LOWER ELKHORN NRD

JANUARY 2017

LOWER ELKHORN
Natural Resources District

JEO CONSULTING GROUP INC

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Lower Elkhorn Natural Resources District Drought Management Plan

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Section Two: Lower Elkhorn NRD Profile – This section provides an overall profile of the planning area, including: a description of the NRD, location, demographics, and water sources and uses.

Section Three: Current Planning Efforts – This section highlights the current planning efforts of the LENRD and jurisdictions within the planning area that relate to drought.

Section Four: Drought Risk Assessment – This section describes the unique characteristics that affect the risk and vulnerability of the planning area to drought, including: historical occurrence and extent, past impacts, future probability of occurrence, water quality concerns, economics, and seasonal vulnerabilities.

Section Five: Drought Monitoring – This section defines drought locally and establishes a protocol for monitoring drought with indicators and triggers for response.

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List of Acronyms

EPA – Environmental Protection Agency

LENRD – Lower Elkhorn Natural Resources District

NCDC – National Climatic Data Center

NIDIS – National Integrated Drought Information System

NDMC – National Drought Mitigation Center

NDNR – Nebraska Department of Natural Resources

NOAA – National Oceanic and Atmospheric Administration

NRD – Natural Resources District

PDSI – Palmer Drought Severity Index

RMA – Risk Management Agency

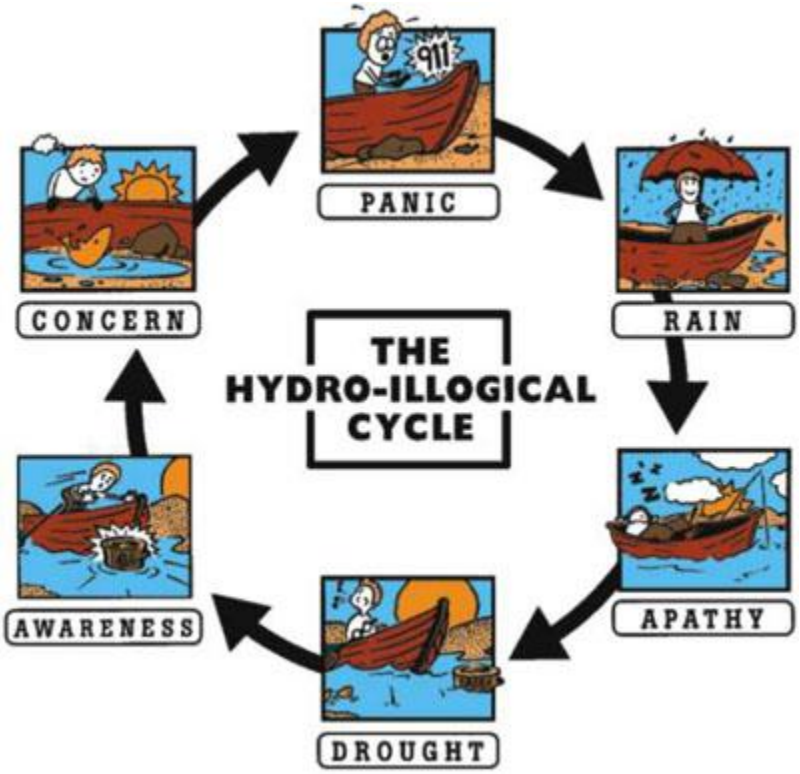
SPI – Standardized Precipitation Index

USGS – United States Geological Survey

Section One: Introduction

Traditionally, many water users have reacted to droughts in the manner shown in Figure 1. During normal or wet years, water users are often apathetic to drought and do not take action to prepare for future droughts. Then, when a drought does occur, water users are not sufficiently prepared and often respond too late. As a result, drought impacts are much more severe than if water users had planned ahead. The Lower Elkhorn Natural Resources District (LENRD) is attempting to break the hydro-illogical cycle by being proactive and planning for drought.

Figure 1: The Hydro-Illogical Cycle



Plan Purpose

The intent of LENRD Drought Management Plan is to define drought locally and identify processes in order to respond to and manage the impacts of future drought events. The Drought Management Plan is a tool that will assist the LENRD in long term resource management and policy development.

The Drought Management Plan is being developed with the intention that it be adopted as an appendix of the approved and adopted 2015 Lower Elkhorn NRD Hazard Mitigation Plan. This plan will include recommendations for the district, counties, municipalities, and water providers to reduce the impacts of future drought events.

