

Lower Platte South Natural Resource District Drought Emergency Response Plan

November 2015



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List of Acronyms

Cfs – Cubic Feet per second
CWSPA – Community Water System Protection Area
HCA – Hydrologically Connected Areas
GWR – Ground Water Reservoir
LPSNRD – Lower Platte South Natural Resource District
MGD – Million Gallons a Day
MUD – Metropolitan Utilities District
NDEQ – Nebraska Department of Environmental Quality
NDMC – National Drought Mitigation Center
NDNR – Nebraska Department of Natural Resources
NOAA – National Oceanic and Atmospheric Administration
NRCS – Natural Resource Conservation Service
NRD – Natural Resource District
NWS – National Weather Service
PDSI – Palmer Drought Severity Index
RA – Remaining Area
RWD – Rural Water District
USDA – U.S. Department of Agriculture
USGS – U. S. Geological Survey
WHPA – Wellhead Protection Areas

Section One: Introduction

The Lower Platte South Natural Resource District (LPSNRD) is located in southeast Nebraska, and receives an average of 28 inches of precipitation each year. At times the local weather patterns can put the district into extended dry periods, also known as a drought. On average the LPSNRD has a drought every two to three years. This section includes: an overview of this plan; the purpose of the plan; the mission of the LPSNRD; and a brief overview of the drought tournament which was a key part of the planning process.

Drought differs from other natural hazards in a number of ways. The major difference between drought and other hazards is the onset and duration of the event. Drought is a slow-onset phenomenon that can last for months or years (in some cases); while other hazards such as tornados develop quickly and only last a few minutes to a few hours. Another difference is the population and area affected by a drought. Droughts normally affect more people than other natural hazards, and their impacts are spread over a larger geographical area. Due to these differences, the detection and early warning signs of drought conditions, and assessment of impacts, are more difficult to identify than that of quick-onset natural hazards (e.g., flood and storm) that result in more visible impacts. Generally according to the National Drought Mitigation Center (NDMC), droughts are classified into four major types:

- **Metrological Drought** – is defined based on the degree of dryness and the duration of the dry period. Metrological drought is often the first type of drought to be identified and should be defined regionally as precipitation rates and frequencies (“norms”) vary.
- **Agricultural Drought** – occurs when there is deficient moisture that hinders plant germination, leading to low plant population per hectare and a reduction of final yield. Agricultural drought is closely linked with metrological and hydrological drought, as agricultural water supplies are contingent upon the two sectors.
- **Hydrologic Drought** – occurs when water available in aquifers, lakes, and reservoirs falls below the statistical average. This situation can arise even when the area of interest receives average precipitation. This is due to the reserves diminishing from increased water usage, usually from agricultural use or high levels of evapotranspiration resulting from prolonged high temperatures. Hydrological drought is often identified later than metrological and agricultural drought. Impacts from hydrological drought may manifest themselves in decreased hydropower production and loss of water based recreation.
- **Socioeconomic Drought**– occurs when the demand for an economic good exceeds supply due to a weather-related shortfall in water supply. The supply of many economic goods include, but are not limited to, water, forage, food grains, fish, and hydroelectric power.

The occurrence of a drought can also create conditions which exacerbate the impacts of other hazards, or increase the probability of their occurrence. The damage done by these hazards is considered cascading impacts from the drought. Drought, for example, might increase the risk of wildfires due to the resulting dry conditions. Drought conditions can also lead to flooding, since overly dry soil is not able to absorb moisture quickly, increasing the amount of runoff, and leading to flash flooding. Droughts can also weaken trees and result in greater damages during severe weather or high wind events.

Plan Summary and Organization

This plan consists of the seven sections described below:

Section One – Introduction: This section introduces the drought emergency response plan, including an overview of LPSNRD, purpose of the plan, and the drought tournament.

Section Two – NRD Description and Physical Characteristics: This section provides an overall profile of the planning area including geography, climate, plants and wildlife, and water resource.

Section Three – Demographics and Economics: This section provides an overall profile of the planning area including demographics, major water users, agricultural information, and water based recreation.

Section Four – Water Management: This section contains the LPSNRD water management controls, information on irrigated acres, water allocation, water storages, and flood controls

Section Five – Drought Defined Locally: This section discusses what a drought looks like in the LPSNRD including discussion on historic droughts and the potential of droughts in the future.

Section Six – Drought Monitoring Board Recommendations: This section contains recommendations for developing a Water Resource Committee and the process for making a drought declaration including the indicators used, the notification process, and how to revoke the declaration.

Section Seven – Response Actions: This section discusses what controls LPSNRD has over water appropriations in the NRD and who controls ground water and surface water rights. The section then contains recommendations on educational resources that are available to the public. This section also highlights what the LPSNRD is doing under the state drought plan and other actions the LPSNRD can consider.

Purpose of the Plan

The purpose of the plan is to help the LPSNRD develop strategies to respond to and manage the impacts of a multi-year drought. The plan is being developed by the LPSNRD as part of its integrated management plan with input from communities and stakeholders within the district. This plan will include methods for the district, localities, agricultural, and recreational users to reduce demand during times of drought.

Lower Platte South NRD Mission

LPSNRD is one of Nebraska's 23 Natural Resource Districts (NRDs). Unlike the county-wide districts found in most states, Nebraska's NRDs are based on river basin boundaries, enabling them to approach natural resources management on a watershed basis. LPSNRD is autonomous, governed by a locally-elected Board of Directors. While NRDs share a common set of responsibilities, each district sets its own priorities and develops its own programs to serve local needs. In general, NRDs are charged under state law with 12 areas of responsibility:

- Erosion prevention and control
- Prevention of damages from flood water and sediment
- Flood prevention and control
- Soil conservation
- Water supply for any beneficial uses
- Development, management, utilization, and conservation of ground water and surface water
- Pollution control

- Solid waste disposal and drainage
- Drainage improvement and channel rectification
- Development and management of fish and wildlife habitat
- Development and management of recreational and park facilities
- Forestry and range management

LPSNRD takes the lead on a variety of projects that fulfill the responsibilities required by the state law. Some recently completed projects include Bank Stabilization, Salt Creek Levee, Flood Control Watershed Project Dams, Antelope Valley Flood Control Project, Flood Control Non-Watershed Project Dams, Stream Interventions, and Trails/Conservation Corridors. The NRD also offers educational programs, cost-shares with landowners to conserve, and establishes many other programs for the protection of natural resources, which includes the management and control of ground water. In addition to taking the lead in long-term drought management planning, the NRD also develops plans for water resources, storm water management, hazard mitigation, and emergency actions.

Drought Tournament

In order to bring stakeholders together to help with the development of the plan LPSNRD sponsored a drought tournament. A drought tournament is a table top drought exercise which includes a gaming element and encourages individuals to work competitively. The goals of the drought tournament were to gain an understanding of how stakeholders across the NRD respond to drought conditions and to identify potential gaps in planning and response.

Prior to the tournament research was conducted to establish how communities across the NRD plan for drought response. The drought response plan for the City of Lincoln was reviewed and incorporated as a component of the scenario utilized for the tournament. Other communities, water users, and water suppliers were contacted in the lead-up to the tournament and asked about their own drought response plans. Across the district the response was consistent, there are drought response protocols but they have not been formally documented up to this point.

Stakeholder Involvement

A key component to the drought tournament was stakeholder engagement. For this event a stakeholder list was developed based upon the participants from previous planning processes, such as the Integrated Management Plan and Hazard Mitigation Plan. This was based upon the assumption that past participants would be more likely to attend meetings moving forward, and the goal was to have between 20 and 30 participants from a range of stakeholder groups. Stakeholder groups identified and invited to participate included: farmers, water suppliers, village and city officials, Nebraska Game and Parks, U.S. Department of Agriculture (USDA) Farm Service Agency, county emergency management, state emergency management, the University of Nebraska – Lincoln, and staff from the NRD. For the event 29 stakeholders were in attendance (some served as observers while most participated directly in the event). Sign-in sheets are included in the *Appendix A* of this plan.

The tournament was designed as a one day workshop in which a drought scenario based on the historical data from the 2012 drought in the NRD was utilized. Data (such as the National Oceanic and Atmospheric Administration (NOAA) Drought Outlook, U. S. Drought Monitor, U.S. Geological Survey (USGS) stream flows, etc.) were adapted from the year of record for use in the scenario. A summary report from the tournament can be found in *Appendix B* of this plan.

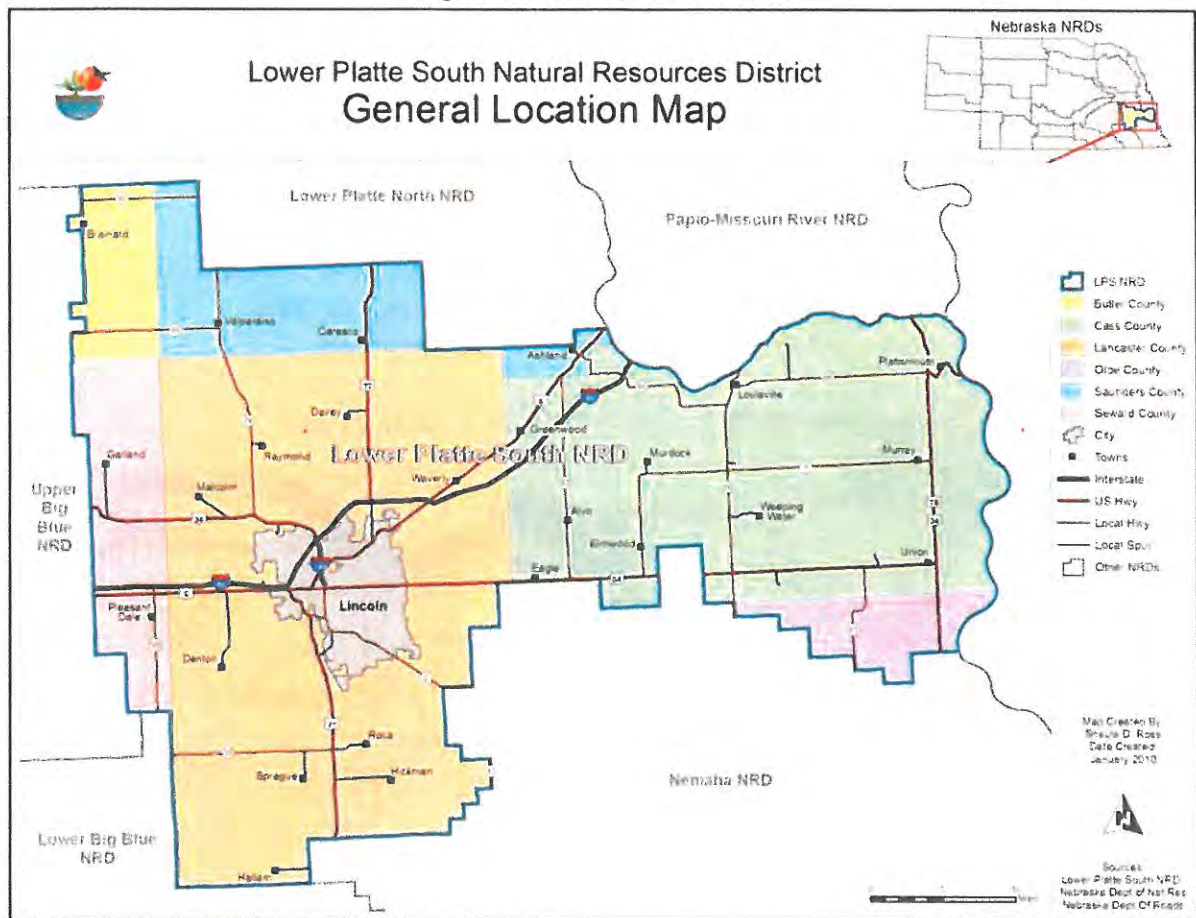
Section Two: NRD Description and Physical Characteristics Summary

- Location and Physical Characteristics of LPSNRD
- Natural Resources

Location

The LPSNRD is located in southeastern Nebraska and is made up of almost all of Lancaster and Cass Counties as well as portions of Seward, Saunders, Otoe, and Butler Counties. The NRD covers more than 1,069,000 acres (1,600 square miles). Figure 1 shows the location of the LPSNRD.

Figure 1: Location of LPSNRD

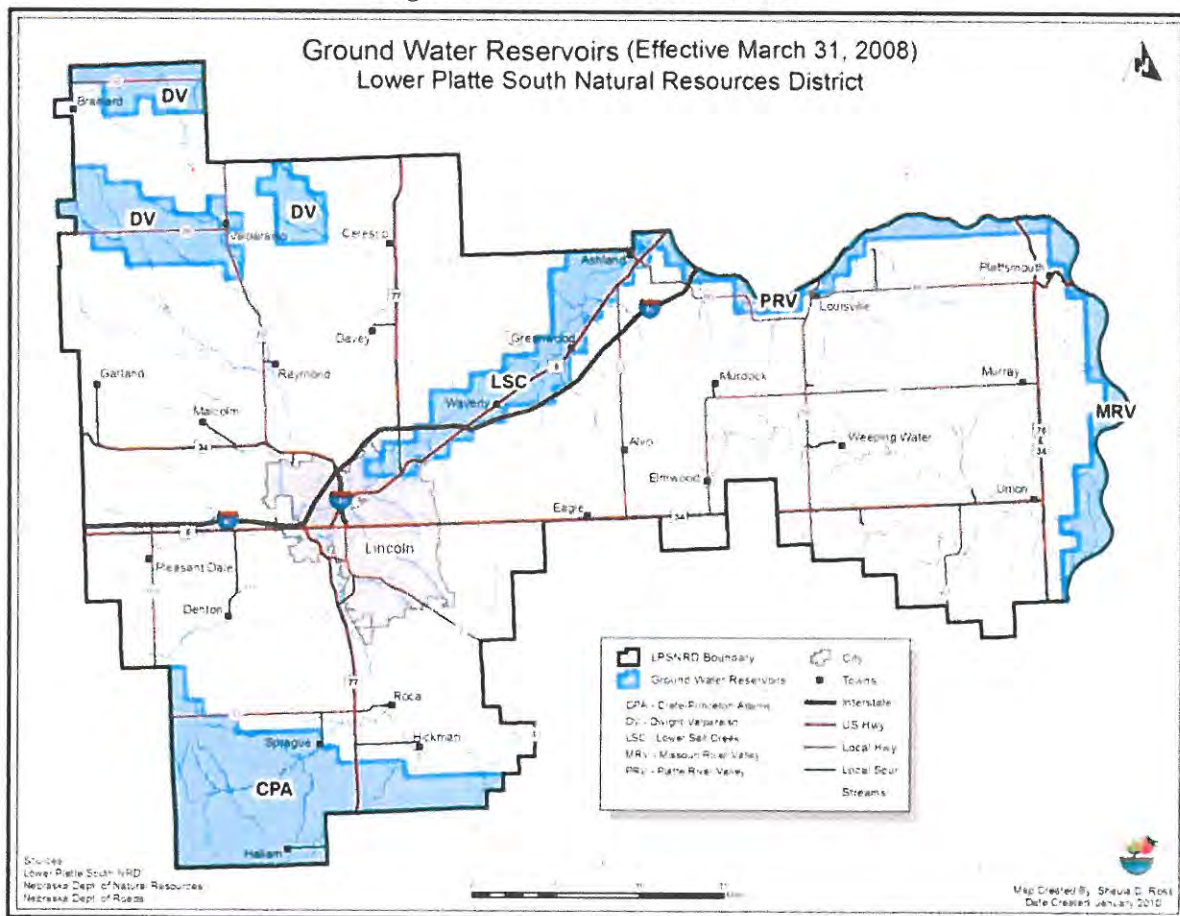


The District consists of the Salt Creek Watershed, the Weeping Water Creek Watershed, and the Northeast Cass Watershed. The Salt Creek Watershed is comprised of a series of sub-basins such as; Antelope Creek, Beal Slough, Cardwell Branch, Deadman's Run, Upper Salt Creek, Rock Creek, Callahan, Dee, Haines Branch, Little Salt Creek, Lynn Creek, Middle Creek, Oak Creek, Southeast Upper Salt Creek (SEUSC), and Stevens Creek basins. The District mostly drains into the Platte River along with the Missouri River to the east. As described by its name, the area is considered the southern portion of the Lower Platte River watershed. The estimated storage of surface water is 70,000 acre-feet.

