earth-quake	Flood	Levee Failure	Summer Storm	Land slide	Winter Storm	Tornado /Wind	Wildfire
Probability	None	High	None	Low	None	High	None	High	High	Low
Extent	Zero	Severe	Zero	Limited	Zero	Severe	Zero	Severe	Full	Limited
Previous Occurrence	No	Yes	No	Yes	No	Yes	No	Yes	Yes	No

Probability: Based on history, what is the likelihood this type of event will happen again?
- None, Low, Medium, or High

Extent – If this event were to happen, how extensive could the damage be?
- Zero, Limited, Severe, Full, or Unknown

Previous Occurrence: Is there an historic record of this type of hazard in the community?

The above table shows the input provided at the initial public meeting. Due to the geographical proximity, the following hazard types were not considered due to there being no likelihood of occurring in Nebraska: volcanic eruptions, avalanches, hurricanes, tidal surges, and tsunamis.

In the following sections, only the hazard types which have a significant likelihood of occurring or have a reason to potentially occur are listed. These types are: severe weather (summer and winter), tornado, flood, and drought. Doniphan is situated at the drainage divide for the Platte River and Blue River systems; therefore, there are no upstream dams which could fail and impact the Village. Although there is a small risk for earthquakes, wildfires, and landslides, the threat and associated risk for these hazards is not high enough and there are no realistic or feasible mitigation action which can be taken to reduce the level of risk. The National Climatic Data Center lists no records of wildfire for Hall County. Additionally, the citizens did not rank these hazards high enough to warrant detailed discussion in this plan. This may change in future updates.

Disaster History

Flood

There is no floodplain in Doniphan given its location on a drainage divide between major Nebraska river systems. The only concerns for flooding would be from stormwater problems caused by intense rain events.

As defined by FEMA's repetitive loss list, there are no repetitive flood loss properties in Doniphan.

Severe Weather

May 16, 1996: Winds of 55 mph caused $1000 in undisclosed property damage.
June 21, 1996: Hail of ¾ inch diameter caused $5000 in property damage in Doniphan.
August 17, 1999: Severe thunderstorms packing high winds and some hail ripped across Hall County. Most of the region received 2-3 inches of rain in less than one hour. Intense

straight-line winds over 65 mph damaged homes five miles west of Doniphan, tossing grain bins and out buildings like toys.

May 7, 2000: Walnut sized hail (1½ inch) fell near Doniphan.

May 5, 2002: Severe thunderstorms produced large hail of up to 2¾ inch diameter, causing significant and widespread damage from Doniphan to east of Grand Island. Dozens of roofs and windows were heavily damaged just west of Doniphan as tennis ball sized hail lasted ten minutes. Total property damage from this event was estimated at $1 million.

March 30, 2006: Walnut sized hail blown by 75 mph wind gusts was reported northeast of Doniphan.

April 6, 2006: Hail of up to 1 inch diameter was blown by 65 mph winds northeast of Doniphan

May 23, 2006: 1-inch hail fell in Doniphan, and the same storm brought 80 mph winds

December 30, 2006: The "New Years Ice Storm" left thousands without power. As a result of this event, the Village hooked up a generator to the Village's Maintenance Shop and offered people without electricity a place to congregate, stay warm, and eat.

Tornado

No tornadoes have been found to have directly-impacted Doniphan; however, tornadoes are common in Hall County, and they have been seen near Doniphan.

June 11, 1997: An outbreak of weak F0 tornadoes in Hall County caused $50,000 in crop damage from Ord to near Doniphan. The closest one to Doniphan was 4 miles north of town.

October 29, 2000: A funnel cloud spotted one mile north of Doniphan was a part of a system which spawned an F3 tornado that destroyed farmsteads in Merrick and Nance County.

Drought

NCDC reports two drought events since 1950 for Hall County: in 2000 and 2002. Both of these droughts appear to have been agricultural droughts with the most impact to growing crops. Although Doniphan is situated in an area which has been directly impacted by a drought, there are no indications that the Village has ever been materially impacted by a drought.

Likelihood of Future Hazard Events

It is certain that Doniphan will be impacted by severe weather – perhaps as often as each year. In these events, it should be expected to witness large hail, high winds, and intense rain in the summer, and large snowfalls, ice, and bitter windchills in the winter. Although it is certainly possible, it is less likely that Doniphan will be directly impacted by a tornado.

Past Hazard Mitigation Efforts

The Village of Doniphan participates and is in good standing in the National Flood Insurance Program (NFIP). The initial floodplain map for Doniphan went effective on January 24, 1975 and the Village joined the Emergency Phase of the NFIP on January 14, 1976. Participation in the Regular Phase of the NFIP occurred on August 8, 1978. Doniphan's floodplain map was rescinded on August 4, 1987, which means that it was later determined that the low level of flood risk did warrant the administrative cost to maintain the maps by the Federal Emergency Management Agency. This means that there is currently no effective floodplain map; however, the old map can be used to show the most likely areas of flooding. Despite the rescinded floodplain map, Doniphan continues to participate as is in good standing in the National Flood Insurance Program. Preliminary floodplain maps for all of Hall County were published on

August 31, 2007. These maps show an area of floodplain which enters town from the southwest at Pine Street and Highway 281, then turns north to flow just west of 6th Street, then north between the Caterpillar plant and the residential development before continuing north to the Platte River. It is not possible to tell when the preliminary Hall County maps will become effective.

Doniphan has also been a Tree City USA community since 1995.

Vulnerability Assessment

According to an assessment completed by the Nebraska Department of Natural Resources in March of 2007, there are 348 total structures in Doniphan. **Figure 1** shows the structures broken out by type, and the count is:

294 residences
34 businesses
9 (at least) out buildings large enough to be seen on aerial photographs
8 publicly-owned structures, including the municipal building, school, library
3 church or non-profit buildings

According to the Nebraska Department of Property Assessment and Taxation, the total assessed taxable value for Doniphan in 2007 was $29,803,701. Broken out by significant property types, this is:

Residential real property:	$ 21,027,264
Commercial/Industrial real property:	$ 7,634,971
Public Service Co. total property:	$ 650,205
Comm/Ind. Personal property:	$ 384,236
Agricultural – all property types:	$ 107,025

The entire structure stock is vulnerable to the severe weather, tornado, and drought hazard. This means that, as of 2007, there is $29,803,701 in at-risk assets for these hazard types.

In the structural inventory completed by the Corps of Engineers, zero properties were found to be located in a regulated floodplain in Doniphan's extraterritorial zoning jurisdiction. NDNR's inventory in the corporate limits found no properties in a regulated floodplain.

Figure 2 shows the critical facilities, as identified by the Village and supplemented with various federal databases. Critical facilities are those structures which will be essential for returning the Village functions to normal after a disaster ("Civic"), are vital for disaster response and sheltering ("Shelter"), and are essential for public health and safety ("Lifeline Utility"). Critical facilities can also be economic ("Financial") because the loss of a major employer or the loss of the Village's main source(s) of revenue will greatly hinder recovery. The critical facilities identified are:

Civic: Fire & Rescue, Village Hall building, Village Maintenance Shop
Sheltering: Doniphan-Trumbull Public School, St. Ann's Catholic Church, United Methodist Church, St. Paul Lutheran Church
Financial: Prairie Winds Assisted Living Center, Nebraska Machinery
Lifeline Utility: water tower

Figure 3 shows the potential ranges of the tornado warning sirens in Doniphan, with the yellow shading being a half-mile from each siren and red one mile from each siren. As shown by the figure, the majority of current development within the Doniphan corporate limits is in the yellow shaded area. It must be recognized, however, that these are outdoor warning sirens which are designed to alert residents who are outside and in close proximity to the sirens. They are not designed to warn persons indoors at-distance, traveling in vehicles, or in noisy environments. In addition, a warning system works best if there are operational redundancies – meaning that it is always safer to have additional sirens in a network in case a siren malfunctions or is destroyed. An additional consideration is that periods during which warning sirens are needed are often noisy in themselves with high wind, intense rain, and hail which all act to reduce peoples' ability to hear the sirens. It is easier to hear a warning for people who are downwind of the siren.

Figure 4 shows the areas of new development which is most likely to occur in the next five to ten years. New residential development is already taking place in the blue highlighted area with road and sewer infrastructure in place. The two commercial areas in red are 80 acres (north) and 70 acres (west). The vulnerability of all development – existing or future – is the same now and will be the same in the future for severe winter storms, severe summer storms, and tornadoes. The only hazard which is able to be modified by human behavior or activity is flooding. However, since there is very little developable area in or near Doniphan which is in a floodplain and since Doniphan is in good standing in the Regular Phase of the National Flood Insurance Program, any future floodplain development will be completed in compliance with the Village's floodplain management ordinance.

Mitigation Alternatives

Doniphan's planning goals are the same as the goals for the county portion of the plan.

GOALS: 1) Reduce or prevent future damage from natural hazard events,
2) Increase public safety

To address these goals, mitigation alternatives were suggested in the public meeting and prioritized by the Doniphan Village Board.

Prioritization
Doniphan prioritized the mitigation alternatives according to the "STAPLE(E)" procedure (Social acceptability, Technical feasibility, Administrative capability of local government, Political acceptability, Legal authority to implement, Economic justification, and Environmental acceptability). In addition, alternatives were prioritized based on the community's goals and planning objectives.

At its discretion, Doniphan officials may choose to not implement any of the proposed mitigation projects at this time with the realization that future events may change this stance as well as the prioritization of projects. Projects sponsored for implementation will follow a public process.

1) Maintain good standing in the National Flood Insurance Program
   Objective 1: Continue to regulate development in floodplain areas and adopt the Hall County floodplain maps when they become effective.
   Funding sources and potential cost: No funding needed, no cost.

2) Identify and designate additional tornado shelters, publicize the locations of all public tornado shelters to increase public awareness – perhaps with a sign on the building.
   Objective 2: Provide emergency shelter(s) to which students or local residents would evacuate in the event of a tornado warning, especially those who live in vulnerable housing
   - Action 2.1: Create public shelters by retrofitting or new construction. FEMA has retrofitted schools and constructed all-new shelters in several places in the Midwest. However, most tornadoes occur in late-afternoon to early evening when a school might be closed for the day. Furthermore, it has been reported that public tornado shelters that are left open to the public are not used properly, with vandalism and use by vagrants as problems. At-risk structure types include mobile homes and slab-on-grade construction which has no basement.
   - Action 2.2: Consider constructing tornado shelters for vulnerable construction like manufactured home concentrations.

   Funding sources and potential cost: FEMA's Pre-Disaster Mitigation program or Hazard Mitigation Grant Program for construction only– cost varies widely based on scope and design

3) Reduce damages caused by downed tree limbs
   Objective 3: Reduce the duration or eliminate power outages from severe weather. Overhead power lines are vulnerable to collapse from icing in the cold weather months and from high winds or tree limbs falling on power lines in warm weather months.
   - Action 3.1: Initiate a power line burying project.

   Funding sources and potential cost: FEMA's Hazard Mitigation Grant Program or Pre-Disaster Mitigation Program could provide up to 75% of the project cost. The remaining cost might be shared with the Public Power District, City, or property owners.
   - Action 3.2: Write to the Nebraska Forest Service and request a tree inventory. An inventory is especially helpful in mitigation planning for communities which experience regular tree-related damages. An inventory can identify problem trees and recommend changes to the way a community administer a local tree management program (i.e., through a Tree Board or Park Board). Problematic areas of tree limbs with power lines could be addressed as a priority.

   Funding sources and potential cost: Free

4) Ensure adequate severe weather notifications to critical facilities
   Objective 4: Purchasing or education of a weather radio
   - Action 4.1: For public critical facilities, the Village should consider purchasing a weather radio to be used in each facility for the rapid dissemination of a severe weather warning.
   - Action 4.2: If the Village has noisy manufacturing facilities which may not hear tornado sirens, the Village could inform the owners of these facilities of the option that they could purchase a weather radio.

Funding sources and potential cost: Village of Doniphan, local businesses. Approximate cost about $30 per radio.

Goal: 3) Increase Public Education

There are no explicit objectives or actions for this goal; however, there is an implicit action related to this goal for above actions which will require public participation. Activities for this goal are found in the County portion of this document since the likely lead or assisting agency will be the Hall County Emergency Management Agency.

Implementation
To start implementation, determining which projects should be submitted for funding will be based on a FEMA-approved cost-benefit method. This means that proposed projects would need to be reviewed for cost effectiveness with the assistance of state emergency management or floodplain management personnel. Unless otherwise delegated, the Village Clerk will be the person responsible for project administration of any project selected for implementation. FEMA has the authority to approve or deny mitigation projects applied for under their agency's mitigation programs.

Evaluation
In this plan, several potential mitigation projects are identified; however, it is not designed to have an all-inclusive list of projects. It is designed to be a living document which can be adapted to the landscape as conditions change. This means that this plan should be revised and updated as new projects are identified and prioritized and participating communities. There is a requirement to review and update this plan every five years. To do this, communities will follow the same procedure that Hall County will utilize in its mitigation plan updates, which is detailed starting on page 46 of the County portion of this report. There are also evaluation, update, and revision worksheets which have been included in this plan as **Appendix B** to assist with this process.