The planning team utilized the stated goals from the 2015 Lower Elkhorn NRD Hazard Mitigation Plan, and modified them specifically for the Drought Management Plan. These goals provide direction to guide the LENRD in reducing future drought related losses.

Goal 1: Protect the Health and Safety of Residents

Goal 2: Reduce Future Losses from Drought Events

Goal 3: Increase Public Awareness and Educate on the Vulnerability to Drought

Goal 4: Improve Emergency Management Capabilities

Goal 5: Pursue Multi-Objective Opportunities (Whenever Possible)

Goal 6: Enhance Overall Resilience and Promote Sustainability

Drought

Drought is generally defined as a natural hazard resulting from a substantial period with a lack of precipitation. Although many incorrectly consider it a rare and random event, drought is actually a normal, recurrent feature of climate. It occurs in virtually all climatic zones, but its characteristics vary significantly from one region to another. A drought often coexists with periods of extreme heat, which together can cause significant social stress, economic losses, and environmental degradation.

Drought is a slow-onset, creeping phenomenon, and its impacts are largely non-structural. Drought normally affects more people than other natural hazards do, and its effects are spread over a larger geographical area. As a result, the detection and early warning signs of drought conditions and the subsequent assessment of impacts are more difficult to identify than quick-onset natural hazards (e.g., flood and storm) that results in more immediate, visible impacts. In addition, drought has more than 150 definitions and this lack of a universal definition makes it even harder to indicate the onset and ending. According to the National Drought Mitigation Center (NDMC), droughts are classified into four major types:

Meteorological Drought– is defined based on the degree of dryness and the duration of the dry period. Meteorological 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 meteorological and hydrological drought as agricultural water supplies are contingent upon the two sectors.

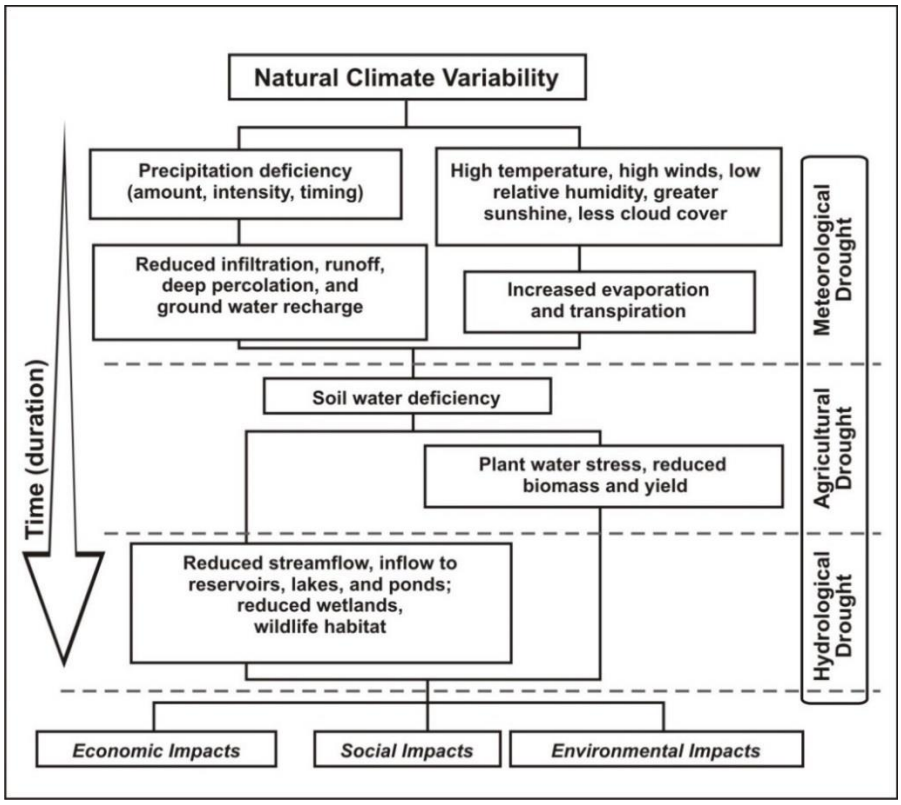
Hydrological Drought – occurs when water available in aquifers, lakes, and reservoirs falls below the statistical average. This situation can arise even when the area of interest receives average precipitation. This is due to the reserves diminishing from increased water usage, usually from agricultural use or high levels of evapotranspiration, resulting from prolonged high temperatures. Hydrological drought often is identified later than meteorological 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 economic goods exceeds supply due to a weather-related shortfall in water supply. The supply of many economic goods includes, but is 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 occurrences. The damage done by these other hazards is understood as 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.