There are eight flood control reservoirs that are owned by the district. These are Wildwood, Meadowlark, Red Cedar, Timber Point, Cottontail, Merganser, Tanglewood, and Wild Plum. The district also owns saline wetlands. Saline wetlands are classified as such by the levels of salinity found in the soil. The saline wetlands are one of the Earth's rarest ecosystems; only 4,000 acres of the estimated 20,000 that originally existed, remain today. The LPSNRD's wetlands are home to two endangered species, thus it is especially important to make thorough efforts to conserve these wetlands. The US Army Corps of Engineers owns ten flood control reservoirs with the district, which include: Bluestem, Branched Oak, Conestoga, Holmes, Olive Creek, Pawnee, Stagecoach, Twin Lakes, Wagon Train, and Yankee Hill. All of the lakes allow some type of boats and recreational activities. There are at least 200 permits that have been issued for smaller reservoirs to store surface water.

The geology of the district makes ground water within the LPSNRD variable from place to place. To address this the district has delineated five major ground water reservoirs (GWRs) in its jurisdiction. The GWRs are areas where useable amounts of good quality ground water are generally available. The remainder of the district has been designated as the remaining area (RA). The RA includes the Dakota Formation aquifer and other aquifers not designated as GWRs. Ground water within the RA is discontinuous spatially, and variable in both quality and quantity. The ground water storage in the LPSNRD area is estimated to be 4,000,000 acre-feet. Figure 2 shows the location of the GWRs and the RA in LPSNRD.

Figure 2: Ground Water Reservoirs



Geography & Soils

This region lies in a topographic region of 'rolling hills'. Rolling hills are hilly land with moderate to steep slopes and rounded ridge crests. In eastern Nebraska, the rolling hills are mostly glacial till that has been eroded and mantled by loess.

There are four main soil associations that are present in the NRD. These associations include the Aksarben Association, the Aksarben-Pawnee-Steinauer Association, the Marshall-Ponca Association and the Wymore-Pawnee Association. All of the associations are moderately well drained soils and are mostly all silty soils, with the exception of the Pawnee and Steinauer soils which are loamy soils.

Land Use & Land Cover

The land cover in the NRD consists of two main types: agriculture and urban. Within the NRD there are also small areas of forested land, wetlands and water. Agriculture accounts for 82.1 percent of the land cover with 52 percent crops and 30 percent pasture/grassland. Urban land accounts for 9.1 percent of the NRD with Lincoln holding the most developed land. Forests represent 6.5 percent of the of the land cover. Open water accounts for 1.6 percent and wetlands accounts for 0.7 percent of the land cover.

Cropland use can be broken down even further by the type of crops grown. Based on data from the USDA the two main crops grown are corn (49%) and soybeans (48%). The other crops grown include alfalfa (2%) and wheat, barley, popcorn, oats, potatoes, rye, and sorghum (1%). The most water intensive crops grown in the LPSNRD include soybeans requiring about 2 inches of water per day during the growing season, wheat requiring about 1.3 inches of water per day during the growing season, and corn requiring about .65 inches per day of water during the growing season. Corn is can be very drought tolerant in the early growing stages however after about 40 days after emergence corn requires a large amount of water. Figure 3 shows the 2010 LPSNRD Land Cover:

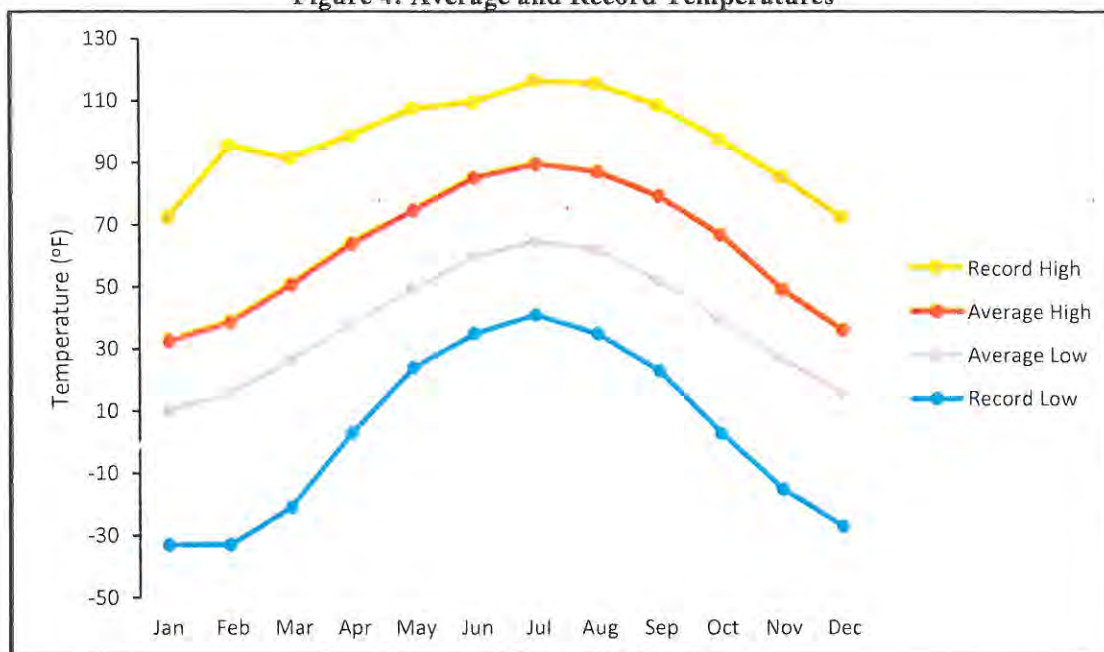
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Climate

Located on the Great Plains far from the moderating influence of mountains or large bodies of water, the planning area possesses a highly variable four-season humid continental climate: winters are cold, but relatively dry; springs are generally warm with a regular wind; summers are hot and humid; and fall is generally pleasant but can produce an early season snow event. With little precipitation falling during winter, precipitation is concentrated in the warmer months, when thunderstorms frequently roll in, some can produce tornados. Snow tends to fall in light amounts, but heavy snow and blizzards are possible.

The average annual temperature for LPSNRD is 61.9°F (16.6°C) based on the 30 year normal from 1971 – 2000 for 2 miles outside of Ashland, NE (250375). The average high temperature for July is 87.3°F (30.7°C), and the average low temperature for January is 11°F (-11.7°C). Figure 4 shows the average and record temperatures for the LPSNRD. However, the planning area is subject both to episodes of bitter cold in winter and heat waves during summer, with 11.4 nights of sub-0°F (-18°C) lows, 41 days of 90°F (32°C)+ highs, and 4.6 days of 100°F (38°C)+ highs. The planning area straddles the boundary of USDA Plant Hardiness Zones 5b and 6a, indicating an annual minimum temperature of around -10°F (-23°C). Temperature extremes have ranged from -33°F (-36°C) on January 12, 1974 up to 115°F (46°C) on July 25, 1936.

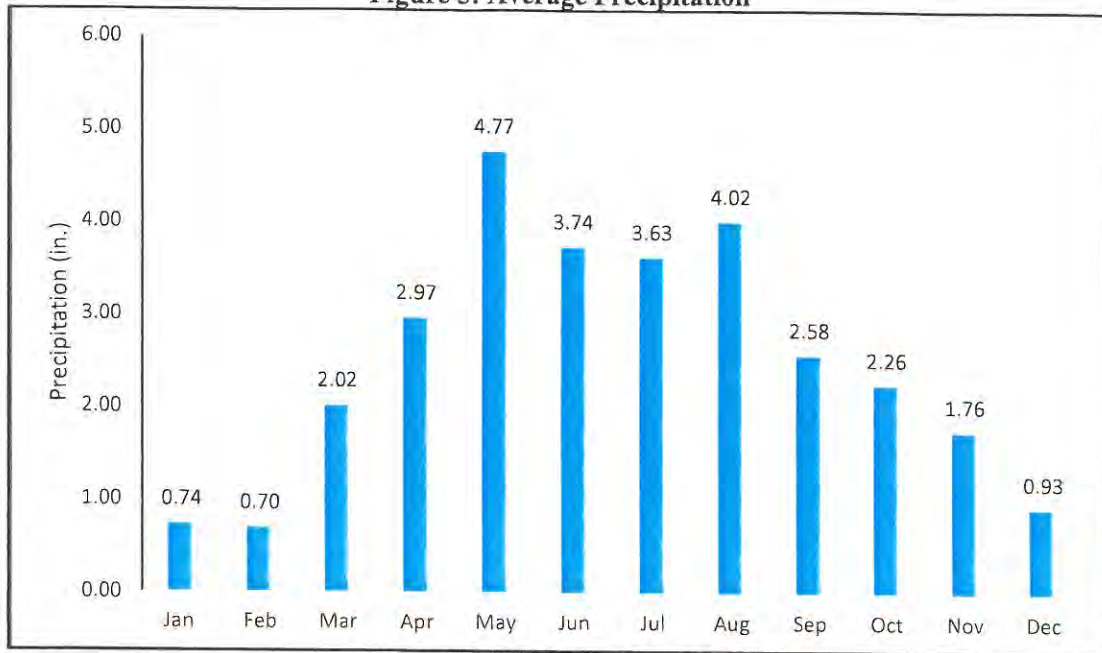
Figure 4: Average and Record Temperatures



Source: High Plains Regional Climate Center

The monthly precipitation averages range from 0.70 inches in February to 4.77 inches in May based on the 30 year normal for the station 2 miles outside of Ashland. Figure 5 shows the average monthly precipitation. Given the range in temperatures some of the precipitation will fall as snow. The NRD averages about 24.7 inches of snow between October and April. The monthly snowfall averages range from 0.5 inch in October to 6.0 inches in February.

Figure 5: Average Precipitation



Source: High Plains Regional Climate Center

Plants & Wildlife

Plants and wildlife are not immune to the impacts of drought. When the drought is combined with intense heat it can lead to grass/wildfires. In addition to fire plants can also be affected from the stress due to high temperatures and lack of precipitation. Within LPSNRD nearly 76,800 acres of land is either forest land or wetlands. This accounts for 7.2 percent of the land in the NRD, and this accounts for the majority of the habitat for the wildlife in the NRD.

The most noticeable wildlife effect from drought would be the whitetail deer population. During droughts animal populations become more vulnerable to diseases, such as epizootic hemorrhagic disease in the case of whitetail deer.

Fish kills have also been reported in the NRD as a result of low flows and high water temperatures along the Platte River. The Platte River is habitat to many species of fish including catfish, carp, minnows, the endangered pallid sturgeon, and many others.

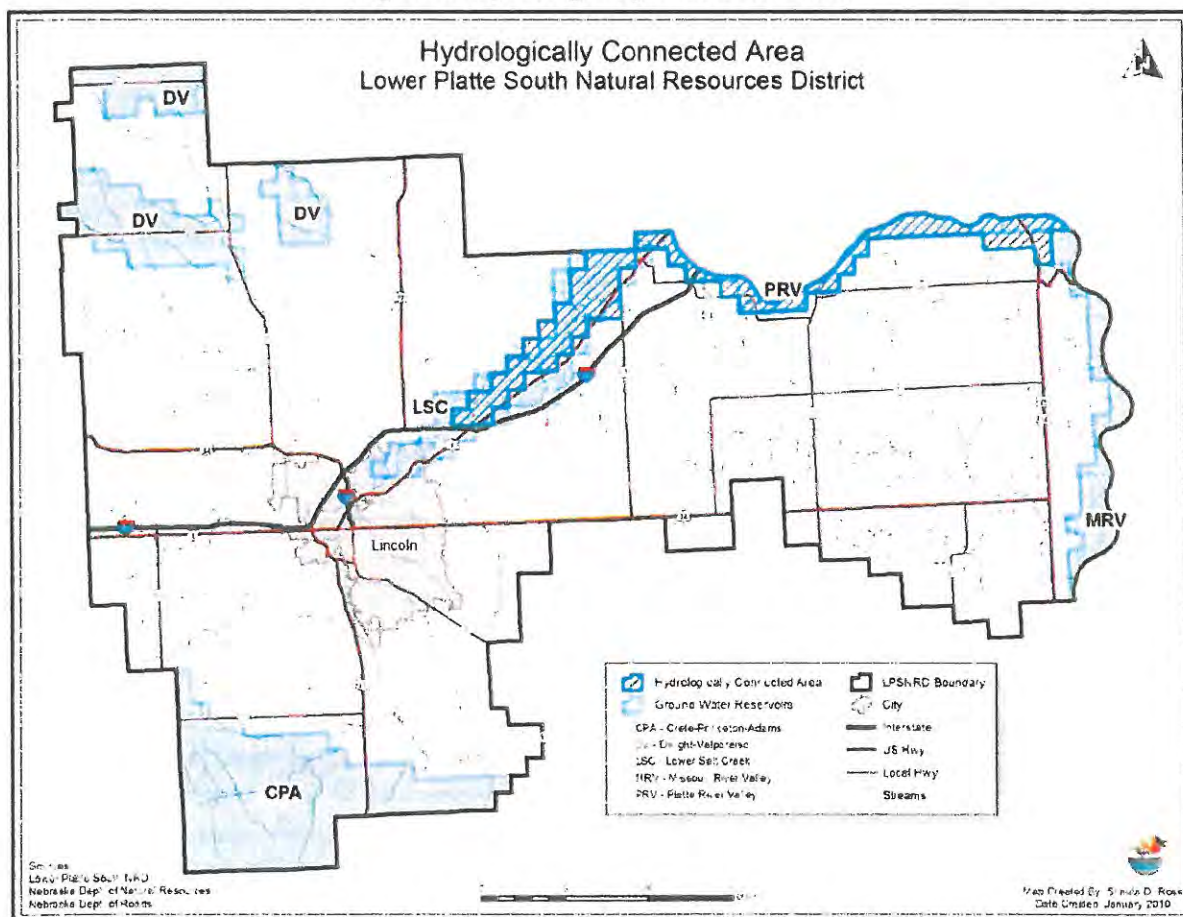
There are endangered species that have habitat in the area. The endangered species that could be the most affected by drought include the interior least tern, the piping plover, and the pallid sturgeon. During a drought the Platte River can experience low flows and many areas can run completely dry. The Nebraska Game and Parks Commission holds permits for instream flows on the Lower Platte River for pallid sturgeon and other fish species, but during a severe drought the flows may run below normal or permitted due to the conditions.