Figure 1
Doniphan Structural Inventory

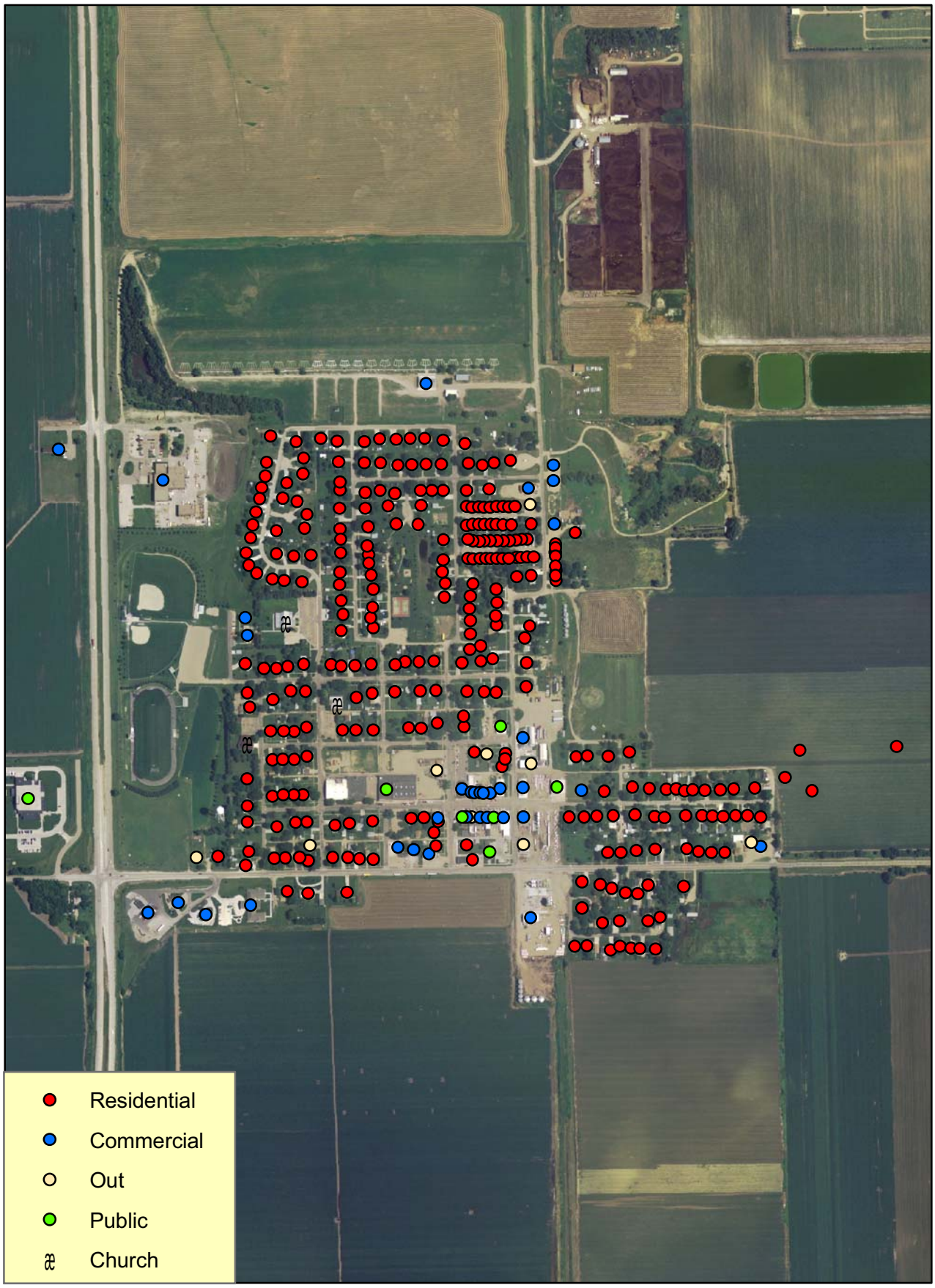
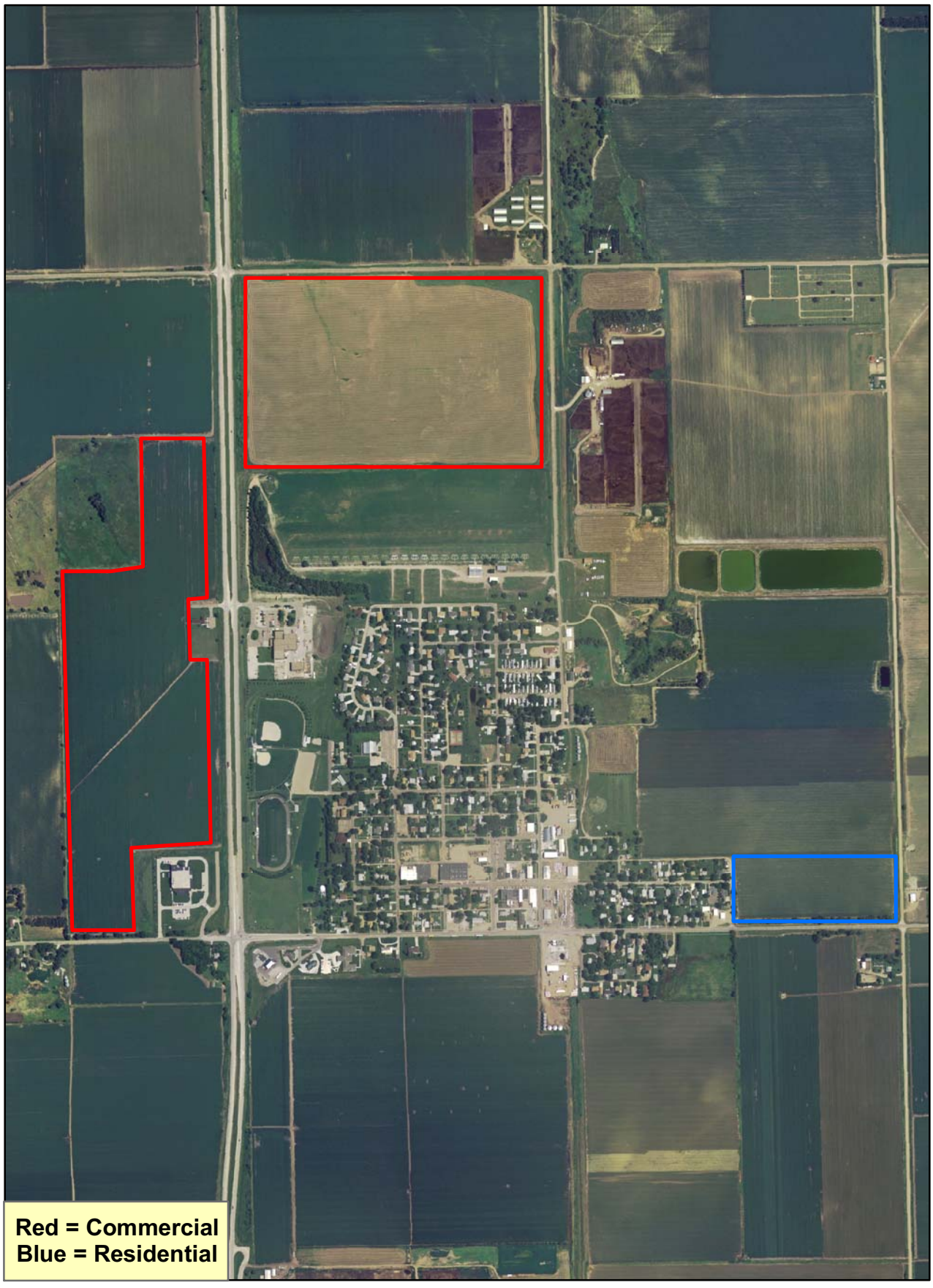


Figure 2
Doniphan Critical Facilities

Figure 3
Tornado Siren Distances

Figure 4
Doniphan Future Development Areas



Grand Island

	Dam Failure	Drought	Earth-quake	Flood	Levee Failure	Summer Storm	Land slide	Winter Storm	Tornado /Wind	Wildfire
Probability	Low	Medium	None	High	Low	High	None	High	High	Low
Extent	Limited	Limited	Unknown	Severe	Limited	Severe	Zero	Severe	Severe	Limited
Previous Occurrence	No	Yes	No	Yes	No	Yes	No	Yes	Yes	No

Probability: Based on history, what is the likelihood this type of event will happen again?
- None, Low, Medium, or High

Extent – If this event were to happen, how extensive could the damage be?
- Zero, Limited, Severe, Full, or Unknown

Previous Occurrence: Is there an historic record of this type of hazard in the community?

The above table shows the input provided at the initial public meeting. Due to the geographical proximity, the following hazard types were not considered due to there being no likelihood of occurring in Nebraska: volcanic eruptions, avalanches, hurricanes, tidal surges, and tsunamis.

In the following sections, only the hazard types which have a significant likelihood of occurring or have a reason to potentially occur are listed. These types are: severe weather (summer and winter), tornado, flood, and drought. Although there is a small risk for earthquakes, wildfires, and landslides, the threat and associated risk for these hazards is not high enough and there are no realistic or feasible mitigation action which can be taken to reduce the level of risk. The National Climatic Data Center lists no records of wildfire for Hall County. Additionally, the citizens did not rank these hazards high enough to warrant detailed discussion in this plan. This may change in future updates.

Disaster History

Flood

On June 20, 1947, Wood River came up and flooded Stolley State Park. Water was over Highway 2 for one mile. Damage was estimated at $5,000.

On June 10, 1949, $219,000 was caused by Wood River flooding. Woodland and Riverside golf courses recorded significant damage.

The most extensive flood event to impact Hall County, resulting from a long period of excessive rainfall in May and June of 1967. From June 7 to 15, more than 10 inches fell, but the main culprit for the flooding was the 3.2 inches which fell on June 13th. The Wood River crested at six feet (3.5 foot flood stage) and was flowing at 25,000 cubic feet per second. Three people were killed, 1800 buildings were flooded, and 11,000 of the City's 28,600 residents were directly impacted. Prairie Creek, Silver Creek, and Moores Creek flooded 62 residences and 7 businesses on the north side of the City. Total damage in Grand Island was set at $6.25 million ($38.2 million in 2006 dollars). This flood event was a part of the larger Platte River valley

flood, which saw total damage at $49,309,015 – of which $40.8 million was private damage ($23 million agricultural damage, $12 million transportation damage, and $5 million classified as "urban" damage), and $8.5 million was public damage.

On May 11 and 12, 2005, 7.21 inches of rain fell in a 24-hour period with 7.16 inches of the total falling from 4pm on the 11th to 4am on the 12th. These rainfall totals eclipsed the previous 25-hour rainfall record of 5.88 inches and the previous 12-hour rainfall record of 5.65 inches. Officials from the High Plains Regional Climate Center claimed that this intense rain event was equal to a 100-year storm. An incredible 6.38 inches of rain fell in the six-hour period from 7pm to 1 am. Thirty-six homes were evacuated in Grand Island as flooding was rampant over the west and north part of the city. The city's sewer system handled about 75 million gallons of water, or about 6 times the normal amount during the storm. Many parts of the business and residential districts sustained flood damage as the Prairie, Silver, and Moores Creeks flooded. On the southern end of town, the newly-completed Wood River Diversion project prevented the vast majority of the damage. Without the project, it was estimated that the extent of the 2005 flood would have equaled the 1967 flood.

On July 10, 2006, afternoon and evening thunderstorms produced heavy rains, which caused urban flooding. Property damage was estimated at $20,000.

On July 29, 2007, thunderstorms 5.07 inches of rain on Grand Island. This caused flooding in the northwest part of Grand Island with total property damage set at $75,000.

On August 22, 2007, flooding on the south side of town washed a car off the road into a ditch. In addition to the heavy rain, 80 mph wind gusts, hail, and brief small tornadoes occurred in south central Nebraska. Damage estimate for Grand Island was placed at $50,000.

As defined by FEMA's repetitive loss list, there is one repetitive flood loss property with a Grand Island address.

Severe Weather

There have been so many instances of severe weather events impacting Grand Island that only the ones with significant damage or unusual weather phenomena are listed below.

August 5, 1995: 80 mph winds caused $100,000 in undisclosed property damage. Hail of 2 inches in diameter also caused more than $1.5 million in property damage.

June 20, 1997: A thunderstorm developed north of Kearney and moved east through Grand Island. Strong winds, over 75 mph, caused property damage in the area set at $40,000.

July 7, 1997: 1-inch hail along with very heavy rain and high winds caused $150,000 in damage.

August 21, 1997: 1-inch hail broke windows and damage numerous cars. Damage: $100,000.

August 15, 1999: Severe thunderstorms early in the evening left a narrow path of wind damage from south of Kearney to the Grand Island area. Wind gusts of 60 to 80 mph damaged buildings, trees and downed several power lines. In Grand Island, a couple of garages were damaged, trees uprooted and about 5,000 people were left without electricity for a short time. Total property damage was estimated at $50,000.

April 22, 2001: a microburst near the mall in Grand Island damaged several trees, signs and knocked over one light post. Damage was estimated at $10,000.