Figure 2 indicates the different types of droughts, their temporal sequence, and the various types of effects they can have on a community.

Figure 2: Sequence and Impacts of Drought Types



Planning Process

The LENRD began the process of securing funding for their Drought Management Plan in June 2015. The LENRD was awarded a Pre-Disaster Mitigation (PDM) grant to assist the development of the plan. JEO Consulting Group, INC. (JEO) was contracted in July 2015 to guide and facilitate the planning process and assemble the Drought Management Plan. Brian Bruckner (Water Resources Manager with LENRD) served as the project manager.

The LENRD Drought Management Plan planning team included the individuals listed on Page 8. The planning team provided regular updates at the public LENRD Board of Directors meetings.

Mike Sousek - LENRD, General Manager
Brian Bruckner - LENRD, Water Resources Manager
Kristie Olmer - LENRD, Grant Coordinator
Jeff Henson - JEO, Project Manager
Phil Luebbert - JEO, Planner

A drought workshop was developed as a component of the Drought Management Plan in order to encourage stakeholder involvement. The goals of the workshop were to gain an understanding of how stakeholders across the NRD respond to drought conditions, and to identify potential gaps in planning, mitigation, preparedness, and response. The workshop consisted of four rounds of discussion focused on the presented drought scenario. One round of discussion focused on how the regional approach to managing drought could be revised to be more efficient and effective. The jurisdictions invited to the drought workshop are shown in Table 1.

Table 1: Invited Stakeholders

Communities and Water Operators	Village of Carroll	University of Nebraska-Lincoln
Village of Bancroft	Village of Hoskins	DHHS Drinking Water and Environmental Health
Village of Beemer	City of Wayne	Nebraska Game and Parks
Cuming County RWD #1	Village of Winside	NEMA
City of West Point	City of Osmond	**Other Stakeholders**
City of Wisner	City of Pierce	Wayne State College
Village of Dodge	City of Plainview	Northeast Community College (Norfolk)
City of Hooper	Logan East Rural Water	Louis Dreyfus Company
City of Scribner	Wau-Col Rural Water	Tyson-Madison
Village of Snyder	**USDA-Farm Service Agencies**	Nucor Steel
Village of Uehling	Cuming County	48 Agriculture and/or Domestic Users
Village of Winslow	Stanton County	Husker Ag LLC
City of Clarkson	Madison County	Grossenburg Implement
Village of Clarkson	Wayne County	Farmers National Co.
Village of Leigh	Pierce County	Farm Credit Services
City of Battle Creek	**Emergency Management Agencies**	Petersen Ag Systems
Covidien	Norfolk/Region 11	Elkhorn Valley Equipment
City of Madison	Colfax County	Platte Valley Equipment
Village of Meadow Grove	Cuming County	Connealy Insurance
City of Norfolk	Stanton County	DeGroot Orchard
City of Tilden	Wayne County	Central Hatchery
Village of Pilger	**State Agencies**	Salmon Well Co.
Stanton Co. SID #1 – Woodland Park	NDNR	Weiland Well Co.
City of Stanton	NDMC	Dietz Well Co

The 34 stakeholders that attended the workshop are shown below.