The piping plover is endangered due to the loss of suitable nesting areas. During prolonged droughts grasses and vegetation can begin growing on the beaches and sandbars along the Platte River making these areas unsuitable for plover nesting. The interior least tern also prefers the sandbars along the Platte River for nesting. The same issue that causes a problem for the plover may also present a problem for the least tern.

Water Resources

The LPSNRD manages ground water and surface water. There are areas within the district where surface water supplies are considered to be hydrologically connected to ground water. There are two areas of hydrologically connected ground and surface water that have been designated by the NDNR under current state programs. These areas include Salt Creek from Waverly to the Platte River and about 70 square miles along the Platte and Missouri Rivers. Seven public water suppliers have wells in the hydrologically connected areas (HCA). The LPSNRD also recognizes that there are other areas of hydrologic connection (e.g. spring-fed creeks, saline wetlands, etc.) in the district. These other areas of hydrologic connection could run dry during periods of drought.

Figure 6: Hydrologically Connected Area



Section Three: Demographics & Economics

Summary

- Population
- Major Water Uses

Population

Table 1 provides a summary of population changes from 2000 to 2010. The percent change was then used to project the population for 2020. This is a relatively simple method to predict population change and it does not account for predominant age cohorts in the community, birth and death rates, or in and out migration which will likely impact the rate of growth or decline. It is important to understand how the population will change due to the fact that water use and population are positively correlated, meaning that as population increases there also is likely to be an increase in water use.

Table 1: Population Trends 2000 - 2010

Jurisdiction	2000 Population	2010 Population	Change	2020 Projected Population
Cass County	24,334	25,241	3.73%	26,182
Alvo	142	132	-7.04%	123
Eagle	1,105	1,024	-7.33%	949
Elmwood	668	634	-5.09%	602
Greenwood	544	568	4.41%	593
Louisville	1,046	1,106	5.74%	1,169
Manley	191	178	-6.81%	166
Murdock	269	236	-12.27%	207
Murray	481	463	-3.74%	446
Nehawka	232	204	-12.07%	179
Plattsmouth	6,887	6,502	-5.59%	6,139
South Bend	86	99	15.12%	114
Union	260	233	-10.38%	209
Weeping Water	1,103	1,050	-4.81%	999
Lancaster County	250,291	285,407	14.03%	325,449
Davey	153	154	0.65%	155
Denton	189	190	0.53%	191
Hallam*	(2010)* 213	(2013)* 216	1.4%*	220*
Hickman	1,111	1,657	49.14%	2,471
Lincoln	225,581	258,379	14.54%	295,947
Malcolm	413	382	-7.51%	353
Raymond	186	167	-10.22%	150
Roca	220	220	0.00%	220
Sprague	146	142	-2.74%	138
Waverly	2,448	3,277	33.86%	4,387

Jurisdiction	2000 Population	2010 Population	Change	2020 Projected Population
Butler, Saunders, and Seward Counties	4,588	4,663	1.63%	4,739
Ashland	2,262	2,453	8.44%	2,744
Brainard	351	330	-5.98%	310
Ceresco	920	889	-3.37%	859
Garland	247	216	-12.55%	189
Pleasant Dale	245	205	-16.33%	172
Valparaiso	563	570	1.24%	577
LPSNRD	278,721	314,890	12.98%	356,121

Source: United States Census Bureau – 2000, 2010

**The Village of Hallam was significantly impacted by a tornado in 2004, as a result the population of the community has decreased significantly from 2000 (population of 304) to 2010 (population of 213). For the purpose of the population projections Hallam's population change from 2010 to 2013 was used to project the 2020 population. It should be noted that this projection is based on a very narrow timeframe and provides a very rough estimate for population change.*

Lancaster County

Lancaster County has 10 communities within the county that are part of the LPSNRD. The largest community is the City of Lincoln. Lincoln uses the most water in Lancaster County because of its size. The well field for the city is located in Saunders County near the City of Ashland. The fastest growing jurisdiction is the City of Hickman which grew by 49 percent between 2000 and 2010. If the population for the City of Hickman continues to grow it will require more water to be able to meet the demand of a larger population. The Village of Raymond experienced the largest population decline losing just over 10 percent of its population between 2000 and 2010.

There are two rural water districts (RWD) that serve portions of Lancaster County. The Lancaster RWD serves the Villages of Bennet, Panama, and Roca and currently has 3,297 customers. The Cass RWD #2 also serves customers in east central Lancaster County. If the population of Lincoln and surrounding areas continues to grow the RWDs expects to see a rise in the number of customers served by the RWDs.

Cass County

Cass County has 13 communities within the county that are part of the LPSNRD. The largest community is the City of Plattsmouth. Plattsmouth uses the most water in Cass County because of the size of its population. The well field for the city is located northeast of the city along the Platte and Missouri Rivers. The fastest growing jurisdiction is the Village of South Bend which grew by 15 percent between 2000 and 2010. The village is served by Cass County RWD #2. If the population of the rest of the RWD #2 grows it may be required to expand its well field to meet the increased demand. The Village of Murdock experienced the largest population decline losing just over 12 percent of its population between 2000 and 2010.

There are three RWDs within Cass County. Two of the RWDs serve areas primarily in Cass County and the final RWD primarily serves communities in Otoe County. Cass County RWD # 1 serves the eastern part of Cass County excluding the Cities of Plattsmouth and Louisville and the Village of Union. Cass County RWD #1 serves 3,253 customers. Cass County RWD #2 serves customers in parts of rural Cass, Otoe, and Lancaster Counties. RWD #2 serves 2,500 customers.

Otoe County RWD #3 serves the Villages of Avoca, Douglas, Dunbar, Otoe, Manley, Unadilla, and Palmyra. The RWD serves Otoe County but has a well field located north of the City of Weeping Water. Otoe County RWD #3 serves 2,440 customers.

Major Water Users

The majority of the water used in the LPSNRD for municipal, domestic, irrigation, and other used comes from ground water. The GWRs contain most of the 418 irrigation and public supply wells located within the NRD boundary. There are 450 surface water permits to divert water from streams or reservoirs for irrigation purposes and one instream flow right on the lower Platte River issued to the Game and Parks Commission. Figure 7 shows the location for domestic and public water supply wells within the district. This figure is only a partial representation of domestic wells, due to the fact that domestic wells were not required to be registered prior to 1993. Figure 8 shows the registered irrigation wells within the NRD boundary.

Figure 7: Locations of Registered Domestic and Public Water Supply Wells

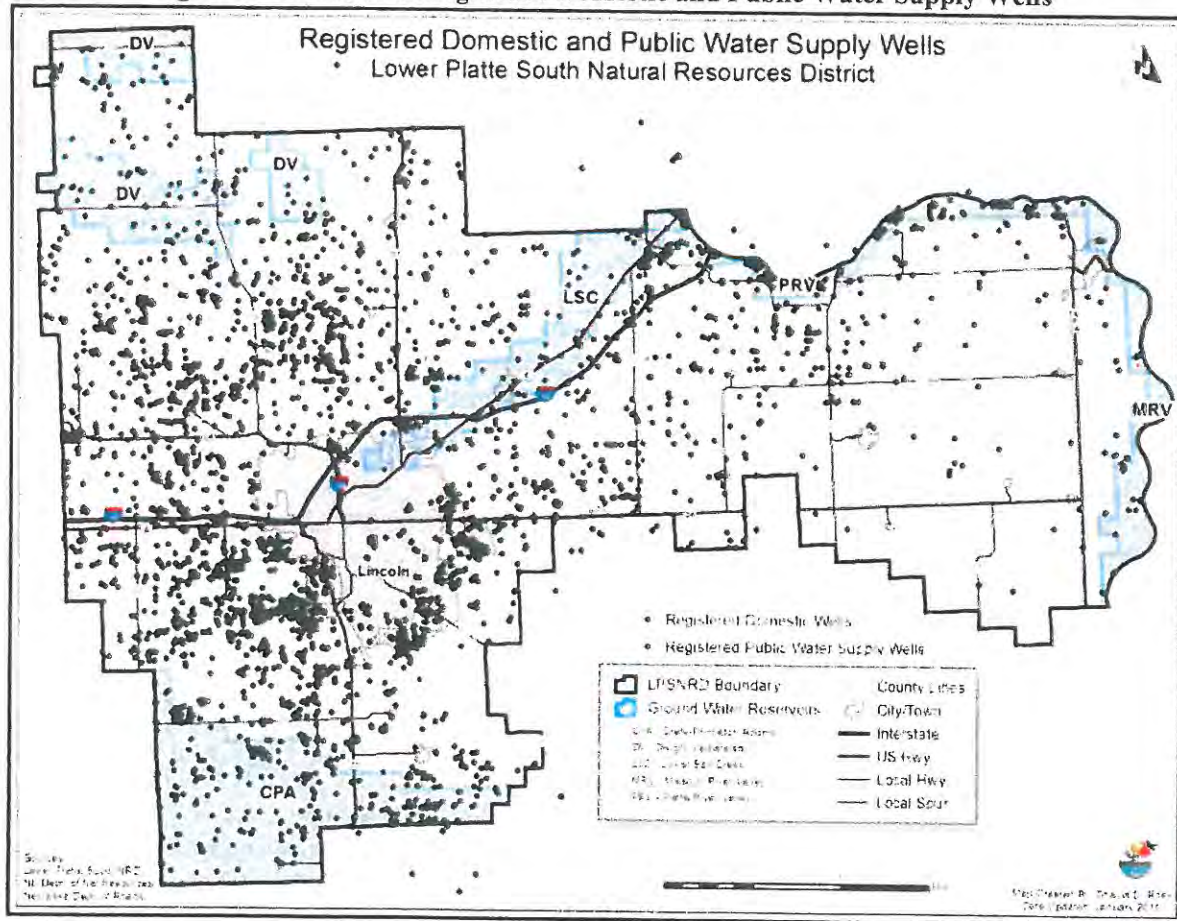
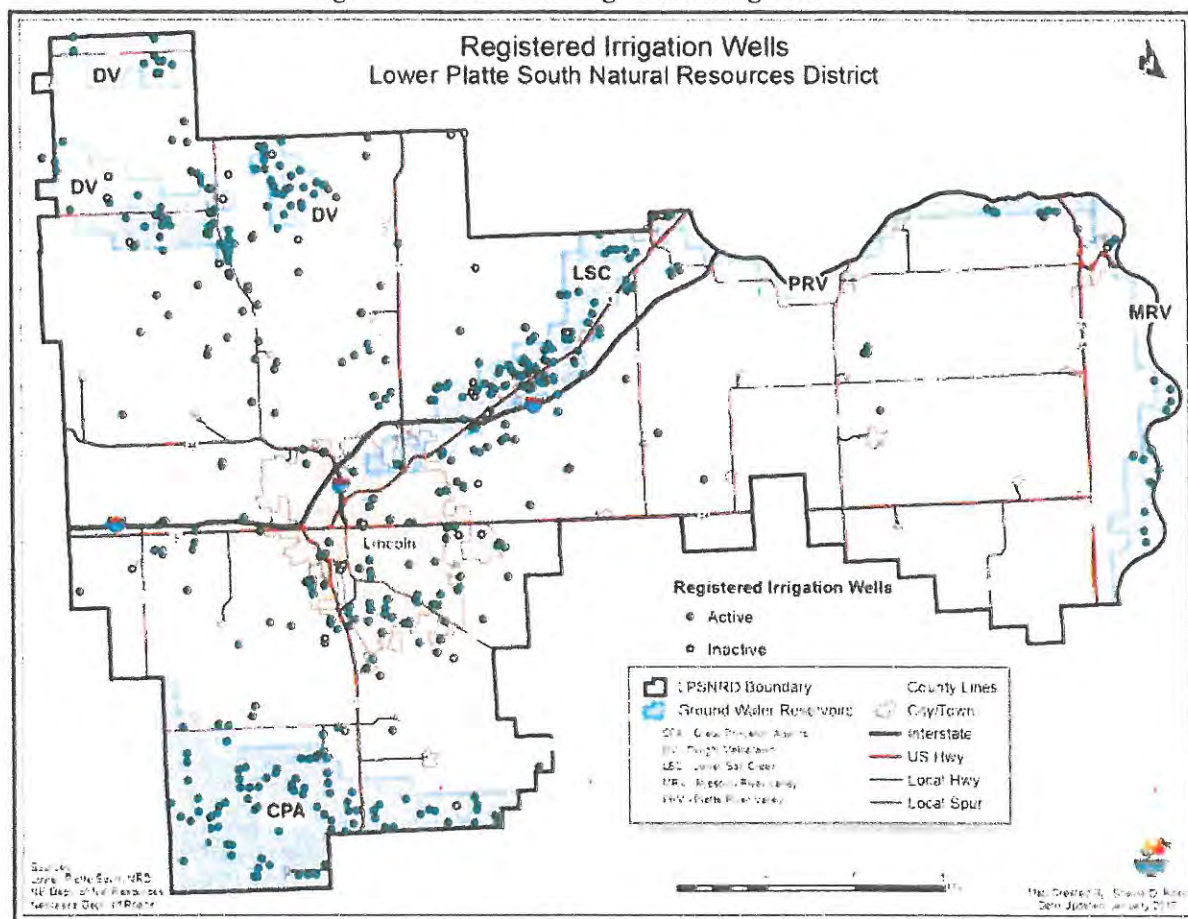
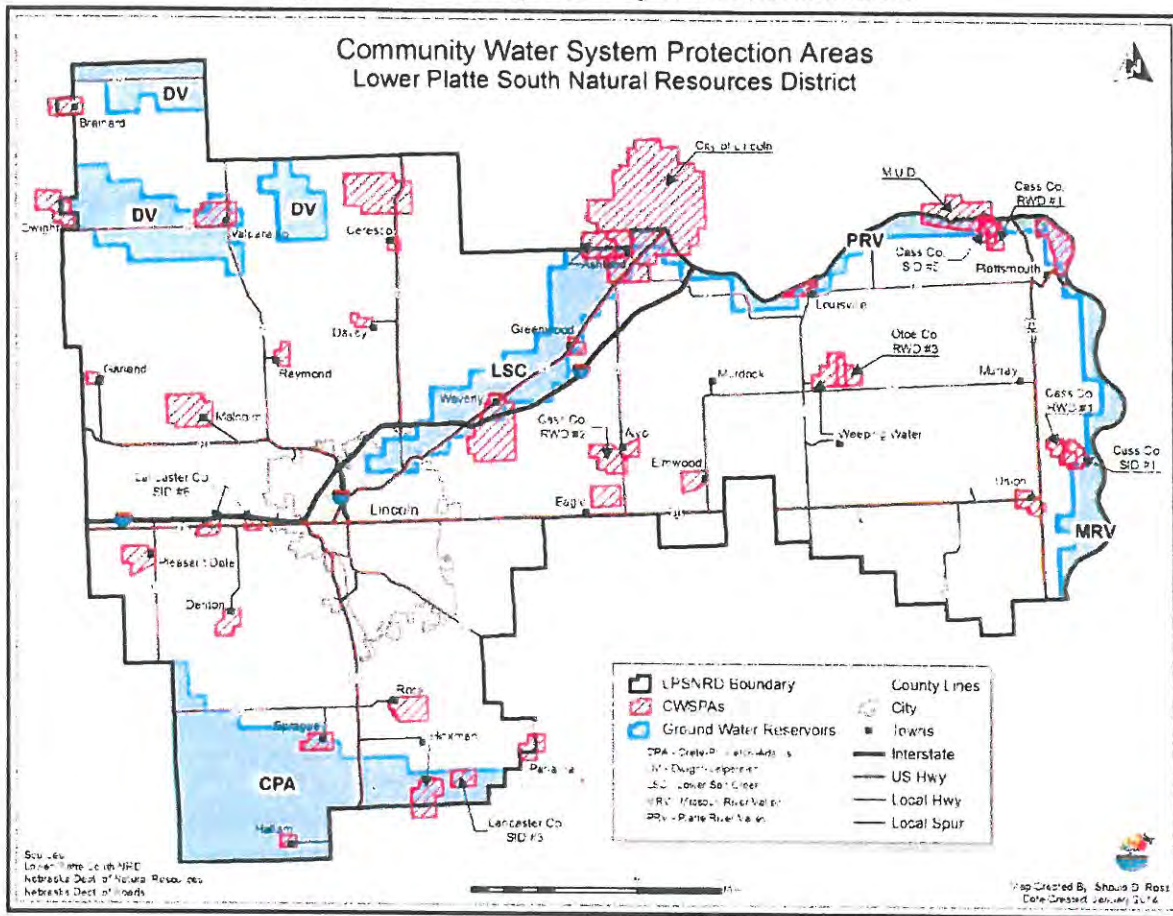