May 5, 2002: 3-inch hail devastated an area from Doniphan to east of Grand Island. Total property damage was established as $2 million; however, it is unclear how much of that damage occurred in Grand Island.
June 19, 2002: 70 mph winds tore the roof off the gymnasium at the R-1 school five miles north of Grand Island. Damage estimate: $16,000.
May 4, 2003: Golf ball sized hail in Grand Island caused $250,000 in property damage.
May 13, 2003: Severe thunderstorms formed northwest of Grand Island during the afternoon and evening hours. A sign was destroyed, minor tree damage was reported, and some small sheds were damaged. Damage estimate: $100,000.
April 18, 2004: 60 mph winds broke a light pole at an auto dealership and damaged four vehicles as it fell to the ground. Damage to the vehicles along was estimated at $14,000.
May 16, 2004: 70 mph winds caused $30,000 to trees and power infrastructure.
May 21, 2004: Golf ball sized hail in Grand Island caused $25,000 damage.
May 10, 2005: 70 mph winds near the airport destroyed a construction trailer. Minor damage was reported southeast of town. Damage: $25,000. 1¾ inch hail caused an additional $100,000 in property damage.
May 11/12, 2005: In addition to the intense rain and flooding, the severe storms also brought large hail driven by high winds. Officials estimated that 2800 homes and businesses had damage in Grand Island.
June 15, 2006: There were numerous reports of trees down blocking roads and knocking out power. Some of the trees fell on homes. Damage: $20,000.
June 24, 2006: Penny to golf ball sized hail fell in and around Grand Island, causing $30,000 in property damage.

Tornado

Grand Island has the unfortunate distinction of having been hit with one of Nebraska's worst tornado outbreaks. The outbreak took place on June 3, 1980, and the twisters devastated entire sections of Grand Island – especially the City's northwest and north central residential areas, as well as the southern business district. Depending on the accounts, between 5 and 15 tornadoes between 7:45pm on the 3rd to 1:30am on the 4th. The National Climatic Data Center reports 13 tornadoes with four of them rated as F1, three as F2, three as F3, and three as F4. The tornadoes killed five people, injured more than 400, and caused $300 million in damage. The destruction covered more than 150 city blocks, including losses to 357 homes, 33 mobile homes, 85 apartments, and 49 businesses. This event has been turned into book and a television movie (*"Night of the Twisters"*), and was studied by a special team of research scientists, including Professor T. Theodore Fujita himself. This tornado outbreak captivated scientists because the storm included both cyclonic and anticyclonic tornadoes.

On August 5, 1995, an F0 tornado came within five miles west of Grand Island.

On August 4, 1996, a severe thunderstorm produced a brief tornado touchdown southwest of Grand Island. Funnel clouds were also observed just south and east of town.

On May 13, 2003, funnel clouds were reported in the Grand Island area, but no tornado was confirmed.

Drought
NCDC reports two drought events since 1950 for Hall County: in 2000 and 2002. Both of these droughts appear to have been agricultural droughts with the most impact to growing crops. Although Grand Island is situated in an area which has been directly impacted by a drought, there are no indications that the City has ever been materially impacted by a drought.

Likelihood of Future Hazard Events
It is certain that Grand Island will be impacted by severe weather – perhaps as often as each year. In these events, it should be expected to witness large hail, high winds, and intense rain in the summer, and large snowfalls, ice, and bitter windchills in the winter. Although it is certainly possible, it is less likely that Grand Island will be directly impacted by a tornado.

Past Hazard Mitigation Efforts

National Flood Insurance Program
The City of Grand Island participates and is in good standing in the National Flood Insurance Program (NFIP). The initial identification for the floodplain map for Grand Island was completed on April 5, 1974 and the City became eligible for the Emergency Phase of the NFIP on March 14, 1975. Flood Hazard Boundary Map revisions were incorporated onto the map dated September 3, 1976. The boundary map was converted to a Flood Insurance Rate Map on March 2, 1983, which was also the date that Grand Island became eligible for the Regular Phase of the NFIIP. New preliminary Hall County countywide floodplain maps were published on August 31, 2007. It is not possible to tell when the preliminary Hall County maps will become effective.

Wood River Diversion
The Wood River Flood Control Project was dedicated in spring of 2004. The 300-foot wide diversion channel diverts excess water from the Wood River and Warm Slough to the east and into the Platte River. This project provides flood control protection for 1500 homes and businesses. The project was tested by the May 11 and 12, 2005, flood event, when 7.21 inches of rain fell in a 24-hour period. From a hydrological standpoint, this event would have resulted in a flood similar to the devastating 1967 flood; however, the Project functioned as designed, and flood damages were minimal for the protected area. The Central Platte Natural Resources District estimated that the $17 million project paid for itself in this event, less than one year after dedication. The project was sponsored by CPNRD and was funded 42.5% by CPNRD, 35% by City of Grand Island, 11.25% Hall County, and 11.25% Merrick County. The project was constructed by the US Army Corps of Engineers, and the Natural Resources Development Fund (administered by the Nebraska Department of Natural Resources) provided the 60% of the non-federal share of the planning.

Prairie/Silver/Moores Creek Flood Control Project
In May of 2000, the CPNRD and City of Grand Island contracted out to perform a detailed hydrologic analysis of northern and western Grand Island. The analysis also included an evaluation of options for reducing flood damages and to present a preferred alternative. An engineering firm was selected in September of 2005 to provide engineering services for the

design and oversight of the flood control project. The flood control project is designed in three phases, expecting to be completed in 2015. Construction of Phase 1 began in January of 2007.

The phases are:

Phase 1 – Silver Creek Low Land Stormwater Detention Cells

The first phase of the project is the construction of four large floodwater detention cells along the Silver Creek channel with a total excavation near 4.5 million cubic yards of earth. The cell design includes the lowering and re-grading of Silver Creek for more then two miles. The detention cells will detain stormwater runoff in excess of the 2-year storm. A 3' x 3' concrete box culvert will be used as the outlet and will release the water from the cells at a rate equal to the 2-year storm. A second 3' x 6' gated box culvert will be used for rapid draw down of the cells. A berm is being placed around the cells, approximately 2 foot above existing ground, to provide sufficient capacity to detain runoff from the 100-year storm with a 1-foot freeboard.

Phase 2 – Basin Divide and Silver/Moores Creek Diversion Channel

A diversion channel that will connect Silver Creek to Moores Creek and a levee that will prevent flood water from flowing from one basin the adjacent basin. The stormwater released from the cells when combined with runoff excess, flows from the Prairie Creek and will cause flooding within the city of Grand Island. This levee will be designed to meet the requirements set forth by FEMA. A diversion channel will be constructed to divert water from Silver Creek to the Moores Creek floodway.

Phase 3 – Upland Dams and Prairie/Silver Creek Channel

A series of upland detention dams and an overflow channel from Prairie Creek to Silver Creek. The exact locations of the detention sites will be finalized in the final design phase of this project. Several sites are available and will be evaluated after geological investigations have been completed. The channel between Prairie and Silver Creek will serve to carry excess flows from Prairie Creek to Silver Creek.

Floodplain Buyouts

The City of Grand Island has acquired and demolished two floodprone properties near the Platte Generating Station.

Prairie Creek Clearing

Although the Prairie Creek Flood Control Project had a local effect, damages could be reduced on Prairie Creek by keeping the channel clear. Projects have been completed from the mouth of Prairie Creek in Merrick County to the Hall-Buffalo county line. Annual maintenance cost to CPNRD is $10,000.

Moores Creek Flood Control Project

Project sponsors of the feasibility study for the flood control on Moores Creek include CPNRD, the City of Grand Island, Merrick County and Hall County. The three-phase project consisted of channel improvements, construction of three detention/retention and wildlife habitat enhancement cells, and construction of waterways and bridges to enable storm runoff. Annual maintenance cost is estimated at $20,000.

Emergency Snow Route

Grand Island has instituted emergency snow routes, which allows the City to remove the snow more quickly and efficiently following a significant snow event. This improves public safety since access to medical care is often needed more frequently as a result of the snowfall. The snow removal plan and maps are available in the local telephone book and online at the City's website.

Tree City USA

Grand Island has been a Tree City USA community since 1987. Being a Tree City USA allows a community to reduce its exposure to falling trees and limbs from high wind, tornado, and ice events. Grand Island also offers a cost sharing program for homeowners who purchase the best types of trees for their boulevard areas and yards.

Vulnerability Assessment

According to the Nebraska Department of Property Assessment and Taxation, the total assessed taxable value for Grand Island in 2007 was $2,215,715,709. Broken out by significant property types, this is:

Residential real property:	$ 1,326,296,441
Commercial real property:	$ 665,277,967
Comm/Ind. personal property:	$ 109,442,265
Industrial real property:	$ 49,777,940
Public service co. total property:	$ 42,670,242
Railroad total personal property:	$ 17,705,107
Agricultural total property:	$ 4,545,747

The entire structure stock is vulnerable to the severe weather, tornado, and drought hazard. This means that, as of 2007 there is $2,215,715,709 in at-risk assets for these hazard types.

For the flood assessment, a software program called HAZUS-MH® was used. HAZUS-MH stands for "Hazards U.S. – Multi-Hazard", and uses default census information to estimate the amount of damage from a flood. In so doing, it generates a basic estimation of the number of structures in the study area and the amount of potential damage. The printout result of the flood model is included at the end of the Grand Island report. There are important disclaimers for using this information as it is generated by computer using data that is not improved from the basic census information – these concerns are outlined below after the flood model summary.

As shown in the report, HAZUS calculates:

Number of Buildings in Grand Island:	20,396
Residential Buildings	18,808
Non-Residential Buildings	1,588

General Building Stock Damage

HAZUS estimates that about 140 buildings will be at least moderately damaged by a flood of a magnitude which inundates the modeled floodplain – this is 6.8% of the total number of buildings in the case study. Of the 140 buildings, 13 will be completely destroyed. More detailed damage figures by occupancy and by building type are given in Table 3 and Table 4 in the HAZUS report at the end of the Grand Island section.

Essential facility damage

HAZUS estimates that there are five fire stations, two hospitals, two police stations, and 25 schools in the study region. Of these 34 essential facilities, four schools are estimated to receive at least moderate damage – with two of these schools losing function.

Debris Generation

HAZUS estimates that 4,337 tons of debris will be generated by a flood. Of this amount, "Finishes" (defined as dry wall, insulation, etc) comprised 81% of the total while "Structural" (wood, brick, etc) comprised 6% of the total. If the debris tonnage is converted into an estimated number of truckloads, it will require 173 truckloads (at 25 tons/truck) to remove the debris generated by the flood.

Shelter Requirements

HAZUS estimates that 2,359 households will be displaced by the flood. Of these, 6,158 people will seek temporary shelter in public shelters.

Economic Loss

The total economic loss for the flood is $76.61 million, which represents 8.72% of the total replacement value of the buildings in the scenario. The building losses are broken into direct building losses and business interruption losses. HAZUS calculates that direct building losses to be $73.25 million while the remaining $3.36 million is for business interruption. Of the $73.25 million on direct building losses, $20.24 million is for residential and $44.10 million is for commercial as the two largest categories (see Table 6 of printout).

Corps of Engineers Structural Inventory

In the structural inventory completed by the Corps of Engineers, 1045 properties were found to be located in a regulated floodplain in Grand Island's extraterritorial zoning jurisdiction. Of these, 88 were in a Zone A, 42 in a floodway, and 915 in Zone AE. The valuation of these 1045 floodplain properties found by the Corps of Engineers is $94,872,642, or 5.2% of the total valuation of Grand Island and its zoning jurisdiction.

Figure 1 shows the Grand Island census tracts in Hall County which were used in the flood assessment. **Figure 2** shows the floodplain which HAZUS automatically models as a part of its assessment – the darker the shade of blue, the deeper the modeled floodplain.

HAZUS report disclaimers: As shown on HAZUS Figure 2, the Wood River Diversion is not shown as eliminating the floodplain on the south end of town. The above analysis was completed using default data, which uses statistical averages for variables across census tracts. Also, there are uncertainties inherent in any loss estimation technique. Therefore, there may be a significant difference between modeled results contained in this report and the actual social and economic losses following a flood. More precise results could be completed by inputting user-defined values for the census tracts or the analysis could be run by census blocks, which would reduce – but not eliminate – the estimates used in the model.

Figure 3 shows the critical facilities, as identified by the City. Critical facilities are those structures which will be essential for returning the Village functions to normal after a disaster

("Civic"), are vital for disaster response and sheltering ("Shelter"), and are essential for public health and safety ("Lifeline Utility"). In Grand Island, the 90 critical facilities identified are:

52 emergency shelters
24 schools
5 fire stations
2 police stations
2 medical facilities
1 hospital
1 power plant
1 treatment plant
1 airport
1 bus terminal

The Corps of Engineers structural inventory found the following critical facilities in the floodplain:

Cedar Hollow Public School
Veterans Administration Medical Center
Berean Bible Church
Grand Island Wastewater Treatment Plant
Grand Island Senior High School
Seventh Day Adventist Church
First United Methodist Church
Community Bible Church
Church of Christ
Platte Generation Station

Figure 4 shows the potential ranges of the tornado warning sirens in Grand Island, with the yellow shading being a half-mile from each siren and red one mile from each siren. As shown by the figure, the majority of current development within the Grand Island corporate limits is in the yellow shaded area. It must be recognized, however, that these are outdoor warning sirens which are designed to alert residents who are outside and in close proximity to the sirens. They are not designed to warn persons indoors at-distance, traveling in vehicles, or in noisy environments. In addition, a warning system works best if there are operational redundancies – meaning that it is always safer to have additional sirens in a network in case a siren malfunctions or is destroyed. An additional consideration is that periods during which warning sirens are needed are often noisy in themselves with high wind, intense rain, and hail which all act to reduce peoples' ability to hear the sirens. It is easier to hear a warning for people who are downwind of the siren.