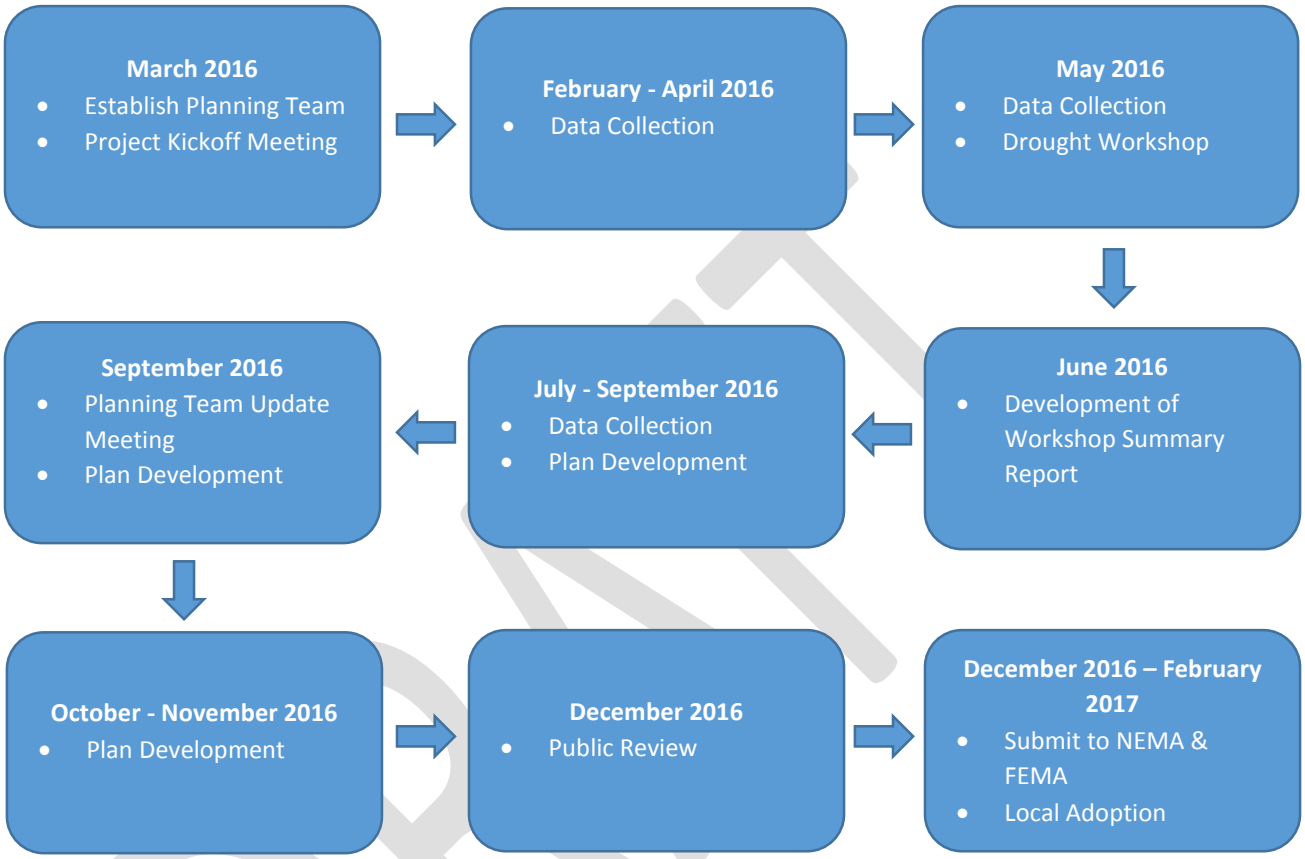
David Kathol (Acreage Owner, LENRD Board Member)
Ted Krienke (Agricultural Producer)
Mark Wooldrik (The Agronomic Consulting Group)
Dennis Watts (City of Norfolk)
Todd Boling (City of Norfolk)
Wade Leisner (City of Pierce)
Bill Hansen (City of Osmond)
Rollie Cederburg (City of Plainview)
Joel Hansen (City of Wayne, LENRD Board Member)
Tom Goulette (City of West Point)
Randy Woldt (City of Wisner)
Mark Arps (Colfax County Emergency Management)
Michelle Evert (Colfax County Emergency Management)
Doug Olson (Grossenburg Implements)
Curt Becker (LENRD)
Danny Kluthe (LENRD Board Member)
Dennis Schultz (LENRD Board Member)
Kristie Olmer (LENRD)
Mike Sousek (LENRD)
Rick Wozniak (LENRD)
Ron Dierking (Logan East Rural Water System)
Nathan Brabec (Louis Dreyfus Company)
Jim Mackel (Mackel's Trailer Court)
Karen Mackel (Mackel's Trailer Court)
Kelly Smith (NDMC)
Nicole Wall (NDMC)
Jennifer Schellpeper (NDNR)
Roy Srymanske (Nucor Steel)
Keith Wiehn (Petersen Ag Systems)
Trenton Howard (Region 11 Emergency Management)
Dave Safty (USDA Farm Service Agency, Stanton County)
Nicolas Kemnitz (Wayne County Emergency Management)

LENRD Drought Workshop

Information gathered at the Drought Workshop is incorporated throughout this Drought Management Plan and greatly influenced the risk assessment and drought management recommendations sections of the plan. The Drought Workshop Summary Report is located in *Appendix B*.