Figure 8: Location of Registered Irrigation Wells



Drinking water in LPSNRD comes primarily from ground water sources. To protect these water supplies the Nebraska Department of Environmental Quality (NDEQ) delineated Wellhead Protection Areas (WHPAs) for all public water supply systems. LPSNRD chose to adopt the boundaries of these WHPAs as additional areas of ground water management. LPSNRD refer to these areas as Community Water System Protection Areas (CWSPAs). Figure 9 shows the locations of the CWSPAs in LPSNRD.

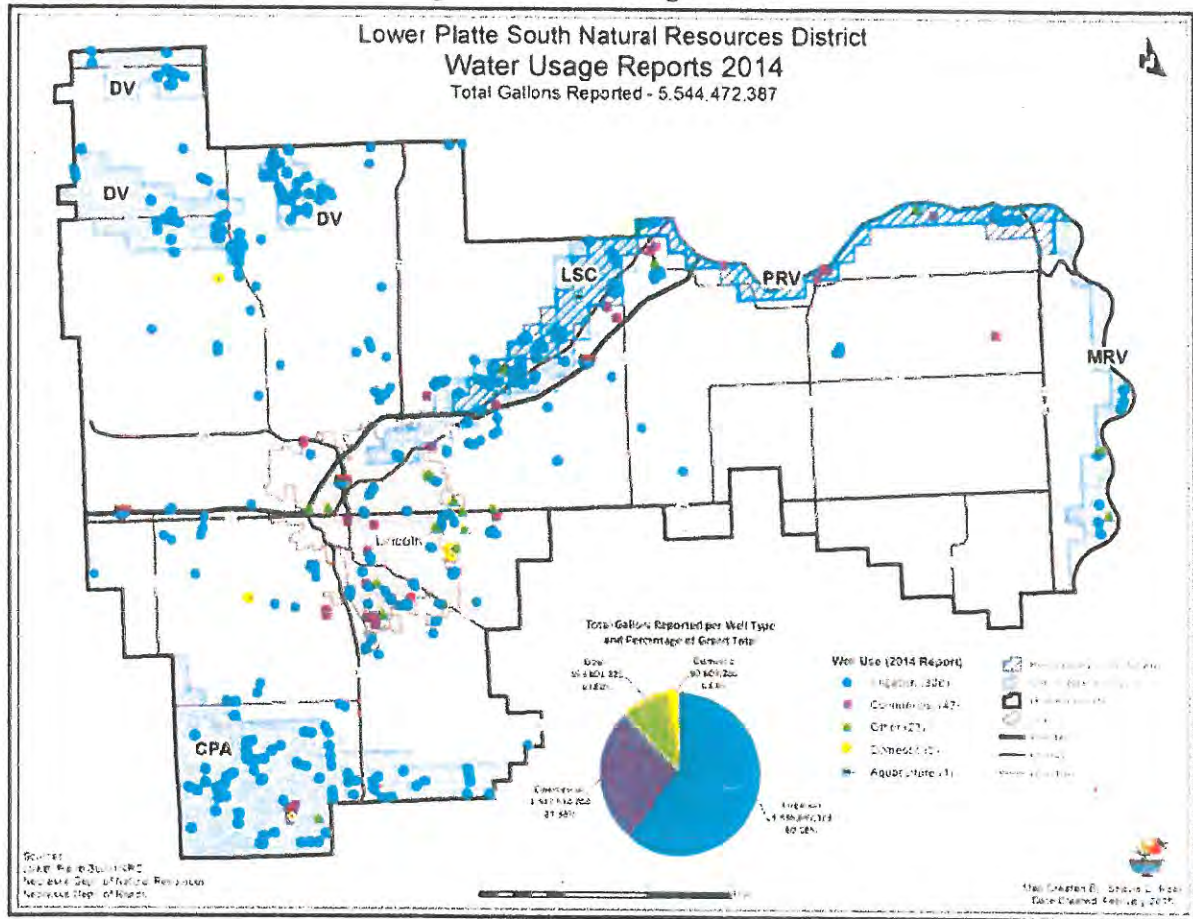
Figure 9: Community Water System Protection Areas



The largest CWSPA in Lancaster County is owned by the City of Waverly. The Village of Davey has the smallest CWSPA in Lancaster County. In Cass County, the largest CWSPA is owned by the Metropolitan Utilities District (MUD), which provides water to the City of Omaha. The smallest CWSPA in Cass County is owned by the Village of Alvo. The City of Lincoln has the largest CWSPA in the entire NRD, but the majority of the CWSPA is located outside of the LPSNRD boundary.

In 2013 LPSNRD was able to calculate the water usage for 352 wells across the district based on data from water meters. The wells pumped a total of 6,092,953,503 gallons in 2013 (Figure 10). Of those 352 wells 279 are irrigation wells. The irrigation wells are responsible for 72 percent of the total which is roughly 4.4 billion gallons.

Figure 10: Water Usage for 2014



Agricultural Inventory

One percent of people working in the district are dependent on agriculture, forestry, fishing, or hunting for their employment based on data from the U.S. Census Bureau. LPSNRD has 2,567 farms that cover 823,892 acres of land. Table 2 shows the number of farms in Lancaster and Cass Counties.

Table 2: Land in Farms in Cass and Lancaster Counties

County	Number of Farmers	Land in farms	Market value of Crop Sales
Cass	731	334,869 acres	\$140,172,000
Lancaster	1,836	489,023 acres	\$146,709,000

Source: 2012 Census of Agriculture

Table 3 shows the total number of acres planted for the most popular crops in the two counties. In Cass County the most water intensive crops (corn and soybeans) about 1.2 percent of the harvest acres were irrigated in 2012. In Lancaster County about 6.0 percent of the harvested acres were irrigated. Having

irrigation makes these farms more resilient to drought when irrigation is possible. The farms without irrigation are not as resilient to drought and are dependent on timely rainfalls during the growing season.

Table 3: Crop Totals Cass and Lancaster Counties

Crop	Acres Harvested : Cass County	Value	Acres Harvested: Lancaster County	Value
Total Corn	136,271	\$80,576,000	167,950	\$83,215,000
Irrigated Corn	2,216	\$1,310,303	12,461	\$6,263,297
Total Wheat	1,122	\$404,000	4,533	\$1,695,000
Irrigated Wheat	0	\$0	NA	NA
Total Oats	79	NA	110	NA
Irrigated Oats	0	NA	0	NA
Total Soybeans	140,042	\$54,615,000	166,654	\$54,372,000
Irrigated Soybeans	1,060	\$413,389	7,566	\$2,468,458

Source: 2012 Census of Agriculture

While crops are the top agricultural product for LPSNRD, there is some livestock being raised in the planning area. Table 4 shows the cattle inventory for Cass and Lancaster Counties.

Table 4: Cattle Inventory Cass and Lancaster Counties

County	Number of farms with Cattle	Number of Cattle	Value
Cass	213	9,824	NR
Lancaster	477	21,732	\$11,867,000

Source: 2012 Census of Agriculture

NR indicates that the data was not disclose to the public

Water Based Recreation

There are many opportunities for water based recreation in LPSNRD. There are eight state recreation areas, two state parks, LPSNRD owns eight lakes, the City of Lincoln has three parks with lakes, and many private lakes are located throughout the LPSNRD. The state recreation areas include Branched Oak, Pawnee, Conestoga, Bluestem, Olive Creek, Stagecoach, and Wagon Train in Lancaster County and Louisville in Cass County. Branched Oak has 49 boat docks and nine boat ramps; Pawnee has two docks and three ramps, Bluestem, has four docks and three ramps; Olive Creek has eight docks and two ramps; and Conestoga, Stagecoach, and Wagon Train each have one dock and one ramp. Olive creek, Stagecoach, and Wagon Train all limit boat speeds to not over 5 mph. Louisville only allows electric motor or non-powered boats. All of the areas have at least one swimming beach except for Branched Oak and Pawnee which have two swimming beaches and Conestoga, Olive Creek, and Stage coach which do not have any swimming. The two state parks Platte River and Mahoney Parks have swimming pools and the opportunity to rent paddle boats. All of the state parks allow fishing.

LPSNRD owns eight lakes which include Wildwood, Red Cedar, Cottontail, Wild Plum, Timber point, Meadowlark, and Tanglewood. All of the parks allow boating, but speeds are restricted to 5 mph. None of the lakes have a boat dock, but all except Tanglewood have at least one boat ramp.

The City of Lincoln has three city parks with lakes. Those parks include Bowling Lake, Holmes Lake, and Oak Lake. All three parks allow fishing and non-motorized boats.

There are also privately owned lakes throughout the planning area. These lakes vary in size and it is up to the owner of the lake to develop any regulations regarding boating and fishing.

Section Four: Water Management

Summary

LPSNRD is responsible for managing the ground water in the basin. The LPSNRD is responsible for all users of ground water including the areas where ground water and surface water are considered hydrologically connected.

- LPSNRD Management Controls
- Irrigated Acres
- Water Allocation and Storage
- Flood Control Strategies

NRD Water Management Controls

The LPSNRD manages ground water use through its *Ground Water Rules & Regulations*, last revised on March 1, 2014. Through these regulations the LPSNRD is able to manage the uses of water in the district for water quantity and/or water quality purposes. Some of the strategies that the district can use during time of drought include allocating the amount of ground water that may be withdrawn by ground water users, requiring installation of devices for measuring ground water withdrawals from wells, limiting or preventing the expansion of irrigated acres or otherwise limiting or preventing increases in consumptive use of ground water withdrawals from water wells used for irrigation or other beneficial purposes, requiring best management practices, mandatory educational requirements to protect water quality of stabilize or reduce the incidence of ground water depletion, requiring water quality monitoring and reporting of results to the district for all water wells within all or part of the management area, closing all or a portion of the management area to the issuance of additional permits, and adopt other reasonable rules and regulations as necessary to carry out the purpose for which a management area was designated.

In order to drill a new well that pumps over 50 gallons per minute (20 gallons per minute for non-domestic wells within the RA) a well permit is required from the LPSNRD. A permit will also be required if the well will pump salt water for beneficial use, or if the well will be commingled, combined, clustered or joined with any other well or wells and such wells shall be considered one water well. Once a permit is applied for the LPSNRD has 30 days to issue or deny the permit.

The LPSNRD is able to deny permits if it finds any of the following problems: the location or operation of the proposed well would conflict with any regulation or controls adopted by LPSNRD or the State of Nebraska; the proposed well would not be a beneficial use of water for domestic, agricultural, manufacturing, or industrial purposes; and the total dissolved solids from a water quality sample at the end of a 24-hour pump test are 2,500 parts per million or more. In the RA well spacing is also reviewed and must be in compliance with Nebraska State Law (refer to Nebraska State Statutes 46-609 and 46-651), a well can be denied if it is within 600 feet of an existing registered well with a higher preference of use or if there are potential short or long-term detrimental effects on the aquifer. If the permit is for an area where the ground water is hydrologically connected with surface water the permit can be denied if: it is for furrow irrigation, the land is determined not to be suitable for irrigation, the lands for irrigation are outside of the HCA, or the annual expansion of irrigated acres is greater than 20 percent of the irrigated acres certified by the district as historical in the HCA.

One of the roles of the LPSNRD is to monitor ground water withdrawals. LPSNRD does this in two ways. The first is through ground water monitoring networks which include pre-existing wells (irrigation, domestic stock, commercial, etc.) as wells as dedicated monitoring wells. These wells are located throughout the district in the GWRs, the RA, and within various CWSPAs and are measured for ground water levels and sampled for ground water quality. The second method is through the use of meters on the

wells. Flow meters are required on any well that required a permit. With the regulations from March 2014 any well that pumps more than 50 gallons per minute requires a flow meter before it can be pumped. LPSNRD can require a flow meter on any well in the RA that pumps 20 to 50 gallons per minute, on a case by case basis to manage ground water quality and/or quantity. Well owners are required to share water usage information on the volume of water pumped annually.