Figure 5 is an aerial photography of the Grand Island area meant to show the community. New development areas are currently in-filling currently undeveloped areas, especially in the red box residential development currently taking place in the northwest portion of the city. The vulnerability of all development – existing or future – is the same now and will be the same in the future for severe winter storms, severe summer storms, and tornadoes. The only hazard which is able to be modified by human behavior or activity is flooding. However, since there Grand Island is in good standing in the Regular Phase of the National Flood Insurance Program,

any future floodplain development will be completed in compliance with the City's floodplain management ordinance.

Mitigation Alternatives

Grand Island's planning goals are the same as the goals for the county portion of the plan.

GOALS: 1) Reduce or prevent future damage from natural hazard events,
2) Increase public safety

To address these goals, mitigation alternatives were suggested in the public meeting and prioritized by the Grand Island City Council.

Prioritization
Grand Island prioritized the mitigation alternatives according to the "STAPLE(E)" procedure (Social acceptability, Technical feasibility, Administrative capability of local government, Political acceptability, Legal authority to implement, Economic justification, and Environmental acceptability). In addition, alternatives were prioritized based on the community's goals and planning objectives.

At its discretion, Grand Island officials may choose to not implement any of the proposed mitigation projects at this time with the realization that future events may change this stance as well as the prioritization of projects. Projects sponsored for implementation will follow a public process.

1) Maintain good standing in the National Flood Insurance Program
Objective 1: Continue to regulate development in floodplain areas and adopt the Hall County floodplain maps when they become effective.
Funding sources and potential cost: No funding needed, no cost.

2) Mitigate repetitive loss properties
Objective 2: Reduce future flood insurance payments and reduce flood losses by mitigating repetitive loss properties through acquisition, elevation, or other techniques. Acquisition should be first priority.
Funding sources and potential cost: FEMA's mitigation programs – cost will vary by structure and by mitigation technique used.

3) Reduce flood damages
Objective 3: Reduce impacts of flood and stormwater problems
- Action 3.1: Complete a drainage study. Given the extremely flat topography in the area, drainage will always be a problem – especially for intense warm weather rainfall events. A drainage study is needed in Grand Island to help the City make wise land use decisions, to identify where existing drainage infrastructure is weak, and to identify ways to address these weaknesses. A drainage study has the potential to also identify good flood mitigation projects which could be funded using FEMA's mitigation programs.

Funding sources and potential cost: Central Platte NRD, Community Development Block Grant, City – average cost varies widely on scope and community size

- Action 3.2: The City Council should consider passing a stormwater management ordinance. Such an ordinance would be designed to hold back stormwater on-site from large developments and to reduce erosion. The City of Lincoln has passed a stormwater management ordinance which could be used as a model or guide.

Funding sources and potential cost: No funding needed, no cost.

- Action 3.3: Upgrade culverts which are found to restrict flows from rain events. A drainage study can show which culverts and bridges are undersized and need to be replaced with larger openings. However, a drainage study is not necessary to know there is a problem. A drainageway which drains properly will not have flow impediments which back up water on to adjacent property. However, flow impediments can be placed in the flow path on purpose to direct the flow of water toward a specific area designed to retain excess water during periods of high flows. It must be noted that culvert upgrades may not have a lasting impact if upstream stormwater is not somehow managed.

Funding sources and potential cost: City, NRD, Natural Resources Development Fund. Cost varies greatly by design and scope.

- Action 3.4: Clear ditches to improve channel conveyance capacity to allow flows to move unimpeded to the Platte River.

Funding sources and potential cost: City, CPNRD

- Action 3.5: Create a maintenance plan for the drainage system. If improvements are made to Grand Island's drainage system, it will be important to protect the "current condition" of the drainage so that it does not revert back to problem areas.

Funding sources and potential cost: City. Cost to create a maintenance plan would be none to little; however, the City may need to devote financial resources toward it.

- Action 3.6: Floodproof any critical facility which is prone to flooding.

Funding sources and potential cost: FEMA's mitigation programs, cost would vary by scope and design. 25% non-federal match requirement would be needed – most likely from City.

4) Identify and designate tornado shelters, publicize the locations of all public tornado shelters to increase public awareness with a sign on the building.

Objective 4: Provide emergency shelter(s) to which students or local residents would evacuate in the event of a tornado warning, especially those who live in vulnerable housing.

- Action 4.1: Study existing public buildings to see if they offer adequate tornado shelter. If buildings are found, they should be identified with proper signage so that citizens know where they can go during a tornado warning.

Funding sources: Unknown

- Action 4.2: Create public shelters by retrofitting or new construction. FEMA has retrofitted schools and constructed all-new shelters in several places in the Midwest. However, most tornadoes occur in late-afternoon to early evening when a school might be closed for the day. Furthermore, it has been reported that public tornado shelters that are left open to the public are not used properly, with vandalism and use by vagrants as problems. At-risk structure types include mobile homes and slab-on-grade construction which has no basement.
- Action 4.3: Consider constructing tornado shelters for vulnerable construction like manufactured home concentrations.

Funding sources and potential cost: FEMA's Pre-Disaster Mitigation program or Hazard Mitigation Grant Program for construction only– cost varies widely based on scope and design

5) Ensure adequate outdoor severe weather warning coverage
Objective 5: Replace the existing tornado sirens which are outdated.
In Hall County, the warning sirens are owned by the communities. There is no funding assistance available from the County for new sirens; however, if the community purchases a warning siren, Hall County Emergency Management can help coordinate the warning system through the central siren warning system located in Grand Island.

There have been significant advances in warning siren technology since the time that many sirens were erected as a result of the Cold War scare in the 1950s and 60s. The old style of warning siren is manual and operates using at least 110 volts – possibly as much as 220 or 240 volts. In addition, these sirens also have no battery backup since it is not economically feasible to purchase backup systems for manual sirens. In the event that severe weather is approaching, a power outage – which is common in severe weather – means that no warning will be sounded. As a result, there could be higher loss of life since a warning would have alerted people within earshot to seek shelter. Newer sirens operate using 12 volts, which makes battery backup possible – in fact, these sirens typically have a backup system already built in. This means that the only option for having a tornado siren with battery backup is the actual purchase of a new siren.
- Action 5.1: Purchase new tornado sirens to replace the older models.

Funding sources and potential cost: City. Estimated cost: $25,000 to $50,000 .

6) Reduce damages caused by downed tree limbs
Objective 6: Reduce the duration or eliminate power outages from severe weather. Overhead power lines are vulnerable to collapse from icing in the cold weather months and from high winds or tree limbs falling on power lines in warm weather months.
- Action 6.1: Initiate a power line burying project.

Funding sources and potential cost: FEMA's Hazard Mitigation Grant Program or Pre-Disaster Mitigation Program could provide up to 75% of the project cost. The remaining cost might be shared with the Public Power District, City, or property owners.
- Action 6.2: Write to the Nebraska Forest Service and request a tree inventory. An inventory is especially helpful in mitigation planning for communities which experience regular tree-related damages. An inventory can identify problem trees and recommend changes to the way a community administer a local tree management program (i.e., through a Tree Board or Park Board). Problematic areas of tree limbs with power lines could be addressed as a priority.

Funding sources and potential cost: Free

7) Ensure adequate severe weather notifications to citizens and critical facilities
Objective 7: Purchasing or education of a weather radio
- Action 7.1: Work with the local cable television company to create a cable television interrupt warning system. Such a system would remove the concern over which television

or radio station to turn to for weather information and would be a way to inform the majority of the public of impending severe weather.
- Action 7.2: For public critical facilities, the City should consider purchasing a weather radio to be used in each facility for the rapid dissemination of a severe weather warning.
- Action 7.3: In noisy manufacturing facilities which may not hear tornado sirens, the City could inform the owners of these facilities of the option that they could purchase a weather radio.
- Action 7.4: Encourage critical facilities like senior care facilities and hospitals to develop and practice their own emergency sheltering plans.

Funding sources and potential cost: City of Grand Island, local businesses. Approximate cost about $30 per radio. Plan development would carry no cost other than staff time.

8) Improve the City's capability to communicate in a post-disaster scenario

Objective 8: Acquire a comprehensive communication system. The current system of cellular telephones depends on having a cell tower network and being able to connect with other emergency responders when cellular traffic will be very high.
- Action 8.1: Assess the types of communication systems that are available, being used by other counties or communities, and which would fit into the budget. Options might include something like a satellite telephone network with handheld units.
- Action 8.2: The City and County could have a Ham radio network on standby in case of communication failure.

9) Prevent or reduce the duration of power outages

Objective 9: Increase the capability for the City's electric infrastructure to withstand severe weather. Whether for public safety or public welfare, having a function electric system has clear benefits in a post-disaster scenario. These actions would be more effective for more rural transmission and distribution lines which have a longer space between poles than in urban areas.
- Action 9.1: Install "T2" line, which prevents ice buildup
- Action 9.2: Periodically in a segment of power line, strengthen a power pole. This will prevent any "cascading" effect of pole failures, which will reduce the time necessary for repairs.
- Action 9.3: Instead of T2 line, automatic disconnects could be installed on the lines at the poles to prevent the weight of the line from pulling down the poles.

GOAL: 3) Increase Public Education

10) Educate the public about natural hazards, preparedness, and mitigation

Objective 10: Initiate or continue natural hazard awareness and education programs
- Action 10.1: Hall County Emergency Management Agency (HCEMA) will continue its current educational programs. HCEMA also completes annual education programs to grade schools each year, reaching approximately 500 to 600 kids. They discuss severe weather and where to go and what to do if there is a tornado warning.
- Action 10.2: HCEMA also participates in the annual Severe Weather Awareness Week by placing articles in the local paper and airing information on the City's local government

television station. Educational outreach programs could be expanded to include all hazards and a severe winter weather preparedness program for the fall.

- Action 10.3: HCEMA also participates during the test warning day by using all of our normal procedures as if there were an actual event, including setting off the warning sirens.
- Action 10.4: The City and HCEMA can make educational materials available to the public in the public library and website. Education would include, but not be limited to, how to protect yourself and your property from tornadoes and severe weather, their potential risks to different disaster types, preparedness procedures for their home, more wind-resistant construction design, and hardier types of trees to plant in areas close to homes, power lines, and streets. Free brochures are available through the National Weather Service and American Red Cross.

Funding sources and potential cost: Funding sources are not applicable, cost is free except for work time.

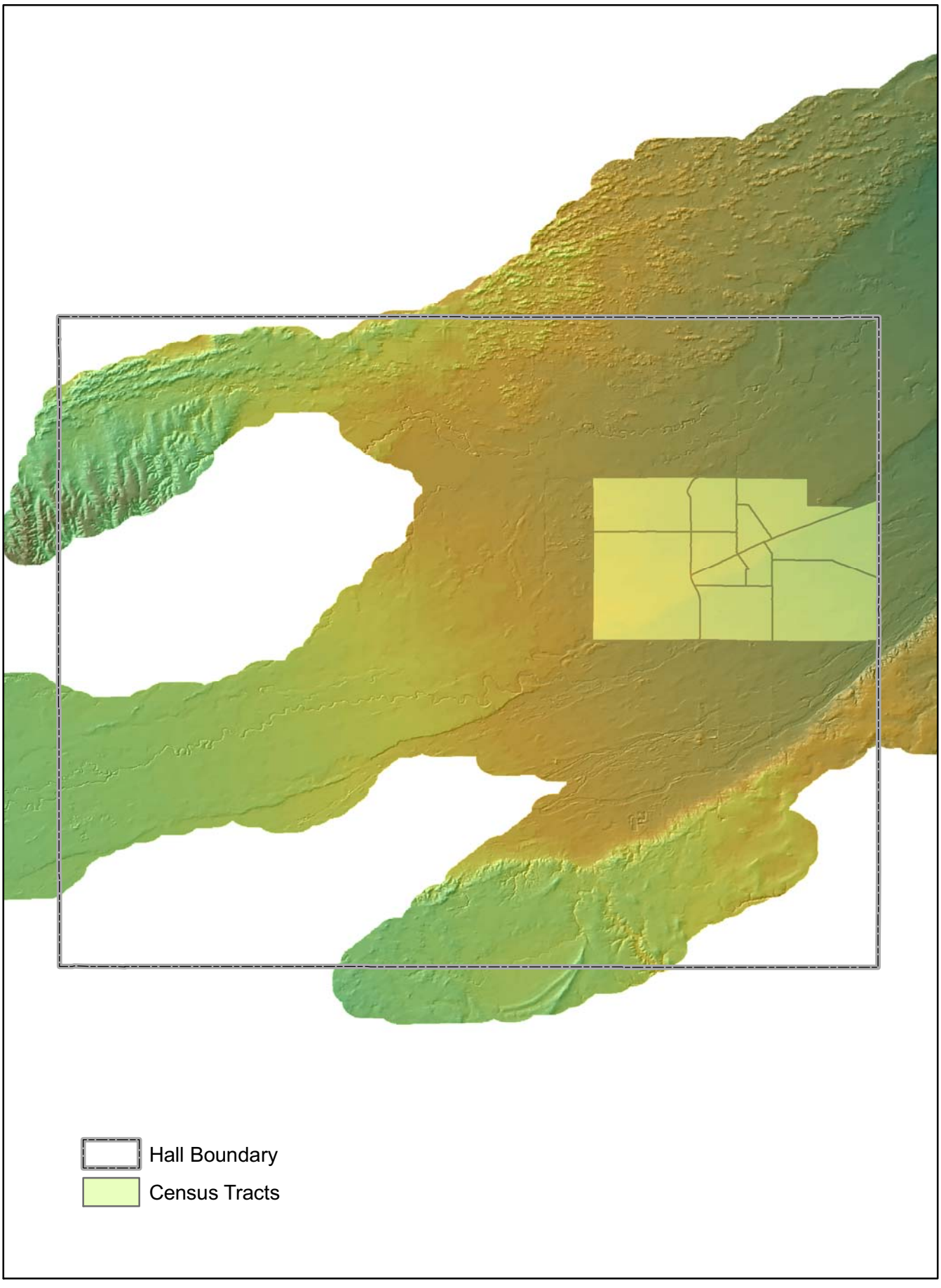
Implementation

To start implementation, determining which projects should be submitted for funding will be based on a FEMA-approved cost-benefit method. This means that proposed projects would need to be reviewed for cost effectiveness with the assistance of state emergency management or floodplain management personnel. Unless otherwise delegated, the Hall County Regional Planning Director will be the person responsible for project administration of any project selected for implementation. FEMA has the authority to approve or deny mitigation projects applied for under their agency's mitigation programs.