The LENRD Drought Management Plan was also available for public review from _____ to _____. All comments from the public review period will be noted and incorporated within the plan. A clear timeline of the plan process is provided below.

Figure 3: Planning Process



Section Two: Lower Elkhorn NRD Profile

Lower Elkhorn NRD

The LENRD 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. The LENRD 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:

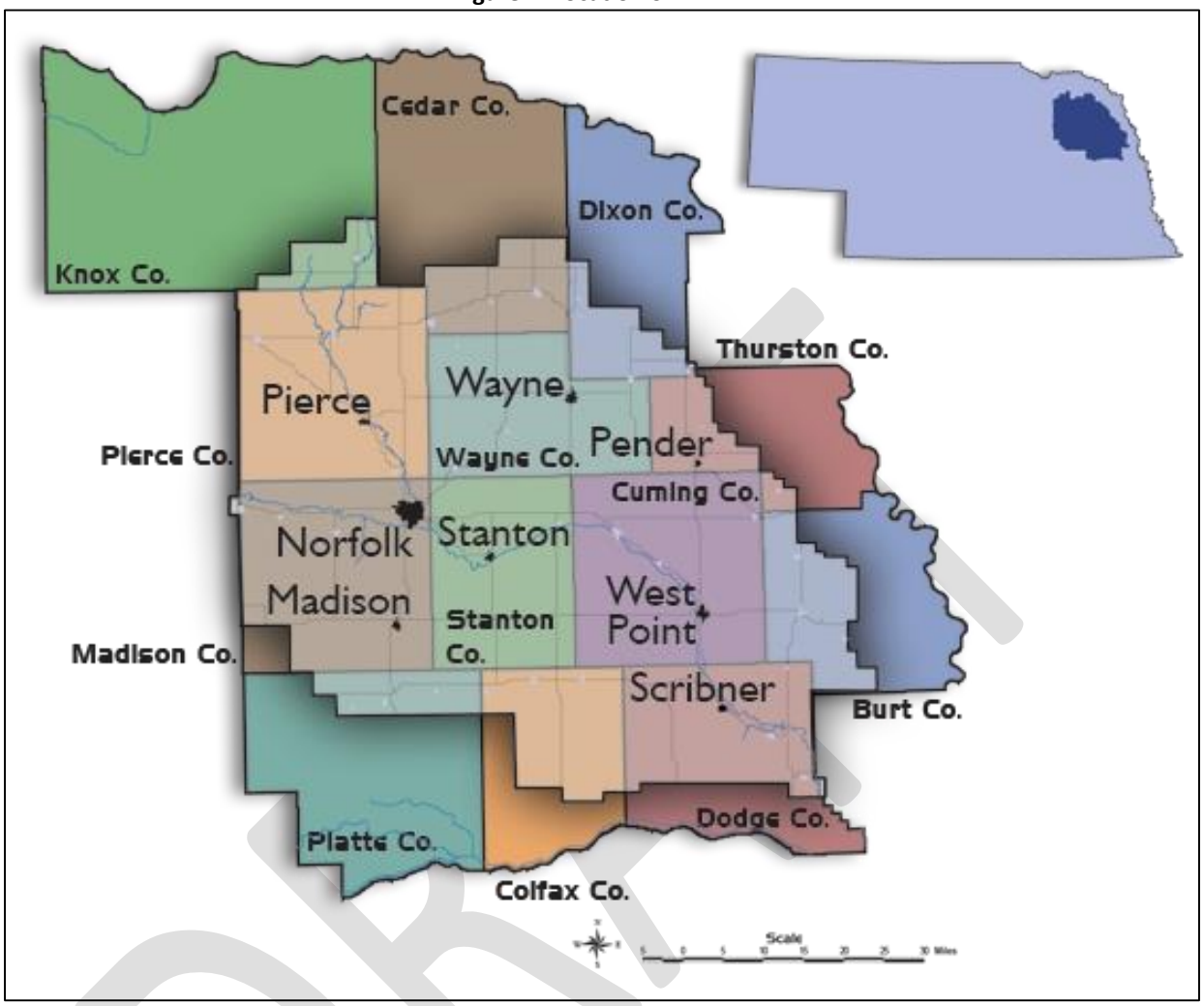
- Erosion prevention and control
- Prevention of damages from flood water and sediment
- Flood prevention and control
- Soil conservation
- Water supply for any beneficial uses
- Development, management, utilization, and conservation of ground water and surface water
- Pollution control
- Solid waste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

Nebraska Statute, Chapter 2, Article 32 establishes Nebraska's NRDs and grants them the powers and authorities that assist in the function of the districts. The LENRD has the authority to levy property taxes to fund the functions of the district, which include a variety of programs and incentives to facilitate the implementation of resource management activities.