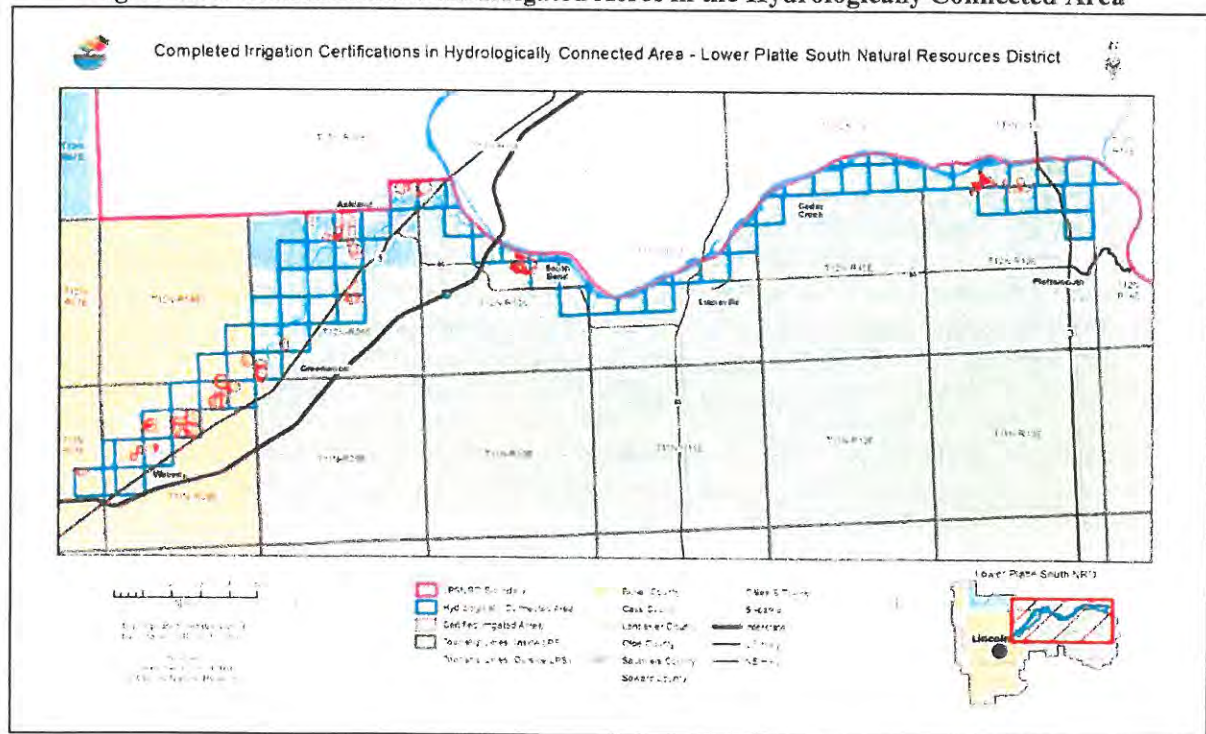
Irrigated Acres

Irrigation is about a \$10 million industry for corn and soybeans in the LPSNRD. Irrigation is the primary use of ground water in LPSNRD and throughout the state. One of the tools to manage the ground water quantity is through the certification of irrigated acres. As part of the certification process LPSNRD had to identify "historically ground water irrigated acres" within the HCA. "Historically ground water irrigated acres" are acres which were under irrigation from a ground water source before the requirements of LB 843 passed in 2009. The LPSNRD received and verified 34 separate certifications in the HCA for a total of 2,964.48 acres as "historically ground water irrigated" by March 2010. The current statute allows LPSNRD to approve a limited amount of new or expanded irrigated acres each year through 2012. The LPSNRD can allow a maximum of 592,896 new acres of irrigated land each year in the HCA. At the beginning of 2013, LPSNRD has certified 2,987.81 acres. The LPSNRD received two applications to expand a total of 160.51 acres in the HCA which increased the total to 3,148.32 acres. Table 5 breaks down the certification by county. Figure 11 shows the locations of the certified acres.

Table 5: Certified Acres in the Hydrologically Connected Area

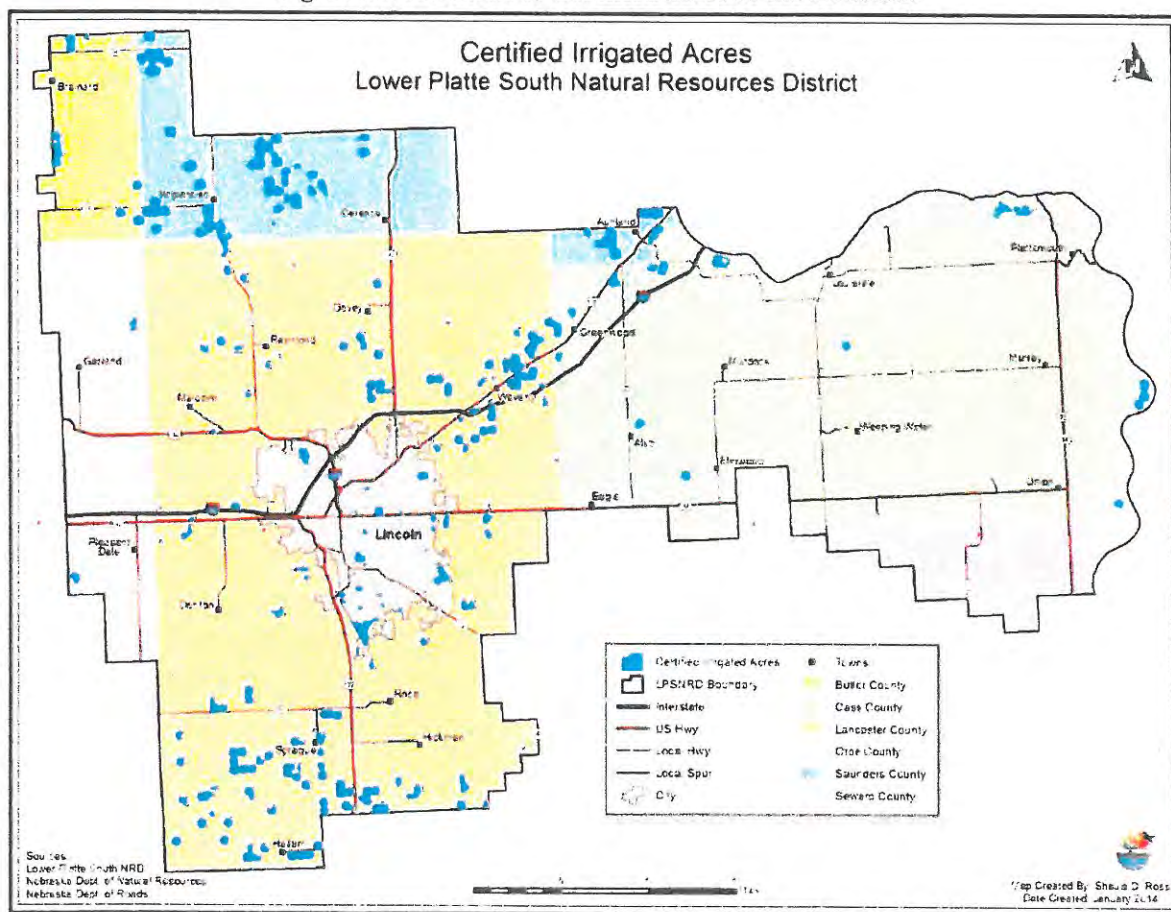
County	Number of Certified Acres	Number of Certifications
Cass	840.29	12
Lancaster	1,322.71	12
Saunders	985.32	10
LPSNRD Total	3,148.32	34

Figure 11: Location of Certified Irrigated Acres in the Hydrologically Connected Area



To improve the ground water management in the planning area, LPSNRD is also certifying ground water irrigated acres outside of the HCA. In October 2011 the LPSNRD revised its rules and regulations to require any lands irrigated with ground water must be certified prior to those lands being irrigated. The LPSNRD received and approved applications to certify 2,325.25 acres in 2013. As of December 31, 2013 LPSNRD has a total of 21,421.63 certified acres in the non- HCA. Figure 12 shows the total (HCA and non-HCA) ground water irrigated acres in LPSNRD.

Figure 12: Location of Certified acres in the LPSNRD



Water Allocation

The ground water in the State of Nebraska is managed as a shared resource among all users. The LPSNRD does have the authority to restrict ground water usage in the planning area by placing allocations on users in specific ground water basins. To do this LPSNRD monitors wells in the GWRs as well as talking with well owners to determine if restrictions and allocations need to be put in place. The LPSNRD in 2014 designated the area in the northwest part of the district as a Special Management area for quantity and established an allocation of ground water use of 21 inches over three years, with a maximum of nine inches in any year.

Water Storage

The LPSNRD has an estimated storage capacity of 4,070,000 acre-feet of total storage (ground and surface water). Of that storage 4,000,000 acre-feet is estimated to be ground water. The ground water storage is based on the amount of drainable ground water in the Dwight-Valparaiso GWR, Crete-Princeton-Adams GWR, Little Salt Creek GWR, Platte River Valley GWR, Missouri River Valley GWR, and the RA.

Section Five: Drought Defined Locally

Summary

- Drought Declarations
- Community Definitions
- Historic Droughts and impacts
- Cascading Impacts
- Future Probability

Drought has more than 150 definitions and every community can define drought differently. This section will attempt to define what a drought will look like for the LPSNRD.

Drought Declarations

None of the communities in the LPSNRD issue formal drought declarations. The State of Nebraska and the USDA issue drought declarations when a drought reaches a certain extent. The State of Nebraska will issue a declaration when communities in the state begin reporting problems with water quality and quantity. The USDA will issue a declaration based on the U.S. Drought Monitor categories. If a county is in D2 for at least 8 weeks during the grazing period livestock operators are eligible for assistance. Once the county is in D3 for any amount of time during the grazing period operators are eligible for more assistance.

Community Definitions

The City of Lincoln is the only community in the LPSNRD that has a formal plan in place for drought conditions. The city defines drought based on the flow of the Platte River in cubic feet per second (cfs) and water use by millions gallons a day (MGD). Table 6 shows the Drought phases for the City of Lincoln.

Table 6: Lincoln Drought Phases

Phase	Signal River Flow	Signal Water Use	Possible Actions
1: Moderate Shortage	3,000 – 1,500 cfs	Greater than 75 MGD	Voluntary three designated days
2: Severe Shortage	1,500 – 200 cfs	Greater than 65 MGD	Mandatory three designated days
3: Critical Shortage	Less than 200 cfs	Greater than 55 MGD	Limited Outdoor water use; may result in either mandatory two or one designated day or no outside watering

Source: City of Lincoln's Water Management Plan, 2013

The LPSNRD monitors the well levels in each of the GWRs. Well levels are an indication of weather conditions for the previous year. In a multi-year drought the wells levels will be able to provide information on how the drought is affecting the ground water in the district. LPSNRD's ground water rules and regulations have the entire geographic area designated as a Phase I Quality and Quantity Ground Water Management Area. A Phase II Ground Water Quantity is triggered when spring static water elevations in 30 percent of monitoring network wells have declined from the established upper elevation of the saturated thickness to an elevation that represents greater than or equal to a percent reduction in saturated thickness and has remained below that elevation for two consecutive years. A Phase III Ground Water Quantity is triggered when spring static water elevations in 50 percent the monitoring network wells have declined from the established upper elevation of the saturated thickness to an elevation that represents greater than or equal to a percent reduction in saturated thickness and has remained below that elevation for two consecutive years.

Table 7 shows the percent reduction required for Phase II and III actions in each GWR and the RA.

Table 7: Phase II and III triggers based on GWR

Ground Water Reservoir	Phase II (30% of the wells)	Phase III (50% of the wells)
Lower Salt Creek	15%	30%
Missouri River	8%	15%
Platte River	8%	15%
Crete-Princeton	8%	15%
Dwight Valparaiso	8%	15%
Remaining Area	8%	15%

Source: Ground Water Rules and Regulations, 2014

To gather information about the drought conditions the LPSNRD will communicate with irrigators about their water levels and increase monitoring of wells to understand how the drought is affecting the ground water. The *Additional IMP Planning Components Report* (Section 6.2) discusses the need for additional reporting to better understand aquifer properties and potential well interference issues.

Additional applications for well permits are also a way the NRD can monitor drought conditions. During droughts the number of applications increases due to the increased demand for water. The NRD will also be in contact with well drillers to gain an understanding of how many residents are trying to drill a new well or dig a current well deeper.

Historical Occurrences

Drought Indices

Due to drought's unique nature and characteristics, there are many indicators that can be used to rank the severity of droughts. The most widely used indicator is the Palmer Drought Severity Index (PDSI) which has been used by many governments in the U.S. to determine the severity of drought. Table 8 shows the classification for the PDSI.

Table 8: Palmer Drought Severity Index Classification

Numerical Value	Description	Numerical Value	Description
4.0 or more	Extremely wet	-0.5 to -0.99	Incipient dry spell
3.0 to 3.99	Very wet	-1.0 to -1.99	Mild drought
2.0 to 2.99	Moderately wet	-2.0 to -2.99	Moderate drought
1.0 to 1.99	Slightly wet	-3.0 to -3.99	Severe drought
0.5 to 0.99	Incipient wet spell	-4.0 or less	Extreme drought
0.49 to -0.49	Near normal	--	--

Source: National Oceanic and Atmospheric Administration

Since 2000 the NDMC, in cooperation with NOAA, and USDA, has produced the U. S. Drought Monitor. The U.S. Drought Monitor was designed to combine different drought indices and local input to give a snapshot of drought across the country in one simple easy to read figure. The Drought Monitor classifies drought on a scale from D0 (abnormally dry) to D4 (exceptional drought). Table 9 shows the classifications from the U.S. Drought Monitor.

Table 9: U.S. Drought Monitor Classification

Category	Description	Palmer Classification	Possible Impacts
D0	Abnormally Dry	-1.0 to -1.9	Going into drought: short-term dryness slowing planting, growth of crops or pastures. Coming out of drought: some lingering water deficits; pastures or crops not fully recovered.
D1	Moderate Drought	-2.0 to -2.9	Some damage to crops, pastures; streams, reservoirs, or wells low, some water shortages developing or imminent; voluntary water-use restrictions requested
D2	Severe Drought	-3.0 to -3.9	Crop or pasture losses likely, water shortages common; water restrictions imposed
D3	Extreme Drought	-4.0 to -4.9	Major crop/pasture losses; widespread water shortages or restrictions
D4	Exceptional Drought	-5.0 or less	Exceptional and widespread crop/pasture losses; shortages of water in reservoirs, streams and wells creating water emergencies.