Evaluation

In this plan, several potential mitigation projects are identified; however, it is not designed to have an all-inclusive list of projects. It is designed to be a living document which can be adapted to the landscape as conditions change. This means that this plan should be revised and updated as new projects are identified and prioritized and participating communities. There is a requirement to review and update this plan every five years. To do this, communities will follow the same procedure that Hall County will utilize in its mitigation plan updates, which is detailed starting on page 46 of the County portion of this report. There are also evaluation, update, and revision worksheets which have been included in this plan as **Appendix B** to assist with this process.

Grand Island HAZUS - Figure 1



Grand Island HAZUS - Figure 2

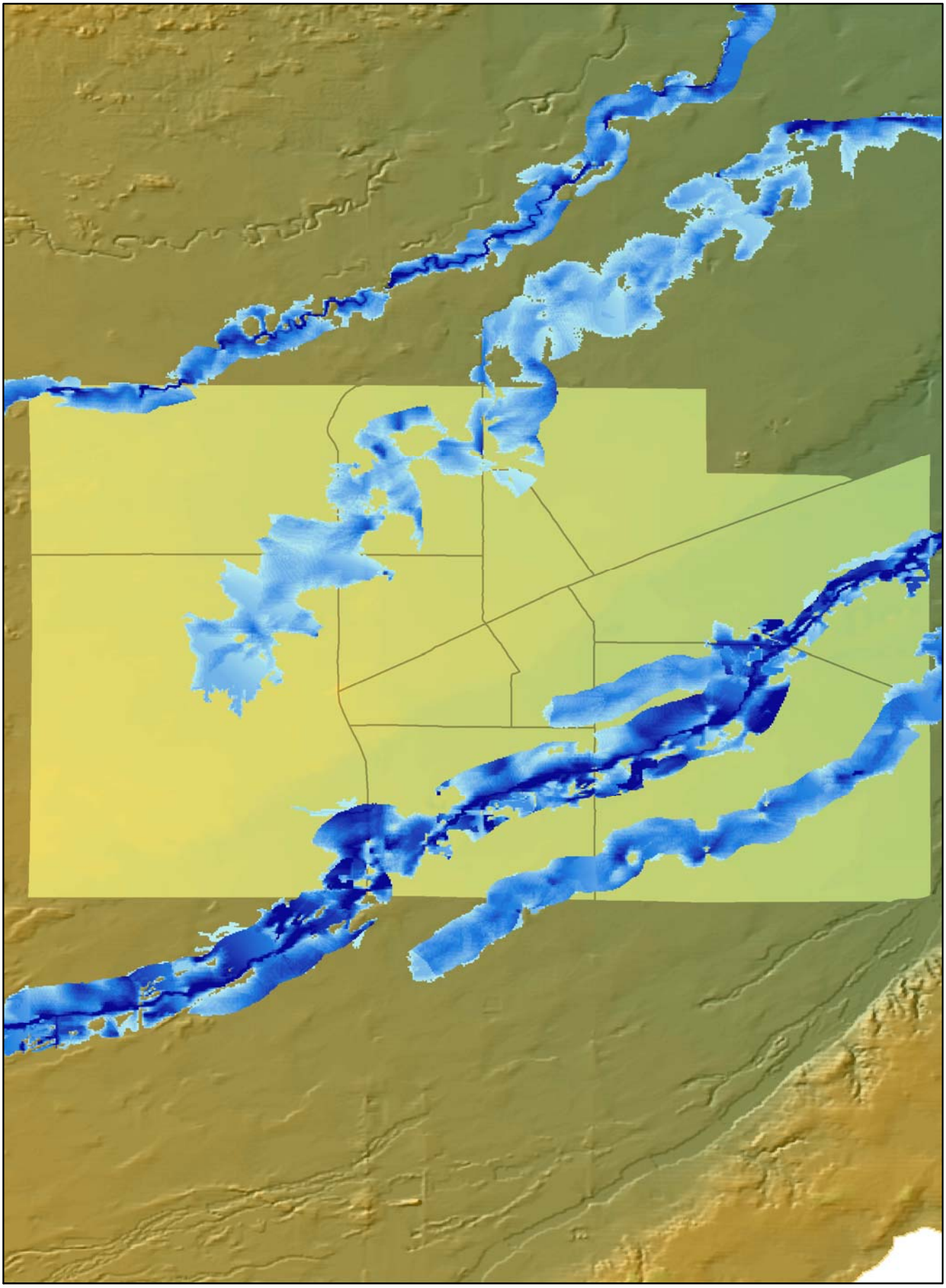


Figure 3
Critical Facillities

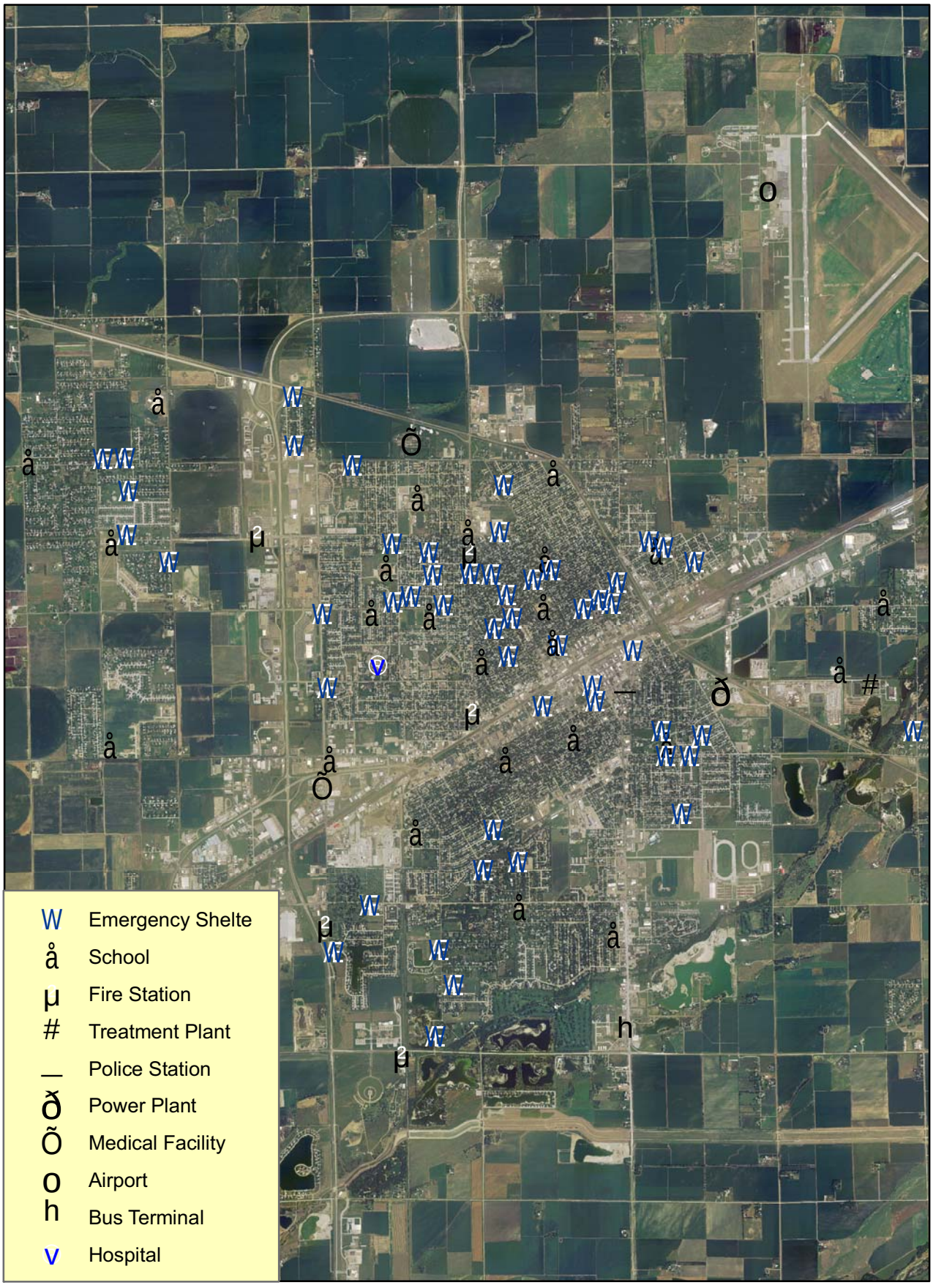


Figure 4
Grand Island Warning Siren Coverage

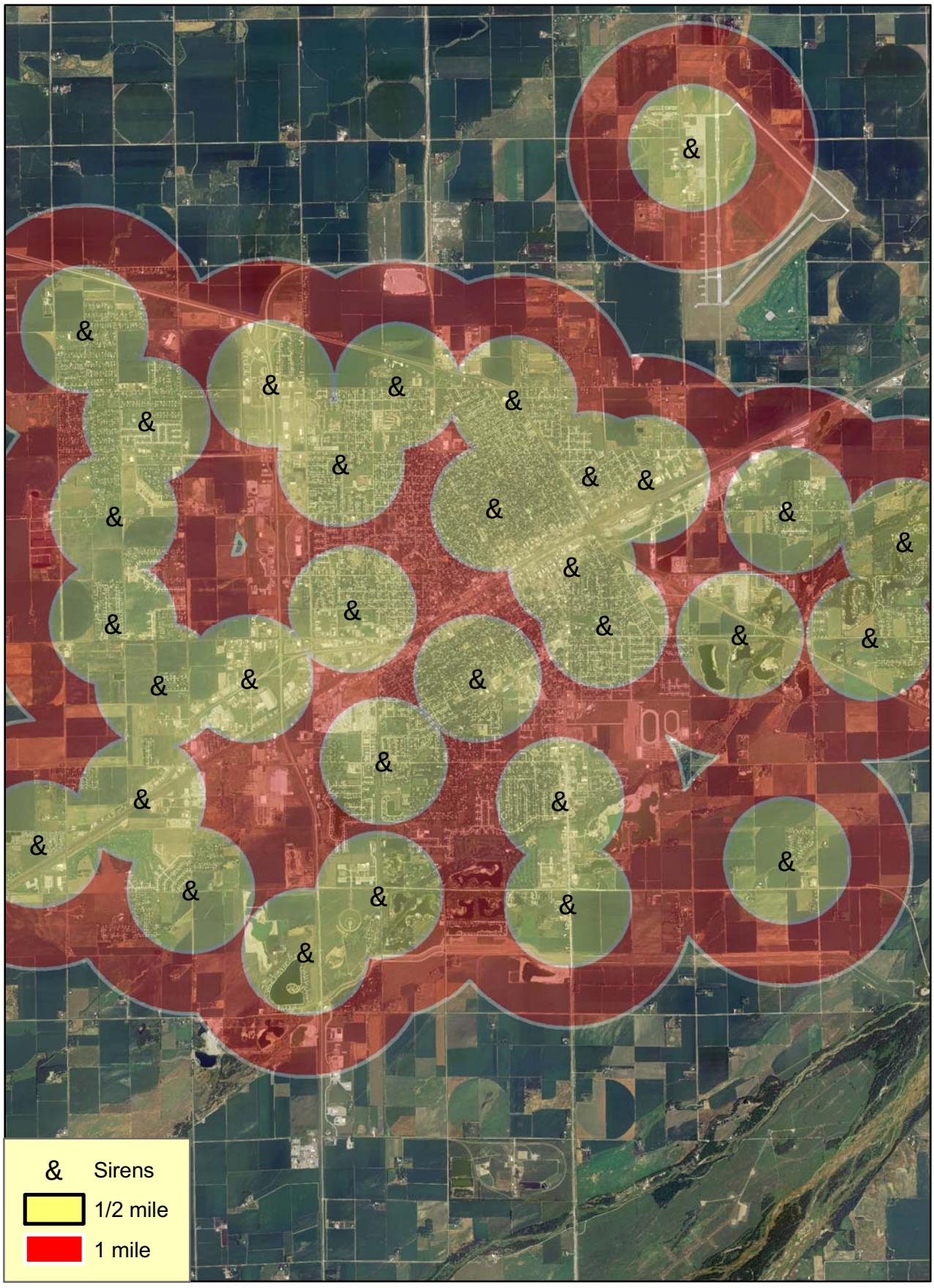


Figure 5
Future Development

HAZUS-MH: Flood Event Report

Region Name: Grand Island

Flood Scenario: Grand Island flood

Print Date: Friday, March 14, 2008

Disclaimer:

Totals only reflect data for those census tracts/blocks included in the user's study region.