The LENRD is located in northeastern Nebraska and is made up of approximately 2,560,000 acres; encompassing all or parts of fifteen counties including: Cuming, Pierce, Madison, Stanton, Wayne, Antelope, Burt, Cedar, Colfax, Dixon, Dodge, Knox, Platte, Dakota and Thurston Counties.

The Elkhorn River is the predominant surface water feature in the LENRD. Major tributaries of the Elkhorn River include the North Folk of the Elkhorn River on the western side of the District, the Logan Creek on the eastern side of the District, and the Maple Creek system in the southern portion of the District. The District also has a number of man-made reservoirs, the largest of which are Willow Creek Recreation Area near Pierce, Maskenthine Lake Recreation Area near Stanton, and Maple Creek Recreation Area near Leigh. These reservoirs not only provide recreation opportunities but also provide flood protection to the local areas.

Figure 4: Location of LENRD



Source: www.lenrd.org

Population

Table 2 provides a summary of population trends within the planning area from 2000 to 2010. The percent change was used to project the population for 2020. This is a relatively simple method to predict population change, and 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. In Table 2, the entire population of counties within the LENRD were provided despite the fact that the LENRD boundary only includes portions of many of these counties. This was done because the US Census Bureau does not organize data by the NRD level. The total population living within the LENRD boundaries is approximately 89,256 (Nebraska Association of Resources Districts).

It is important to address population trends because water use and population are positively correlated; meaning that as population increases there also is likely to be an increase in water use. Most of the planning area is experiencing population decline; therefore, there will likely be a decrease in non-agricultural water use in these areas. However, this does not guarantee a decrease in overall water use as a majority of water use is agriculture related.

Table 2: Population Trends 2000 - 2010

Jurisdiction	2000 Population	2010 Population	Change	2020 Projected Population
Burt County+	7,791	6,858	-11.98%	6,037
Village of Lyons	963	851	-11.63%	752
City of Oakland	1,367	1,244	-9.00%	1,132
Village of Craig	241	199	-17.43%	165
Cedar County+	9,615	8,852	-7.94%	8,150
Village of Belden	131	115	-12.21%	101
City of Laurel	986	964	-2.23%	942
City of Randolph	955	944	-1.15%	933
Colfax County+	10,441	10,515	0.71%	10,590
City of Clarkson	685	658	-3.94%	632
Village of Howells	632	561	-11.23	498
Village of Leigh	442	405	-8.09%	371
Cuming County+	10,203	9,139	-10.43%	8,186
Village of Bancroft	520	495	-4.81	471
Village of Beemer	773	678	-12.29%	595
City of West Point	3,660	3,364	-8.09%	3,092
City of Wisner	1,270	1,170	-7.87%	1,078
Dodge County+	36,160	36,691	-1.47%	37,230
Village of Dodge	700	612	-12.6%	535
Village of Emerson	817	840	2.82%	864
City of Hooper	827	830	0.36%	833
Village of Nickerson	431	369	-14.4%	316
City of Scribner	971	857	-11.74%	756
City of Snyder	318	300	-5.66%	283
Village of Winslow	104	103	-1.0%	102
Dixon County	6,339	6,000	-0.99%	5,679
Village of Concord	160	166	3.75%	172
Village of Dixon	108	87	-19.40%	70
City of Wakefield	1,411	1,451	2.83%	1,492
Knox County	9,374	8,701	-7.2%	8,075
Wausa	636	634	-0.3%	631
Madison County+	35,226	34,876	-0.99%	34,529
City of Battle Creek	1,158	1,207	4.23%	1,258
City of Madison	2,367	2,438	3.00%	2,511