Source: NDMC

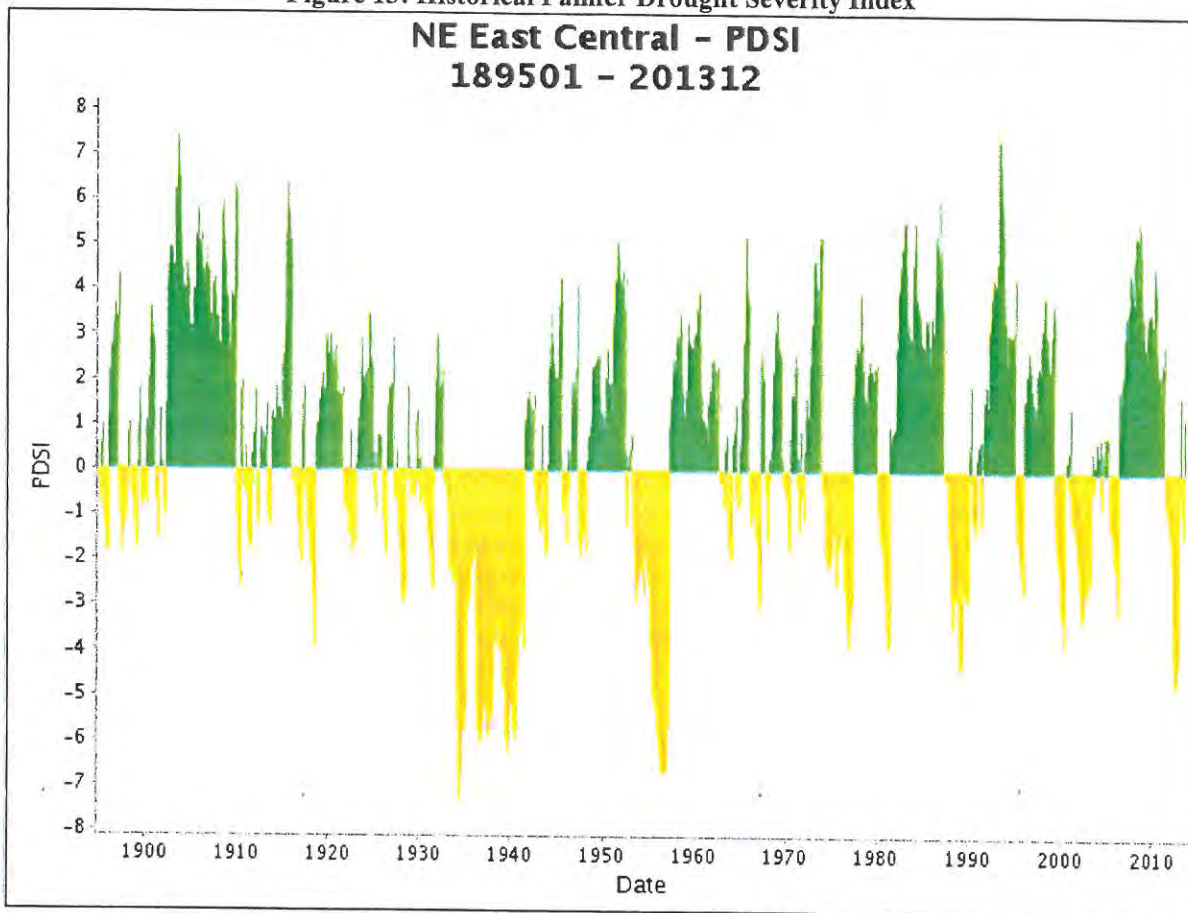
Historic Droughts

Drought is a normal part of the climate in LPSNRD and across the state. There have been several prolonged droughts throughout history in Nebraska. The most severe drought was the Dust Bowl of the 1930s when the state and LPSNRD were in drought for most of the 1930s until about 1944. The worst year of the Dust Bowl in the NRD was 1934. The next period of prolonged severe drought occurred in the 1950s. The drought peaked in 1955. The weather station two miles outside of Ashland recorded a PDSI score of -13.73 in May of 1957; this was the lowest PDSI value recorded in the LPSNRD. This drought was not as long or as severe as the Dust Bowl. Since 1960 there have been numerous short term (1 – 2 years) droughts that have caused problems as well. Some of the more severe short term droughts -3 or greater on the PDSI are shown in Table 10. Figure 13 shows the PDSI from 1895 to 2013.

Table 10: D4 Droughts since 1960 in LPSNRD

Drought Start	Drought End	Duration (months)
7/21/2012	5/1/2013	11
6/1/2006	8/1/2006	2
7/1/2002	11/1/2004	28
3/1/1996	4/1/1996	1
5/1/1989	11/1/1991	30
2/1/1977	8/1/1977	6
8/1/1970	9/1/1970	1

Figure 13: Historical Palmer Drought Severity Index



Source: National Oceanic and Atmospheric Administration

Historical Impacts

The Dust Bowl has often been described as the worst drought in U.S. history. In LPSNRD and across southeast Nebraska the drought began in 1934 and lasted until at least 1940. It is estimated that the government paid out as much as \$ 1 billion (in 1930s dollars) in financial assistance across the Great Plains. Due to the financial hardship created by the drought many families abandoned their farms and migrated either to cities or out of state looking for jobs.

The Dust Bowl earned its name because of the dust storms that were created by the wind blowing the loose topsoil through the air. Without the topsoil in place it became very hard to grow any crops in the area, and if any of the crops did start to grow they would be killed by the next dust storm that came through the area. The Dust Bowl led to many changes in farming practices during the 1940s.

The 2012 drought has been described as the worst single year drought in Nebraska. 2012 was the hottest and driest year for the state going back to 1895. LPSNRD experienced drought impacts in almost every sector. The City of Lincoln reported about 700 pine trees were killed and had to be removed in one city park. The Lower Platte River experienced record low flows over the summer which led to considerable fish kills.

Infrastructure was also affected during the drought. LPSNRD closed three bicycle trails that they manage, due to damage to the trail surface from the drought. The City of Lincoln reported that 220 water mains were broken over the summer months from the drought.

Cascading Impacts

Floodplain

The 1% annual floodplain for the LPSNRD is shown in Figure 14. All incorporated jurisdictions have a 1% annual floodplain. The potential for flooding also exists during times of drought. This is due to soil not being able to hold the moisture that occurs during a heavy rain event. This causes the majority of the water to become runoff leading to flashflood events during a drought.

There have been six flash floods according to NCDC in the LPSNRD during drought periods. Five of the floods occurred during the 2002 – 2004 drought and one during the 2012 drought. All of the rain events were heavy rain events and the soil was not able to absorb all of the moisture. Since the moisture was not absorbed it ran off into low lying areas where the flooding occurred.

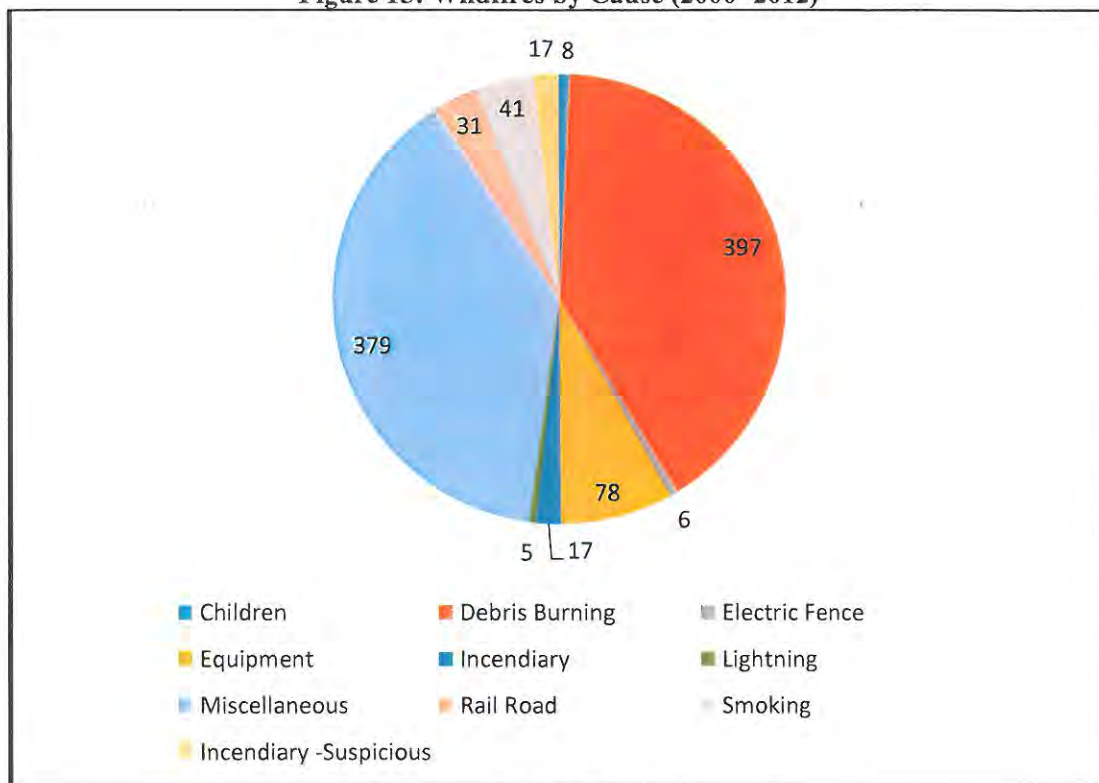
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Wildfire

Another hazard that is present with drought is the possibility of wildfires. Wildfires are characterized in terms of their physical properties including topography, weather, and fuels. Wildfire behavior is often complex and dependent on factors such as fuel type, moisture content in the fuel, humidity, wind speed, topography, geographic location, ambient temperature, the effect of weather on the fire, and the cause of ignition. Fuel is the only physical property humans can control and is the target of most mitigation efforts. The National Weather Service (NWS) monitors the risk factors including high temperature, high wind speed, fuel moisture (greenness of vegetation), low humidity, small cloud cover in the state on a daily basis.

The causes of wildfires within LPSNRD vary. According to the Nebraska Forest Service between 2000 and 2012 the most common cause of wildfire was from burning debris (39.6% of fires). Other causes of wildfires include: miscellaneous, equipment, campfires, smoking, railroads, and lightning (Figure 15). The risk for fires increases the longer the drought lasts. To help mitigate the possibility of wildfires local fire departments or emergency managers can deny burn permits for controlled burns until the conditions improve. The NWS will also issue red flag warnings on days when the possibility of fire is high.

Figure 15: Wildfires by Cause (2000 -2012)



Source: Nebraska Forest Service

Future Potential & Probability

Since a drought is a natural climatic event it is possible Nebraska and LPSNRD could experience a drought every year. Every drought is different, so there is a chance that even with two consecutive years of drought the impacts could affect different sectors. Based on data from the Drought Risk Atlas the LPSNRD has a 15 – 20 percent change of experiencing D2 drought conditions on an annual basis.

According to the report *Understanding and Assessing Climate Change: Implications for Nebraska* the expectation is that drought frequency and severity will increase, particularly in the summer months. It should be noted that Nebraska does have the potential to see multi-year droughts develop as well. The Dust Bowl of the 1930s shows how a drought a decade long drought can occur in Nebraska. Tree ring and other prehistoric records show that Nebraska experienced mega-droughts. These droughts occurred and lasted for multiple decades and sometimes even centuries.

Section Six: Water Resource Committee Recommendations

Summary

- What a Water Resource Committee should look like for the LPSNRD
- How the Board should function
- How the LPSNRD can issue declarations

Water Resource Committee

Board Composition

LPSNRD should establish a Water Resource Committee to help with the response to drought conditions. While this report focus on the drought management aspect of this committee there could be multiple purposes and considerations included in the focus for this group. This committee should be composed of stakeholders and decision makers from across the LPSNRD. The Water Resource Committee should also include: state agencies (e.g. NDNR, Game and Parks Commission, and NDEQ), non-governmental organizations, and community officials. The Water Resource Committee should meet each spring to share discussion and reports on the outlook of drought and to develop a consistent message. The Water Resource Committee will also be able to meet as needed during time of drought development within the district. Table 11 shows the proposed members of the Water Resource Committee.

Table 11: Proposed Water Resource Committee

Name	Position	Organization
Glenn Johnson	General Manager	LPSNRD
James Davidsaver	Emergency Manager/Deputy Emergency Manager	Lancaster County
Sandy Weyers	Emergency Manager/Deputy Emergency Manager	Cass County
Ed Ubben	Projects Coordinator	LPSNRD
Dick Ehrman	Water Resource Specialist	LPSNRD
Jesse Bradley	Division head Integrated Water Management	NDNR
Mike Hayes or appointee	Director	NDMC
Donna Garden	Assistant Director of Public Works	City of Lincoln
Meghan Sittler	Coordinator	Lower Platte Corridor Alliance
Mark Doyle	Chief Information Officer	Metropolitan Utilities District
Greg Chewakin	County Executive Director	Lancaster County FSA
Tom Morrison	Superintendent Branched Oak Lake	NE Game and Parks
Dan Henry	City Administrator	Louisville
Dennis Hoback	Water Operator	Cass County RWD #1
Dale Miller	Water Operator	Cass County RWD #2
Phil Goering	Water Operator	Lancaster County RWD #1
John Chess	Water Quality Supervisor	Lincoln-Lancaster Department of Health
Dan McGuire	District Director	NE Farmers Union
Duane Hovorka	Executive Director	NE Wildlife Federation
Richele Sievers	President	Plattsmouth Chamber of Commerce
Wendy Birdsall	President	Lincoln Chamber of Commerce

Committee Function

The main function of the board will be to serve as the regional drought communicator. One of the main topics at the drought tournament was making sure a consistent message was made across the district. The Water Resource Committee will establish a message and make sure that is the only message that is delivered.

Drought Declaration Process

Pre-season indicators and protocols

When the Water Resource Committee meets in April there are a couple of items that should be examined by the committee. LPSNRD takes well measurements that can be used to trigger different phases of management for wells that are declining. The spring well measurements are completed by April so they will be able to present the findings at the April LPSNRD board meeting. The other item that the committee should examine is the Drought Outlook provide by NOAA. This outlook takes into account climate data and long-term forecasts to give an outlook to the committee in order to determine if drought is possible over the next three months. This information should be used to determine if regular committee meetings are needed. The Water Resource Committee will provide a report of what is discussed at this meeting to all communities, counties, LPSNRD staff, and LPSNRD Board of Directors as to what will be done in the coming months as the conditions change.