The estimates of social and economic impacts contained in this report were produced using HAZUS loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific Flood. These results can be improved by using enhanced inventory data and flood hazard information.

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HAZUS is a regional multi-hazard loss estimation model that was developed by the Federal Emergency Management Agency (FEMA) and the National Institute of Building Sciences (NIBS). The primary purpose of HAZUS is to provide a methodology and software application to develop multi-hazard losses at a regional scale. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from multi-hazards and to prepare for emergency response and recovery.

The flood loss estimates provided in this report were based on a region that included 1 county(ies) from the following state(s):

- Nebraska

Note:
Appendix A contains a complete listing of the counties contained in the region.

The geographical size of the region is 46 square miles and contains 1,650 census blocks. There are over 18 thousand households in the region and has a total population of 46,220 people (2000 Census Bureau data). The distribution of population by State and County for the study region is provided in Appendix B.

There are an estimated 20,396 buildings in the region with a total building replacement value (excluding contents) of 2,667 million dollars (2006 dollars). Approximately 92.21% of the buildings (and 70.33% of the building value) are associated with residential housing.

General Building Stock

HAZUS estimates that there are 20,396 buildings in the region which have an aggregate total replacement value of 2,667 million (2006 dollars). Table 1 and Table 2 present the relative distribution of the value with respect to the general occupancies by Study Region and Scenario respectively. Appendix B provides a general distribution of the building value by State and County.

Table 1
Building Exposure by Occupancy Type for the Study Region

Occupancy	Exposure ($1000)	Percent of Total
Residential	1,875,749	70.3%
Commercial	528,252	19.8%
Industrial	145,485	5.5%
Agricultural	12,787	0.5%
Religion	53,181	2.0%
Government	23,482	0.9%
Education	28,208	1.1%
Total	**2,667,144**	**100.00%**

Table 2
Building Exposure by Occupancy Type for the Scenario

Occupancy	Exposure ($1000)	Percent of Total
Residential	598,278	68.1%
Commercial	210,311	23.9%
Industrial	24,488	2.8%
Agricultural	5,628	0.6%
Religion	10,871	1.2%
Government	11,939	1.4%
Education	17,156	2.0%
Total	**878,671**	**100.00%**

Essential Facility Inventory

For essential facilities, there are 2 hospitals in the region with a total bed capacity of 219 beds. There are 25 schools, 5 fire stations, 2 police stations and no emergency operation centers.

Flood Scenario Parameters

HAZUS used the following set of information to define the flood parameters for the flood loss estimate provided in this report.

Study Region Name:	Grand Island
Scenario Name:	Grand Island flood
Return Period Analyzed:	100
Analysis Options Analyzed:	0

General Building Stock Damage

HAZUS estimates that about 140 buildings will be at least moderately damaged. This is over 5% of the total number of buildings in the study case. There are an estimated 13 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the HAZUS Flood technical manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 summarizes the expected damage by general building type.

Table 3: Expected Building Damage by Occupancy

	1-10		11-20		21-30		31-40		41-50		Substantially	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	2	00.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Commercial	15	48.39	16	51.61	0	0.00	0	0.00	0	0.00	0	0.00
Education	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Government	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Industrial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Religion	1	00.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Residential	1	0.80	33	26.40	34	27.20	35	28.00	9	7.20	13	10.40
Total	**19**		**49**		**34**		**35**		**9**		**13**	

Table 4: Expected Building Damage by Building Type

Building Type	1-10		11-20		21-30		31-40		41-50		Substantially	
	Count	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Concrete	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
ManufHousing	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	13	100.00
Masonry	4	30.77	6	46.15	1	7.69	2	15.38	0	0.00	0	0.00
Steel	3	37.50	5	62.50	0	0.00	0	0.00	0	0.00	0	0.00
Wood	3	2.63	36	31.58	33	28.95	33	28.95	9	7.89	0	0.00

Before the flood analyzed in this study case, the region had 0 hospital beds available for use. On the day of the scenario flood event, the model estimates that 0 hospital beds are available in the region.

Table 5: Expected Damage to Essential Facilities

		# Facilities		
Classification	Total	At Least Moderate	At Least Substantial	Loss of Use
Fire Stations	5	0	0	0
Hospitals	2	0	0	0
Police Stations	2	0	0	0
Schools	25	4	0	2

If this report displays all zeros or is blank, two possibilities can explain this.

(1) None of your facilities were flooded. This can be checked by mapping the inventory data on the depth grid.

(2) The analysis was not run. This can be tested by checking the run box on the Analysis Menu and seeing if a message box asks you to replace the existing results.

Debris Generation

HAZUS estimates the amount of debris that will be generated by the flood. The model breaks debris into three general categories: 1) Finishes (dry wall, insulation, etc.), 2) Structural (wood, brick, etc.) and 3) Foundations (concrete slab, concrete block, rebar, etc.). This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 4,337 tons of debris will be generated. Of the total amount, Finishes comprises 81% of the total, Structure comprises 6% of the total. If the debris tonnage is converted into an estimated number of truckloads, it will require 173 truckloads (@25 tons/truck) to remove the debris generated by the flood.

Shelter Requirements

HAZUS estimates the number of households that are expected to be displaced from their homes due to the flood and the associated potential evacuation. HAZUS also estimates those displaced people that will require accommodations in temporary public shelters. The model estimates 2,359 households will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 6,158 people (out of a total population of 46,220) will seek temporary shelter in public shelters.

The total economic loss estimated for the flood is 76.61 million dollars, which represents 8.72 % of the total replacement value of the scenario buildings.

Building-Related Losses

The building losses are broken into two categories: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the flood. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the flood.

The total building-related losses were 73.25 million dollars. 4% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 26.82% of the total loss. Table 6 below provides a summary of the losses associated with the building damage.

Table 6: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Building Loss						
	Building	10.95	10.48	0.93	0.92	23.27
	Content	9.29	32.59	1.53	4.95	48.35
	Inventory	0.00	1.04	0.40	0.20	1.63
	Subtotal	**20.24**	**44.10**	**2.85**	**6.06**	**73.25**
Business Interruption						
	Income	0.02	0.56	0.00	0.04	0.62
	Relocation	0.19	0.18	0.00	0.00	0.37
	Rental Income	0.07	0.13	0.00	0.00	0.20
	Wage	0.04	0.58	0.00	1.56	2.18
	Subtotal	**0.31**	**1.45**	**0.00**	**1.60**	**3.36**
ALL	**Total**	**20.55**	**45.55**	**2.85**	**7.67**	**76.61**

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Nebraska				
Hall	46,220	1,875,749	791,395	2,667,144
Total	**46,220**	**1,875,749**	**791,395**	**2,667,144**
Total Study Region	**46,220**	**1,875,749**	**791,395**	**2,667,144**

Quick Assessment Report

March 14, 2008

Study Region : Grand Island
Scenario : Grand Island flood
Return Period: 100
Analysis Option: 0

Regional Statistics

Area (Square Miles)	46
Number of Census Blocks	1,650
Number of Buildings	
Residential	18,808
Total	20,396
Number of People in the Region (x 1000)	46
Building Exposure ($ Millions)	
Residential	1,876
Total	2,667

Scenario Results

Shelter Requirements

Displaced Population (# Households)	2,359
Short Term Shelter (# People)	6,158

Economic Loss

Residential Property (Capital Stock) Losses ($Millions)	20.24
Total Property (Capital Stock) Losses ($ Millions)	73.25
Business Interruptions (Income) Losses ($ Millions)	3.36

Disclaimer:

Totals only reflect data for those census tracts/blocks included in the user's study region.

The estimates of social and economic impacts contained in this report were produced using HAZUS loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific flood. These results can be improved by using enhanced inventory data and flood hazard information.

Wood River

	Dam Failure	Drought	Earth-quake	Flood	Levee Failure	Summer Storm	Land slide	Winter Storm	Tornado /Wind	Wildfire
Probability	None	Medium	Low	High	None	High	None	Medium	Medium	Low
Extent	Zero	Limited	Unknown	Severe	Zero	Severe	Zero	Severe	Severe	Limited
Previous Occurrence	No	Yes	No	Yes	No	Yes	No	Yes	Yes	No

Probability: Based on history, what is the likelihood this type of event will happen again?
- None, Low, Medium, or High

Extent – If this event were to happen, how extensive could the damage be?
- Zero, Limited, Severe, Full, or Unknown

Previous Occurrence: Is there an historic record of this type of hazard in the community?

The above table shows the input provided at the initial public meeting. Due to the geographical proximity, the following hazard types were not considered due to there being no likelihood of occurring in Nebraska: volcanic eruptions, avalanches, hurricanes, tidal surges, and tsunamis.

In the following sections, only the hazard types which have a significant likelihood of occurring or have a reason to potentially occur are listed. These types are: severe weather (summer and winter), tornado, flood, and drought. According to the database of dams maintained by the Nebraska Department of Natural Resources, there are no dams upstream of Wood River; therefore, dam failure is not considered further for Wood River. Although there is a small risk for earthquakes, wildfires, and landslides, the threat and associated risk for these hazards is not high enough and there are no realistic or feasible mitigation action which can be taken to reduce the level of risk. The National Climatic Data Center lists no records of wildfire for Hall County. Additionally, the citizens did not rank these hazards high enough to warrant detailed discussion in this plan. This may change in future updates.

Disaster History

Flood

At the town of Wood River, the Wood River has a "nested channel," which means that the banks are higher than the surrounding floodplain. This prevents rainfall from naturally draining overland directly into the river. This means that rain which falls between the river and Highway 30 through town cannot naturally drain to the river, which presents some stormwater concerns. Similarly, in a very large flood event, water which escapes from Wood River and is unable to get back into the channel after the water recedes. Instead, water flows east until it can join enter the Wood River about three miles northeast of town. In the process, it is possible that the business district of Wood River along Highway 30 will be flooded. According to the current floodplain map, water from Wood River cannot inundate development in the city unless it is a 500-year flood event. However, a flood of this magnitude would inundate all development north of the Union Pacific Railroad tracks, including Highway 30 (see **Figure 2**). Wood River High School is situated on the high ground closer to the river, with the building footprint out of the floodplain.

As defined by FEMA's repetitive loss list, there are no repetitive flood loss properties in Wood River.

On May 11 and 12, 2005: 12 people were evacuated due to rising water. The Wood River crested at 9 feet, flooding most streets in town. The river tied a record crest of 12.2 feet at Alda after it had been dry for three years prior to the storm.

Severe Weather

June 4, 1995: 1¾ inch hail caused $10,000 in undisclosed property damage.

May 11 and 12, 2005: Thunderstorms ravaged a large part of south-central Nebraska starting the night of the 11th and continuing through the day on the 12th. Wood River recorded over 11 inches of rain in this timeframe, which is well in excess of the 100-year storm. It was estimated every structure in Wood River sustained some sort of storm damage as wave after wave of severe thunderstorms pounded the town with high winds and hail up to 1¾ inches in diameter. Twelve homes sustained severe damage. Hall County was declared a federal disaster area as the storm caused significant damage in most Hall County communities.

May 23, 2006: Severe thunderstorms brought 80 mph winds, causing damage across 16 counties. Property damage in Wood River was only $5,000.

June 16, 2006: A severe thunderstorm came in from the west, producing 60 mph wind gusts in and golf ball sized hail in Wood River. Total property damage was set at $10,000.

September 15, 2006: Severe thunderstorms developed across south-central Nebraska, bringing baseball-sized hail and strong winds to the region. Wood River did not report as much property damage as Grand Island, Hastings, and Holdrege; however, $10,000 in property damage was recorded.

Tornado

May 7, 1993: A F2 tornado touched down four miles southwest of Upland, moved northeast across Kearney County, crossed the Platte River east of Kearney, and was last seen 1½ miles east of Wood River. Total property damage from this long tornado was set at $5 million.

May 2, 1999: A short-lived F1 tornado was observed just northwest of Wood River. The tornado damaged grain bins, a grain dryer, and a house nearby. Total damage was set at $100,000.

May 7, 2005: The first major outbreak of severe weather for the year brought several tornadoes to central Nebraska. One of these tornadoes was a brief F0 tornado which was spotted five miles north of Wood River, but caused no damage.

May 11, 2005: Just four days later, a F0 tornado clipped the south side of Wood River as a part of extremely severe weather which hit the area, bringing high wind, hail, intense rain, and flooding. Total property damage from this tornado was set at $125,000.