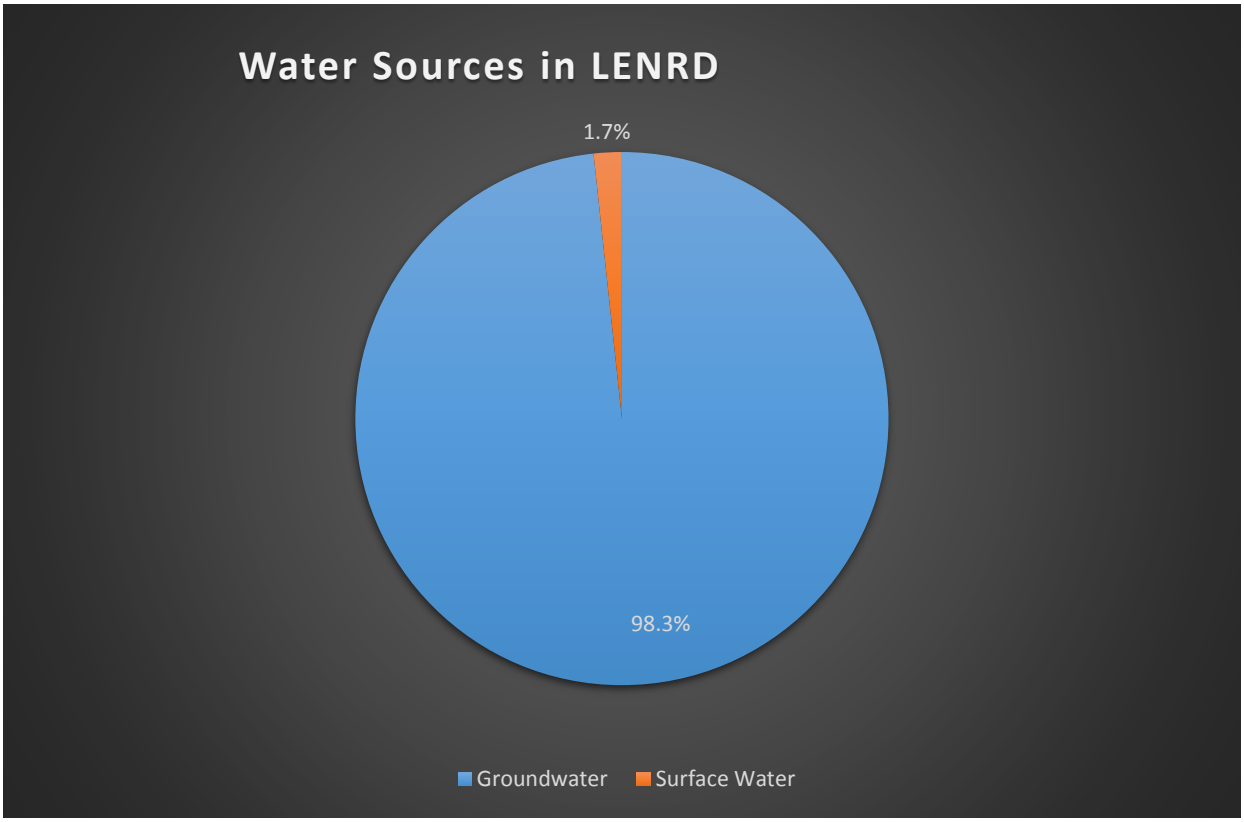
Jurisdiction	2000 Population	2010 Population	Change	2020 Projected Population
Village of Meadow Grove	311	301	-3.22%	291
City of Norfolk	23,516	24,210	2.95%	24,924
City of Tilden	1,078	953	-11.60%	842
Pierce County+	7,857	7,266	-7.52%	6,719
Village of Foster	63	51	-19.0%	42
Village of Hadar	312	293	-6.09%	275
City of Osmond	796	783	-1.63%	770
City of Pierce	1,774	1,767	-0.39%	1,760
City of Plainview	1,353	1,246	-7.91%	1,147
Village of McLean	38	36	-5.3%	34
Platte County	31,662	32,236	1.81%	32,820
Village of Cornlea	41	36	-12.2%	32
Village of Creston	215	203	-5.6%	192
City of Humphrey	786	760	-3.31%	735
Stanton County+	6,455	6,129	-5.05%	5,819
Village of Pilger	378	352	-6.88%	328
City of Stanton	1,627	1,577	-3.07%	1,529
Thurston County+	7,171	6,940	-3.22%	6,716
Village of Pender	1,148	1,002	-12.72%	875
Village of Thurston	125	132	5.6%	139
Village of Rosalie	194	160	-17.5%	132
Wayne County+	9,851	9,595	-2.60%	9,346
Village of Carroll	238	229	-3.78%	220
Village of Hoskins	283	285	0.71%	287
Village of Sholes	24	21	-12.50%	18
City of Wayne	5,583	5,660	1.38%	5,738
Village of Winside	468	427	-8.76%	390