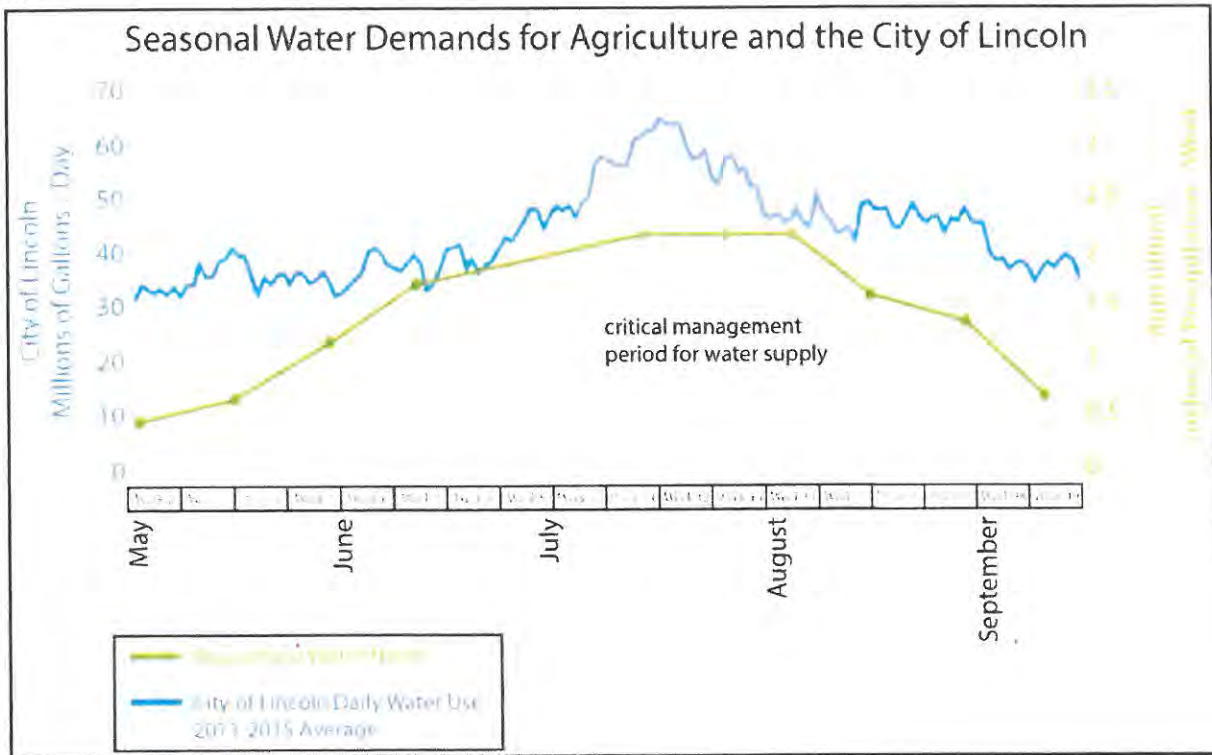
Critical Management Periods

Within the NRD and across the state there are critical management periods related to water availability and water need. For the LPSNRD there are a range of water uses that should be considered, these critical management periods may impact when the Water Resources Committee will meet and the focus of the discussion.

One key consideration in reviewing water use and water need for the LPSNRD is directly related to agricultural irrigation. The phenology for crop development provides an insight regarding water critical periods. The development cycle for corn crops was reviewed (corn is more water intensive than the other primary crops for the region) and can be viewed in figure 16. The ideal time to sow crops in the region ranges from April 25th to May 10th, obviously there is need for moisture throughout the growth cycle, but the most critical times for ground moisture are during the pre-tasseling and tasseling phases of development. Critical moisture management times for 113-day maturing corn occur between weeks 10 and 15. If we assume a sowing date of May 1st this would place water critical times for this particular crop during the months of July and August.

Reviewing the critical management periods for crops and overlaying this data with water use data made available by the City of Lincoln Water System there is an overlap of increased demand during the summer months of July and August. While monitoring of water supplies throughout the year is helpful it is most important for agricultural and municipal water use that the summer month be more closely monitored and planned for.

Figure 16: Critical Management Periods



Drought Notification Protocol

Multiple agencies have developed tiered responses to drought conditions. Denver Water, the City of San Diego, San Diego County, the City of Scottsdale, and the Upper Shenandoah River Basin all have a four stage drought response. The City of Lincoln has a three stage plan. The current LPSNRD plan has two stages since the entire LPSNRD is Phase I for Ground water Quantity already.

Once the LPSNRD is determined to be in a drought the committee should consider taking these steps:

1. Alerting the appropriate municipal and county departments
2. Provide updates to the appropriate state and federal agencies
3. Update the LPSNRD webpage with a drought status report
 - a. Can add a link on the weather resource page
4. Hold a press conference to get the message out to the general public

There are many other options that can be used to communicate drought conditions. The advantage of this process is it ensures a consistent message is presented across the region.

Section Seven: Drought Response Actions

Summary

- Ground Water Appropriations
- Educational Resources
- Suggested Actions from the State Drought Plan

Ground Water Allocation

LPSNRD is authorized by the state to govern ground water within the district. This means the NRD has the ability to restrict the use of ground water. The district requires all wells that pump over 50 gallons a minute to be metered and have the metered information be reported back to the district. The ground water within the state is governed through a policy of sharing the water in times of abundance and deficits.

As drought conditions develop LPSNRD will increase its monitoring of wells in order to ensure that ground water is not being over pumped. As reference in the *Additional IMP Planning Components Report* additional monitoring and monthly reporting could lead to a better understanding of well interference issues and aquifer properties, for more information related to increased monitoring please refer to section 6.2 in the *Additional IMP Planning Components Report*.

If the drought begins to intensity and LPSNRD feels the water is being over pumped it will enforce allocations over the GWR that is being over pumped. The NRD will also begin to monitor any wells within the GWR more closely to ensure no well owners are pumping more water than what is allotted to them. LPSNRD tries to limit enforcing allocations on well owners but will do so if needed.

Surface Water Administration

The NDNR governs the use of surface water in the State of Nebraska. This means that NDNR has the ability to restrict the use of surface water. The state governs surface water through the prior appropriation doctrine which states that the oldest water rights holders get their full allocation of water before any junior rights holders can get their water.

As drought conditions develops a senior water rights holder can place a call to the local NDNR field office and can request a call to be placed on junior rights holders because they are not getting water. The field office will then analyze the situation and determine who they can shut-off in the area to ensure that the senior rights holder will be able to get the water they need. If there are low flows in an area with an interstate water compact the NDNR can shut-off users with rights that are junior to the date of the compact. If a water user has rights senior to the compact they are able to continue to use water but they cannot exceed their appropriation.

Drought Educational Outreach

Another way to deal with drought conditions is through education. The education can focus on resources for agriculture, homeowners, renters, and other organizations. There are many groups that offer information on how to cope with drought conditions. Table 12 shows some sources where educational resources can be found.

Table 12: Drought Education Resources

Resource	NDMC	Colorado State University	Iowa State University	Extension Disaster Education Network	Nebraska Health and Human Services	Centers for Disease Control and Prevention
General Drought Education	X					
Agricultural Drought Education	X	X	X	X		
Homeowners and Renters		X	X	X	X	
Other Drought Resources	X	X	X	X		X

Resources

1. NDMC: <http://drought.unl.edu/Home.aspx>
2. Colorado State University: <http://www.ext.colostate.edu/drought/fsmenu.html>
3. Iowa State University: <http://www.extension.iastate.edu/topic/recovering-disasters>
4. Extension Disaster Education Network:
<http://eden.lsu.edu/Topics/Hazards/Drought/Pages/resourcecollection.aspx>
5. Nebraska Department of Health and Human Services:
http://dhhs.ne.gov/publichealth/Pages/enh_pws_conindex.aspx
6. Centers for Disease Control and Prevention:
http://www.cdc.gov/nceh/ehs/docs/when_every_drop_counts.pdf

Actions for LPSNRD from State Drought Plan

The following actions are actions that were included in the *Nebraska's Climate Assessment Response Committee Drought Mitigation and Response Plan* from 2000 for NRDs from across the state to implement to address drought. The actions listed in this plan are actions that have been determine to be relevant to LPSNRD or are already being done by LPSNRD.

Current Actions

Impact	Economic loss and soil erosion on dry cropland
Action	Use Public Information programs to emphasize installation of soil and water conservation systems (i.e. terraces, crop residue use, and contour planting)
NRD Actions	Cost-share on soil and water conservation
Description	The NRD will assist landowners with the planning, design, and cost of installing soil and water conservation practices on their property (i.e. terrace systems, improved irrigation systems)
Status	This action is done on an ongoing basis

Impact	Decreased Pumping Rates Resulting in Less Capacity to Meet Crop Needs
Action	Maintain water-level measurements program to monitor declining aquifer levels
NRD Actions	Take Well measurements every spring
Description	The NRD takes well measurements every spring to determine if any GWRs need to go into Phase II or III management
Status	This action is done on an ongoing basis

Impact	Decreased Pumping Rates Resulting in Less Capacity to Meet Crop Needs
Action	Maintain ground water metering efforts and establish emergency allocation program
NRD Actions	Requires meters on all wells and will issue allocations if needed
Description	The NRD requires all wells that pump over 50 gallons per minute to have a meter. If water meters are showing more usage than normal the NRD is able to put allocations on the GWR to reduce usage
Status	This action is done on an ongoing basis

Impact	Water Quality and Quantity Problems in private Wells
Action	NRD monitor the system
NRD Actions	Work with private well owners
Description	The NRD will work with private well owners to either drill the current well deeper or find a new well that does not have quality or quantity issues
Status	This action is done on an ongoing basis

Impact	Water Quality and Quantity Problems across LPSNRD
Action	Water Conservation
NRD Actions	NRD encourage indoor and outdoor conservation of water
Description	The NRD encourages residents in the district to conserve water
Status	This action is done on an ongoing basis

Encouraged Actions

Impact	Economic loss and soil erosion on urban landscapes
Action	Investigate the use of rainfall enhancement projects in targeted areas
NRD Actions	Rain barrels for homeowners
Description	The NRD encourages residents in the district to buy a rain barrel to capture rain to water plants with
Status	This action is not being done currently

Impact	Economic loss and soil erosion on dry cropland
Action	Investigate the use of rainfall enhancement projects in targeted areas
NRD Actions	Encourage landowners to join NeRain
Description	Encourage landowners to join NeRain and report precipitation measurements using backyard gauges
Status	This action is not being done currently

Impact	Decreased Pumping Rates Resulting in Less Capacity to Meet Crop Needs
Action	Emphasize irrigation water management techniques and develop emergency program to promote installation of on-farm water conservation measures
NRD Actions	Provide educational materials to landowners
Description	Provide educational materials to landowners about water conservation measures and effective irrigation management techniques
Status	This action is not being done currently

Impact	Public Health Concerns
Action	Remove standing water to reduce concerns of West Nile virus
NRD Actions	Work with health department to remove standing water
Description	Remove standing water to prevent mosquitoes with the West Nile Virus from breeding.
Status	This action is not being done currently, although the health department does monitor and spray areas with standing water to prevent the virus from spreading

Impact	Increased presence of large industrial, independent water users that may overdraft available aquifers during drought
Action	Maintain a list of large, industrial, independent water users
NRD Actions	Develop the list
Description	Work with communities to develop list of large, industrial, independent water users in the LPSNRD

Impact	Increased presence of large industrial, independent water users that may overdraft available aquifers during drought
Status	This action is not being done currently

Impact	Increased presence of large industrial, independent water users that may overdraft available aquifers during drought
Action	Enhance communication between large, independent water users and municipal suppliers to implement water conservation and drought-preparedness guidelines
NRD Actions	Water Resource Committee should start the conversation
Description	Work with municipalities and large, independent users through the Water Resource Committee to implement water conservation
Status	This action is not being done currently

Appendices

Appendix A – Drought Tournament Sign-in Sheet

Appendix B – Drought Tournament Summary Report

Appendix C – Drought Scenario

Appendix A – Drought Tournament Sign-in Sheet



Lower Platte South
Natural Resources District

Lower Platte South NRD – Drought Tournament
Lincoln, NE – Thursday, February 12, 2015; 9:00 AM
PLEASE PRINT CLEARLY- THANK YOU!



NAME	TITLE	JURISDICTION	ADDRESS	PHONE	EMAIL
		Represented	Street & Street Name, City, Zip		
Mark Hosking	Deputy Dir.	Lancaster Co. EMH	233 S 10th St, Lincoln, NE	404-7265	mhosking@lancaster.org
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Please Sign In!



Please Sign In!

Summary Report:

**Lower Platte South
Natural Resources District
Drought Tournament**
February 12, 2015



Acknowledgements

The development of the Lower Platte South Natural Resources District Drought Tournament was a collaborative effort among various private and state entities. The tournament would not have been possible without the contributions of the following individuals and organizations.

Lower Platte South NRD

Glenn Johnson
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Mike Hayes
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HDR Inc.

Vicki Twerdochlib

Introduction

This report provides an overview of the Lower Platte South Natural Resources District (LPSNRD) Drought Tournament. This gaming forum was held on February 12, 2015. The goals of the drought tournament were to gain an understanding of how stakeholders across the NRD respond to drought conditions and to identify potential gaps in planning and response. This information will be incorporated into the LPSNRD's Drought Emergency Response Plan.

Leading up to this event research was conducted to establish what responses were outlined for communities and jurisdictions across the NRD. The drought response plan for the city of Lincoln was reviewed and incorporated as a component of the scenario utilized for the tournament. Other communities, water users, and water suppliers were contacted in the lead-up to the tournament and asked about drought response plans. Across the district the response was consistent, there are drought response protocols but they have not been formally documented to this point.

A key component to the drought tournament was stakeholder engagement. For this event a stakeholder list was developed based upon the participants from previous planning processes, such as the Integrated Management Plan and Hazard Mitigation Plan. This was based upon the assumption that past participants would be more likely to attend meetings moving forward, and the goal was to have between 20 and 30 participants from a range of stakeholder groups. Stakeholder groups identified and invited to participate included: farmers, water suppliers, village and city officials, Nebraska Game and Parks, U.S. Department of Agriculture (USDA) Farm Service Agency, county emergency management, state emergency management, the University of Nebraska – Lincoln, and staff from the NRD. For the event 29 stakeholders were in attendance (some served as observers while most participated directly in the event).

History of Drought Tournaments

The concept of a drought tournament was developed by Dr. Harvey Hill of the Agriculture and Agri-Foods Canada in Saskatchewan. Dr. Hill delivered the first Innovational Drought Tournament in 2011 in Calgary and has since held events in Kelowna and Winnipeg. The goal of these events was to provide a “safe and fun environment” that would stimulate conversations among the players and help to identify key concerns in an extreme drought situation.