Drought

NCDC reports two drought events since 1950 for Hall County: in 2000 and 2002. Both of these droughts appear to have been agricultural droughts with the most impact to growing crops. Although Wood River is situated in an area which has been directly impacted by a drought, there are no indications that the City has ever been materially impacted by a drought.

Likelihood of Future Hazard Events
It is certain that Wood River will be impacted by severe weather – perhaps as often as each year. In these events, it should be expected to witness large hail, high winds, and intense rain in the summer, and large snowfalls, ice, and bitter windchills in the winter. Although it is certainly possible, it is less likely that Wood River will be directly impacted by a tornado.

Past Hazard Mitigation Efforts
The City of Wood River participates and is in good standing in the National Flood Insurance Program (NFIP). The initial identification for the Wood River's floodplain map took place on May 31, 1974, and the City joined the Emergency Phase of the NFIP on September 6th of that year. Participation in the Regular Phase of the NFIP occurred on December 1, 1978. Wood River continues to participate as is in good standing in the National Flood Insurance Program. The effective date of Wood River's current floodplain map is June 3, 1986. However, preliminary floodplain maps for all of Hall County were published on August 31, 2007, and the City will be expected to adopt these maps within one year of these preliminary maps being made effective. It is not possible to tell when the preliminary Hall County maps will become effective.

Vulnerability Assessment
According to an assessment completed by the Nebraska Department of Natural Resources in March of 2007, there are 536 total structures in Wood River. **Figure 1** shows the structures broken out by type, and the count is:

478 residences
29 businesses
17 (at least) out buildings large enough to be seen on aerial photographs
8 publicly-owned structures, including the municipal building, school, library
4 church or non-profit buildings

According to the Nebraska Department of Property Assessment and Taxation, the total assessed taxable value for Wood River in 2007 was $42,169,502. Broken out by significant property types, this is:

Residential real property:	$ 33,340,795
Commercial real property:	$ 6,376,832
Railroad total property:	$ 1,124,990
Public service co. total property:	$ 776,595
Comm/Ind. personal property:	$ 499,990
Agricultural total property:	$ 50,300

The entire structure stock is vulnerable to the severe weather, tornado, and drought hazard. This means that, as of 2007, there is $42,169,502 in at-risk assets for these hazard types.

In the structural inventory completed by the Corps of Engineers, five properties were found to be located in a regulated floodplain in Wood River's extraterritorial zoning jurisdiction. Of these, 1 is in a Zone A and 4 are in a floodway. The valuation of these five floodplain properties found by the Corps of Engineers is $97,153, or 0.2% of the total valuation of Wood River and its zoning jurisdiction.

Figure 2 shows the current effective floodplain overlay with the structure count. The 100-year, or regulated, floodplain is shown in light blue while the 500-year floodplain is shown in orange. 451 of the 536 tagged structures (84%) are in the 500-year floodplain. Assuming an equitable valuation between structures in that floodplain with those not in the floodplain, this represents a total valuation of $ 35,482,174 in the 500-year floodplain in Wood River.

Figure 3 shows the critical facilities, as identified by the City and supplemented with various federal databases. Critical facilities are those structures which will be essential for returning the Village functions to normal after a disaster ("Civic"), are vital for disaster response and sheltering ("Shelter"), and are essential for public health and safety ("Lifeline Utility"). Critical facilities can also be economic because the loss of a major employer or the loss of the City's main source(s) of revenue will greatly hinder recovery. In Wood River, the critical facilities identified are:

Civic/Response: City Hall, Fire & Rescue Building, Police Department
Sheltering: Wood River Elementary School, Wood River Rural High School, St. Mary's Catholic Church, United Methodist, Grace Lutheran Church, First Presbyterian Church
Vulnerable population: Good Samaritan Center
Financial: Cargill/Wood River ethanol plant
Lifeline Utility: Water tower

Figure 4 shows the potential ranges of the tornado warning sirens in Wood River, with the yellow shading being a half-mile the siren, with red the one mile distance. As shown by the figure, the majority of current development within the Wood River corporate limits is in the yellow shaded area. It must be recognized, however, that these are outdoor warning sirens which are designed to alert residents who are outside and in close proximity to the sirens. They are not designed to warn persons indoors at-distance, traveling in vehicles, or in noisy environments. In addition, a warning system works best if there are operational redundancies – meaning that it is always safer to have additional sirens in a network in case a siren malfunctions or is destroyed. An additional consideration is that periods during which warning sirens are needed are often noisy in themselves with high wind, intense rain, and hail which all act to reduce peoples' ability to hear the sirens. It is easier to hear a warning for people who are downwind of the siren.

Figure 5 shows the areas of new development which is most likely to occur in the next five to ten years. The vulnerability of all development – existing or future – is the same now and will be the same in the future for severe winter storms, severe summer storms, and tornadoes. The only hazard which is able to be modified by human behavior or activity is flooding. However, since there is very little developable area in Wood River which is in a regulated floodplain and since Wood River is in good standing in the Regular Phase of the National Flood Insurance Program, any future floodplain development will be completed in compliance with the City's floodplain management ordinance.

Mitigation Alternatives

Wood River's planning goals are the same as the goals for the county portion of the plan.

GOALS: 1) Reduce or prevent future damage from natural hazard events,
2) Increase public safety

To address these goals, mitigation alternatives were suggested in the public meeting and prioritized by the Wood River City Council.

Prioritization
Wood River prioritized the mitigation alternatives according to the "STAPLE(E)" procedure (Social acceptability, Technical feasibility, Administrative capability of local government, Political acceptability, Legal authority to implement, Economic justification, and Environmental acceptability). In addition, alternatives were prioritized based on the community's goals and planning objectives.

At its discretion, Wood River officials may choose to not implement any of the proposed mitigation projects at this time with the realization that future events may change this stance as well as the prioritization of projects. Projects sponsored for implementation will follow a public process.

1) Maintain good standing in the National Flood Insurance Program
Objective 1: Continue to regulate development in floodplain areas and adopt the Hall County floodplain maps when they become effective.
Funding sources and potential cost: No funding needed, no cost.

2) Identify and designate tornado shelters, publicize the locations of all public tornado shelters to increase public awareness – perhaps with a sign on the building.
Objective 2: Provide emergency shelter(s) to which students or local residents would evacuate in the event of a tornado warning, especially those who live in vulnerable housing
- Action 2.1: Create public shelters by retrofitting or new construction. FEMA has retrofitted schools and constructed all-new shelters in several places in the Midwest. However, most tornadoes occur in late-afternoon to early evening when a school might be closed for the day. Furthermore, it has been reported that public tornado shelters that are left open to the public are not used properly, with vandalism and use by vagrants as problems. At-risk structure types include mobile homes and slab-on-grade construction which has no basement.
- Action 2.2: Consider constructing tornado shelters for vulnerable construction like manufactured home concentrations.

Funding sources and potential cost: FEMA's Pre-Disaster Mitigation program or Hazard Mitigation Grant Program for construction only– cost varies widely based on scope and design

3) Reduce damages caused by downed tree limbs
Objective 3: Reduce the duration or eliminate power outages from severe weather. Overhead power lines are vulnerable to collapse from icing in the cold weather months and from high winds or tree limbs falling on power lines in warm weather months.
- Action 3.1: Initiate a power line burying project.

Funding sources and potential cost: FEMA's Hazard Mitigation Grant Program or

Pre-Disaster Mitigation Program could provide up to 75% of the project cost. The remaining cost might be shared with the Public Power District, City, or property owners.

- Action 3.2: Write to the Nebraska Forest Service and request a tree inventory. An inventory is especially helpful in mitigation planning for communities which experience regular tree-related damages. An inventory can identify problem trees and recommend changes to the way a community administer a local tree management program (i.e., through a Tree Board or Park Board). Problematic areas of tree limbs with power lines could be addressed as a priority.

Funding sources and potential cost: Free

4) Ensure adequate severe weather notifications to critical facilities

Objective 4: Purchasing or education of a weather radio

- Action 4.1: For public critical facilities, the City should consider purchasing a weather radio to be used in each facility for the rapid dissemination of a severe weather warning.
- Action 4.2: If the City has noisy manufacturing facilities which may not hear tornado sirens, the City could inform the owners of these facilities of the option that they could purchase a weather radio.

Funding sources and potential cost: City of Wood River, local businesses. Approximate cost about $30 per radio.

5) Ensure adequate water supply for health and safety

Objective 5: Determine ways to secure Wood River's water supply during drought

- Action 5.1: Work with the Nebraska Department of Health and Human Services to secure revolving loan funding for supplementing Wood River's water supply with an additional source.
- Action 5.2: Determine a method to have citizens from Wood River voluntarily reduce demand for water during times of drought. This may involve instituting a moratorium on unnecessary water usage and implementing a fine/penalty system for those found in violation.

Goal: 3) Increase Public Education

There are no explicit objectives or actions for this goal; however, there is an implicit action related to this goal for above actions which will require public participation. Activities for this goal are found in the County portion of this document since the likely lead or assisting agency will be the Hall County Emergency Management Agency.

Implementation

To start implementation, determining which projects should be submitted for funding will be based on a FEMA-approved cost-benefit method. This means that proposed projects would need to be reviewed for cost effectiveness with the assistance of state emergency management or floodplain management personnel. Unless otherwise delegated, the City Clerk will be the person responsible for project administration of any project selected for implementation. FEMA has the authority to approve or deny mitigation projects applied for under their agency's mitigation programs.

Evaluation

In this plan, several potential mitigation projects are identified; however, it is not designed to have an all-inclusive list of projects. It is designed to be a living document which can be adapted to the landscape as conditions change. This means that this plan should be revised and updated as new projects are identified and prioritized and participating communities. There is a requirement to review and update this plan every five years. To do this, communities will follow the same procedure that Hall County will utilize in its mitigation plan updates, which is detailed starting on page 46 of the County portion of this report. There are also evaluation, update, and revision worksheets which have been included in this plan as **Appendix B** to assist with this process.