Since their inception drought tournaments have occurred outside of Canada, mostly at a state level. In 2012 Colorado held their first drought tournament as a precursor to the State Drought Conference in Denver. The event was sponsored by the Colorado Water Conservation Board and the National Integrated Drought Information System. This event was a one-day event where a range of stakeholders (state officials [Colorado and Oklahoma], city officials, tourism groups, water boards, industry groups, etc.) gathered to review state-wide concerns related to extreme drought events. In total 26 participants gathered to discuss what could happen during drought and how they as a state could be better prepared to address these concerns.

A drought tournament was also held in Oklahoma following the Colorado event. Little information is available related to the Oklahoma drought tournament.

Overview of the Tournament

Background

The LPSNRD Drought Tournament was developed as a component of the Drought Emergency Response Plan. Stakeholder lists for the event were developed collaboratively between the LPSNRD, the National Drought Mitigation Center, HDR, and JEO. Targeted stakeholder groups included: water users, water suppliers, community leaders, emergency management agencies, and regulatory agencies (a list of invitees is available in the appendix of this document). This was a half-day event hosted by the LPSNRD.

Outreach efforts for this event included notification letters to invited participants approximately two weeks in advance, email reminders, and follow-up phone call the week of the tournament. These outreach efforts were a joint effort between LPSNRD and JEO. The goal for participation was to have approximately 25 – 30 participants from a range of stakeholder groups.

The desired output from this event was to gain an understanding of the many informal drought response protocols utilized across the district. This information is to be used in the development of the drought emergency response plan being developed for the LPSNRD.

The drought scenario for this event was developed based on the historical data from the 2012 drought and the 200 drought in the NRD. Data (such as the NOAA Drought Outlook, National Drought Monitor, USGA stream flow, etc.) were adapted from the year of record for use in the scenario, the event “workbook” included in the appendix of this report outlines the drought scenario utilized for the tournament. It should be noted that due to the duration of the discussion and high levels of stakeholder engagement only one year of the scenario was delivered during the event.

Tournament Day Overview

29 people were in attendance for the tournament, 23 stakeholders attended as participants, six stakeholders participated as evaluators and recorders (including two members of the NDMC acting as observers for the event). The participant involvement is described below:

- Four teams of five to six players – Each team consisted of players representing different sectors including agriculture, municipal, environmental, and recreation and tourism. The teams were responsible for playing the game and representing their agency or stakeholder group throughout the game play.
- Referees/Evaluators – There were two referees for this event. They were a water resources and public policy specialist from the Lower Platte River Corridor Alliance, and a public policy researcher from the University of Nebraska-Lincoln Public Policy Center. The referees were to serve as content experts who could answer questions for the teams, evaluate the cost/benefit of selected responses, and provide scoring for each team throughout the event.
- Recorders – The recorders were embedded within each team and responsible for note taking to capture participants’ ideas, and to record identified gaps in planning and response. The recorders included three JEO staff members and one student from the University of Nebraska-Lincoln.
- Observers – Observers were asked to observe the tournament and provide feedback related to the overall tournament. Two Observers were from the NDMC, LPSNRD general manager and assistant general manager, and one staff for HDR Inc.

- Facilitator – Responsible for facilitating the overall process, delivering the tournament prompts, monitoring participation and assisting with engagement.

Participants were able to form their own teams, but they were directed to establish multi-disciplinary groups to foster an environment of discussion and sharing. Following is a list of the groups that participated:

Group #1:

Bill Booth – Games and Parks
 Greg Chewakin – USDA/FSA
 Dick Ehrman – LPSNRD
 Tim Maloney – Cass County Emergency Management Agency
 Sandy Weyers – Cass County Emergency Management Agency

Group #2:

Mary Baker – Nebraska Emergency Management
 Mark Hosking – Lancaster County Emergency Management Agency
 Lyle Jakub – Farmer (Butler County)
 Jeff Culberson University of Nebraska – Lincoln Facilities Management/Landscape Services
 Tom Morrison – Game and Parks (Branched Oak Lake)

Group #3:

Roseanne Dobesh-DeGraff – Cass County Emergency Management Agency
 Dan Henry – Louisville water System
 Steve Owen – Lincoln Public Water System
 Jim Portis – Lincoln Parks and Recreation
 Dave Tunink – Nebraska Game and Parks (Fremont Lakes)
 Ed Ubben – LPSNRD

Group #4:

Eileen Burgt - University of Nebraska – Lincoln Facilities Management/Landscape Services
 Jim Davidsaver - Lancaster County Emergency Management Agency
 Donna Garden – Lincoln Public Works
 Phil Goering – Lancaster Rural Water 1
 Bill Landon – Farmer (Cass County)
 Matt Mittelstadt – Lincoln Parks and Recreation

Participants were presented with a prompt and then asked to work within their groups to identify necessary considerations and responses to the provided stimulus. Participants were asked to consider a minimum of three areas during their discussion, these areas of consideration included (but were not limited to): 1) Identification of vulnerability in their sector, this could include social vulnerabilities, ecosystem vulnerabilities, and economic vulnerabilities; 2) Potential impacts; and, 3) Necessary responses and adaptations.

In order to facilitate discussion, the teams were presented with questions after each round regarding how each participant would address drought and disseminate information. These questions included:

- What is the typical response from your agency/group/entity given these circumstances?
- What entities outside of yours will you need to coordinate with at this time?
- Are there any political considerations?
- How will you be communicating with your partners during this process?
- If you are communicating with the public how will that take place?
- If you are communicating with the agricultural sector how will that take place?
- What information are you collecting in order to make decisions at this point?

The tournament consisted of four rounds of discussion focused on the scenario that was developed and one round of discussion focused on how the regional approach to managing drought could be revised to be more efficient and effective.

Because this was developed as a “drought tournament” rather than an exercise, scoring was conducted for each round of responses. The score was based entirely on the referee scores. The referees were instructed to base scoring on three areas: the identification of vulnerabilities to the jurisdictions/stakeholders; identification of probable drought impacts to jurisdictions/stakeholders; effectiveness of drought responses/adaptations. Scoring was based on a scale of 1 – 5, with 5 being the top score and 1 being the lowest score.

Summary of Tournament Results

Information from the participants is summarized below based on common themes and then by each organizations specific responses.

Common Themes

The following thoughts and ideas were identified by all teams.

- Education on water conservation needs to be a year-round activity whether there is a drought or not
- Most groups do not take action until the U.S. Drought Monitor is at a D2 (severe drought) or a D3 (extreme drought) classification
- Few entities have identified drought mitigation as a priority and rely and an effect drought response.
 - Mitigation measures identified during the event focused primarily on education and increased monitoring
- The message to the public needs to be consistent
 - Messages need to have a single voice across jurisdictions and agencies
 - The messages should come from a Public Information Officer or Emergency Management Agency
- Use of drought tolerant plants for both agricultural and municipal plantings
- Platte River must maintain certain flows do to endangered species act

Current NRD Responses

The following strategies are currently being used by the LPSNRD to respond to drought conditions, and were mostly put in place after the 2012 drought. The NRD can only enforce these actions on ground water wells, because surface water in the state is governed by the Department of Natural Resources.

Planning:

- Can change plans and regulations with the approval of the NRS board

Monitoring:

- Talking with well drillers can provide the NRD with an idea of how bad conditions are

Mitigation:

- Provide education on water use and conservation
- Cost-share to help improve irrigation efficiency
- Conservation (this is a long-term action that will require time)

Preparedness/response:

- Increased monitoring on wells that experience decline quickly under drought conditions
- Increase inspections to ensure allocations are not being exceeded
- Deny well permits (domestic wells that pump less than 50 gal/min are exempt from needing a permit)

Public Water Suppliers

There were three public water suppliers that attended the meeting. The water suppliers included the City of Lincoln, the City of Louisville, and Lancaster Rural Water District #1. The following ideas for each water supplier are listed below.

City of Lincoln (Lincoln Water)

Planning:

- The city has an updated water management plan in place
 - Review 6 triggers monthly unless situation changes
- Specific triggers have been identified to determine when restrictions need to be instituted

Monitoring:

- Watch snowpack in the west during winter and early spring months
- Determinations regarding use of the plan are made around April 1

Mitigation:

- Work to identify opportunities to utilize discharged water rather than pulling from wells
- Always encouraging conservation
- Work to keep infrastructure up-to-date
 - Drought can cause an increase in water main breaks
- Use of drought resistant plantings

Preparedness/response:

- Tiered water pricing
 - More expensive for water users who use more water during times of drought

Additional concerns:

- Potential for water riots

- Concerns about early notification: “Don’t cry wolf” on drought
 - Early, inaccurate warnings or communications can lead to “warning fatigue”

City of Louisville

Preparedness/response:

- Communicate with wholesale customers during times of drought to make sure they understand the situation
- Use restrictions when required

Additional concerns:

- Production exceeds demand most of the time

Lancaster Rural Water District # 1

Monitoring:

- Monitor wells to determine water levels and changes
- No monitoring of well users
- Private city wells are metered

Additional concerns:

- Storage capacity is a major concern

Game and Parks

Nebraska Game and Parks Commission sent three representatives. The representative included an assistant division supervisor, and two park superintendents. The following ideas for Game and Parks are listed below.

Mitigation:

- Mulch existing plants and trees
- Use water-wise plant in installed landscapes

Preparedness/response:

- Water at the beginning of a drought to save established plants
- Reduce/eliminate Spring and possibly fall plantings during drought or periods of projected drought
- Adjust watering times and amounts (water at night/during mornings and evenings)
- Change/adjust mowing patterns/frequency
- Shut fountains off early
- Will utilize reclaimed water to water existing plants
- Move or close boat docks based on water levels
- Provide safety buoys to alert boaters of low spots

Additional concerns:

- Noxious weeds may become a problem
- Toxic algae becomes more of a problem during dry times
- Fish Kills/declare a fish emergency

Parks and Recreation

The City of Lincoln Parks and Recreation attended the tournament as well. Two district supervisors attended their ideas are listed below.

Planning:

- Will follow the lead of Lincoln

Preparedness/response:

- Shut down irrigation and watering of medians
- Work to save dying trees
- Prioritize water resources for the next year

Additional concerns:

- Spread of West Nile virus can become an issue due to standing water

Agriculture

Two farmers and the Lancaster County Farm Service Agency (FSA) Executive Director attended the tournament. The University of Nebraska-Lincoln Landscape Services also attended their comments are included in this section. The ideas of all these groups are listed below.

Farmers

Planning:

- Expect a drought every year
- First year of drought can be a cost-saver because of cut-backs and markets
 - Second year of drought is serious
- Need to be prepared and be thinking early on if you want to plant drought resistant seed due to availability
- Review cultivation practices and variety of crops to see what worked

Monitoring:

- Soil testing and fertilize early on

Mitigation:

- Both attendees use no till methods
- Maintain cover crop to keep soil temperature low and not lose as much moisture
- Upgrade irrigation technologies

Preparedness/response:

- Lack of rain early is good
- Irrigate at night
- Supplement livestock food or move cattle
- Prioritize crops to irrigate based on costs and maturity of plants
- Water restrictions are very serious don't want to irrigate unless you have to
- Water pressure can be affected by neighbors use
- Develop monitoring system
- Will work to keep any soil moisture that there is in the soil

- No burn permits
- Pre-irrigation into the winter to improve moisture

FSA

Preparedness/response:

- Need secretarial disaster declaration for action (state disaster declaration will not trigger any response)
- Reaction triggered by U.S. Drought Monitor ranking of D3 or greater for consecutive weeks
- Outreach and education with CRP landowners and other farmers
- Release CRP land for grazing after declaration
- Emergency board to release information
- Assist with emergency loans once a secretarial designation is issued

University of Nebraska-Lincoln Landscape Services

Planning:

- Have a staged water plan
 - Try to stay one step ahead of the city
- Will follow city of Lincoln restrictions

Monitoring:

- Will consult with a university meteorologist

Mitigation:

- Look at more drought tolerant plants and trees (Oklahoma and Northern Texas Varieties)
- Switching to irrigation system to allow for greater monitoring (water use and water loss)

Preparedness/response:

- First year of drought can be a cost-saver because of cut-backs
 - Second year of drought is serious
- Hand water trees, reduce turf watering
- Stop planting if necessary
- Alter mowing practices
- Chancellor can shut off all on campus watering
- Make sure landscape has sufficient moisture going into winter
- Less of an impact on landscape in the summer when students are not on campus

Emergency Management

There were three emergency management agencies that were represented. The State Hazard Mitigation Officer was present along with the Lancaster County and Cass County Emergency Management offices. Their ideas are below based on the organization they are with.

NEMA

Monitoring:

- Monitoring impacts once governor has declared an emergency

Preparedness/response:

- Does not get involved locally unless it gets really bad
- Can truck water in if needed

Cass County Emergency Management

Mitigation:

- Do as much education as possible to keep public aware of issues

Preparedness/response:

- Meet with cities with smaller wells to ensure they will have enough water in a drought
- Keep in touch with local fire departments and work with homeowners who have properties along Platte River about the fire danger that may exist to them.
- They are available to help support but they need to be asked for the support

Lancaster County Emergency Management

Mitigation:

- Education and outreach

Preparedness/response:

- Work with fire departments to quit issuing burn permits
- Work with health departments
 - Concern about West Nile
 - Water Quantity and Quality issues
- Work with public works and pipeline providers about integrity of their structures
- Discuss trucking in hay for livestock with USDA
- Discuss disaster declaration status with USDA
- More resource available when governor declares a drought emergency
 - Can bring in private contractors to aid public works in pipe repair
 - National Guard can be brought in
- Looking forward to another year of drought
 - Considering message that could be issued

Additional concerns:

- As drought gets worse the potential for fire increases

Innovation

This was designed to get stakeholders to think about what they have available to increase their resilience to drought.

- Education
 - Including information on technological advances to monitor wells
 - Use of water and rain barrels
 - Xeriscaping with drought tolerant plants
 - Encourage other NRDs to utilize this model for drought impact/response analysis

- Encourage communities to expand well field or find a new well field
 - USDA Rural Development of CDBG can help assist smaller communities
- Develop a state water plan
 - Encourage all NRDs to do a drought plan
- Develop a “water bank” system for the future
- Build relationships & work together
 - Everyone who participated now knows other people to connect with and can use the relationships but if they do not work on them it will not go anywhere
- Each jurisdiction needs to be ready for the worst case scenario
 - Develop a plan for a 5 year or longer drought

Conclusions

The gaming exercise was an effective means to engage stakeholder and gain participation. By providing the stakeholder an actual scenario to follow the response matches up with what would be done during an actual drought and can lead to a better understanding of why certain things were done when review the response to drought. There are refinements that can be made if the organizers want to conduct another tournament in the future. Some of the refinements suggested include: More attention to the type and number of scenarios used; reduce the number of prompts provided; get more focused responses from participants on the types of information they are using to make decisions; place time constraints on the rounds to solicit more focused responses; include discussion on hydrological cycle; and, invite a wider range of stake holders to include neighboring jurisdictions who may be impacted by the decisions of groups within the LPSNRD.