Figure 1
Wood River Structural Inventory

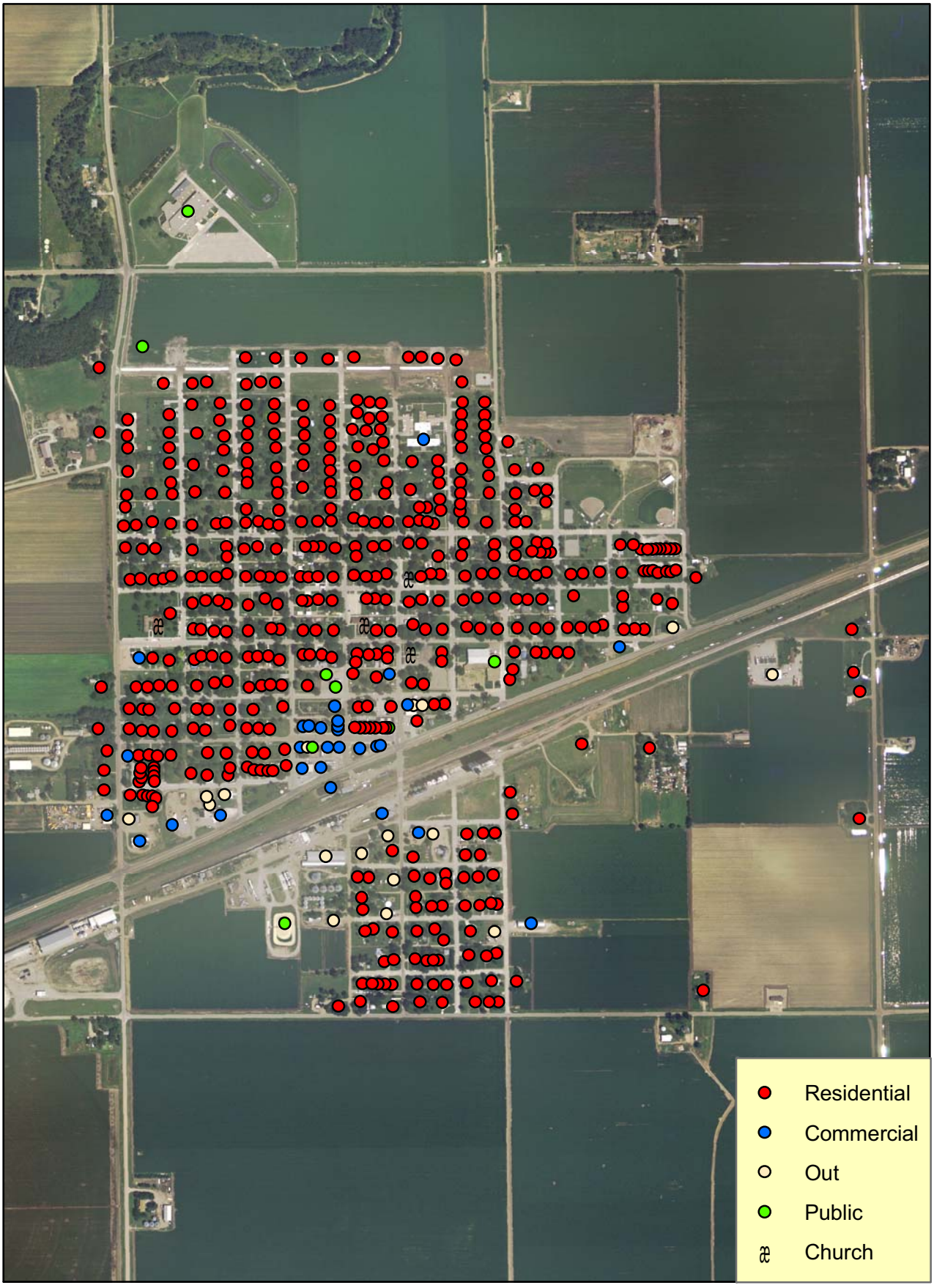

Figure 2
Floodplain Structural Inventory

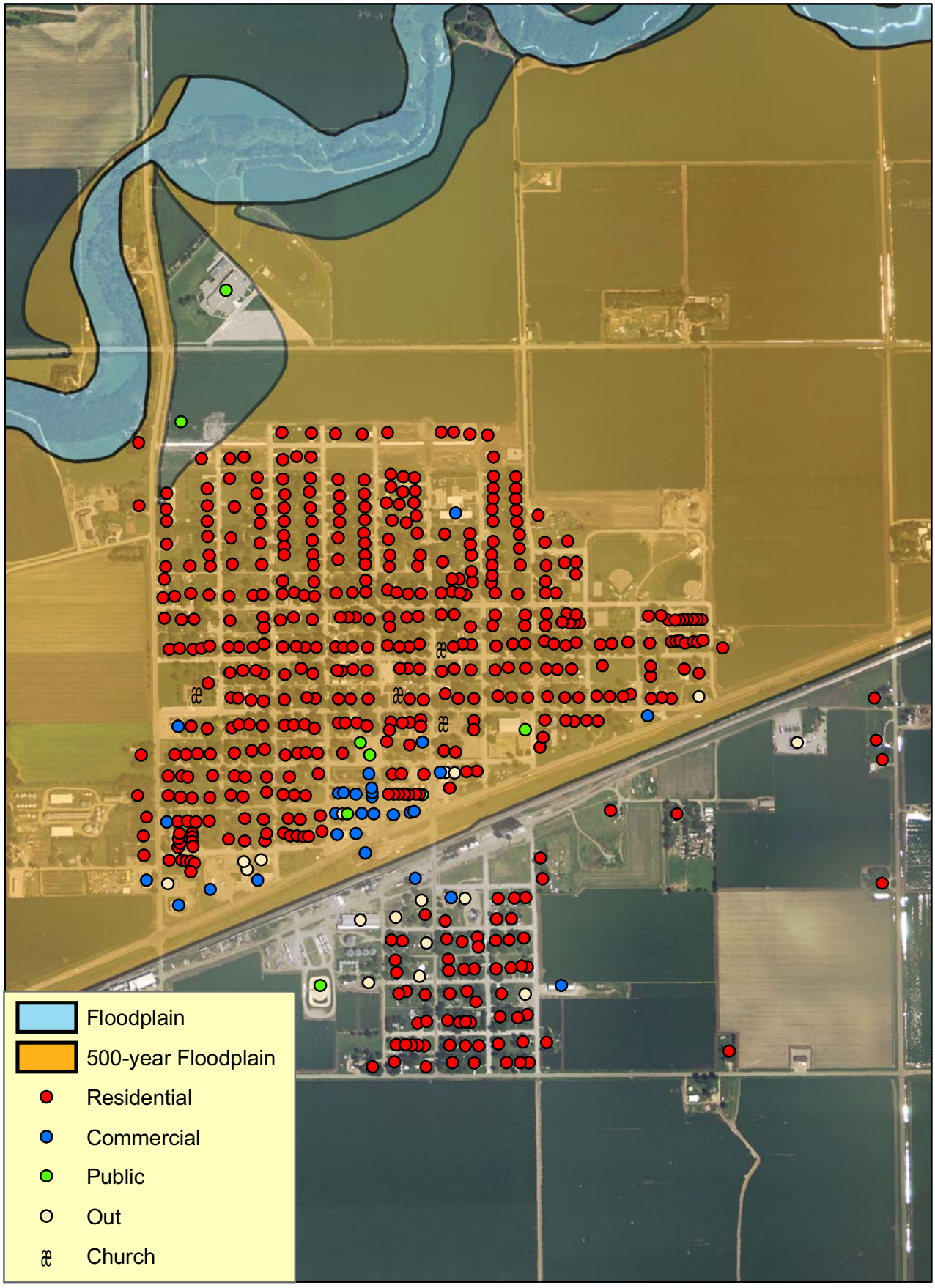

Figure 3
Critical Facilities

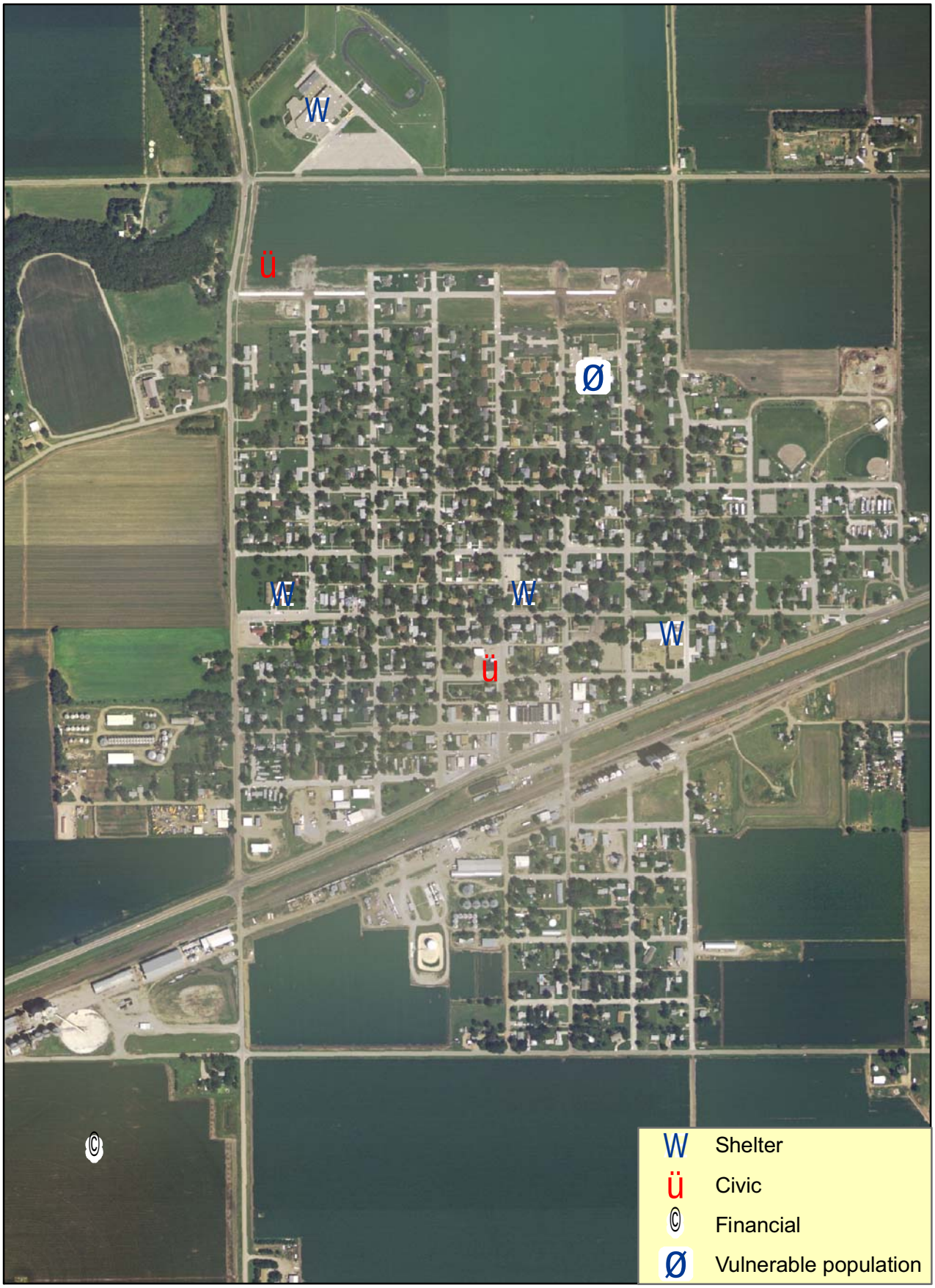

Figure 4
Tornado Siren Distances

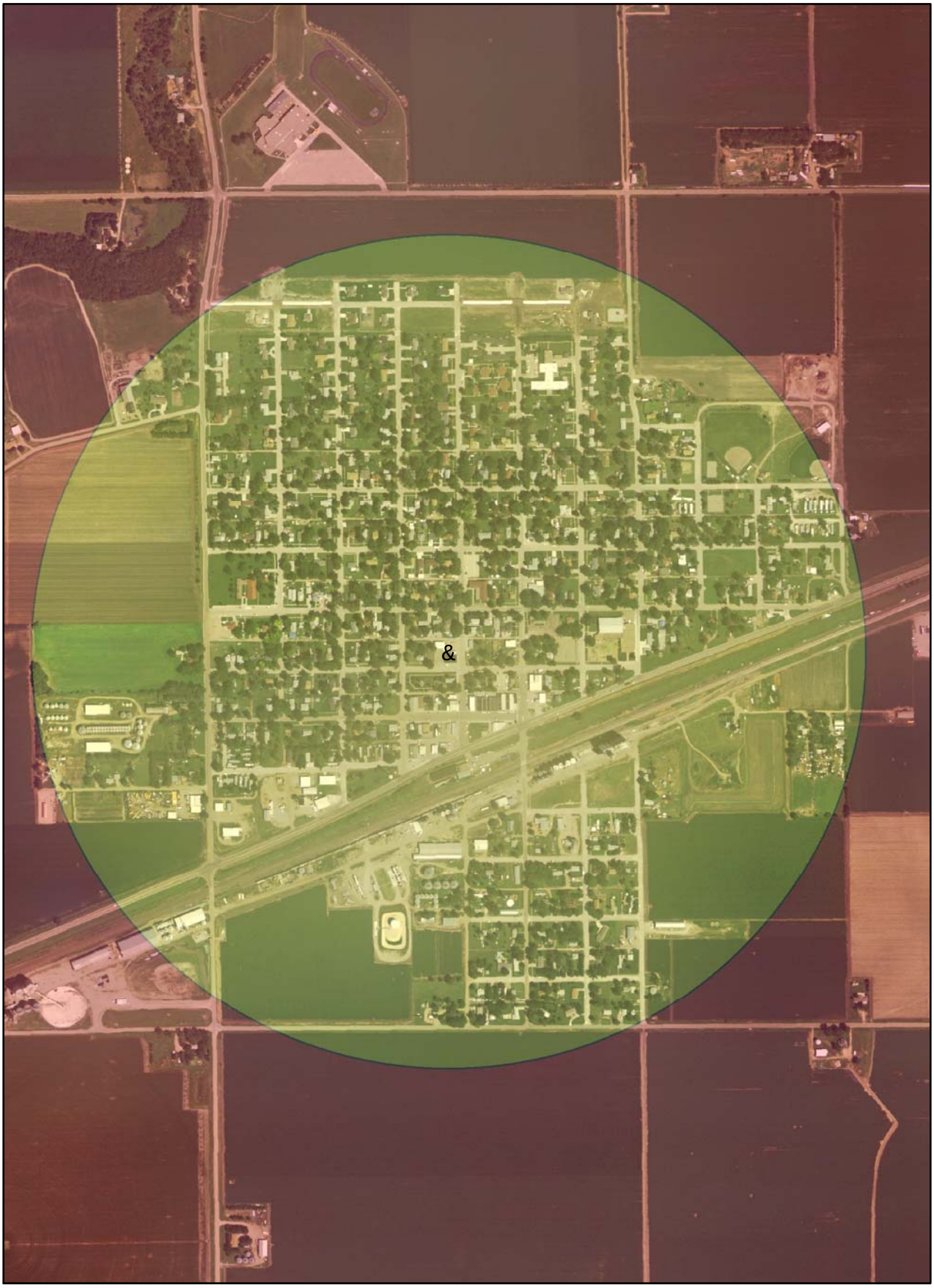

Figure 5
Future Development Areas

APPENDIX E

Adoption Documentation

Resolution Number 08-4

WHEREAS, a study was prepared by the Nebraska Department of Natural Resources for the Village of Doniphan, and

WHEREAS, the purpose of the study was to prepare an all-hazards mitigation plan which establishes the framework and also a process to implement and review the plan to reduce hazards as conditions change, and

WHEREAS, a complete mitigation plan shows that a community is addressing its hazards and qualifies the community for mitigation assistance from federal and state agencies.

WHERAS, the community has identified mitigation activities that can be engaged in but acknowledges that such activities may be accomplished over time as funding is available

NOW, THEREFORE, the governing body of the Village of Doniphan, Hall County, does herewith adopt the All-Hazards Mitigation Plan, a copy of which is marked "Exhibit A" and attached hereto and made a part thereof by reference.

PASSED AND APPROVED this **18th** day of **August**, 2008.

Dan Treat, Chairman

ATTEST BY:

Kim Finecy, Village Clerk