+County figures include incorporated and unincorporated areas.
Source: United States Census Bureau – 2000, 2010

Water Sources and Uses

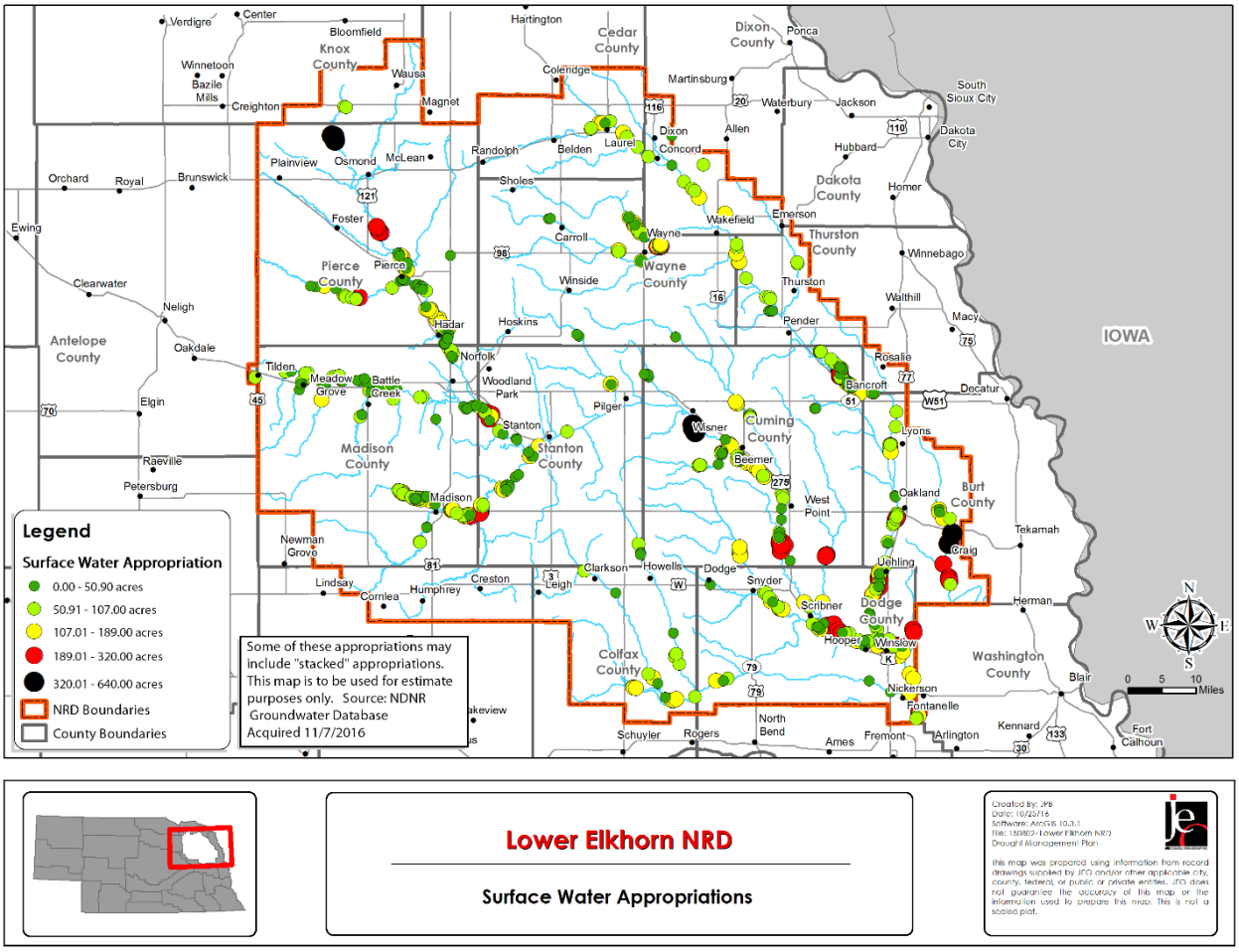
Figure 5 shows that nearly all of the water consumed within the LENRD is sourced from groundwater. Surface water does account for a small percentage of the consumption within the LENRD. There are a number of surface water users within the district; mainly along the Elkhorn River and Logan Creek (Figure 6).

Figure 5: Water Sources in LENRD



Source: USGS, 2010 Water Use by County

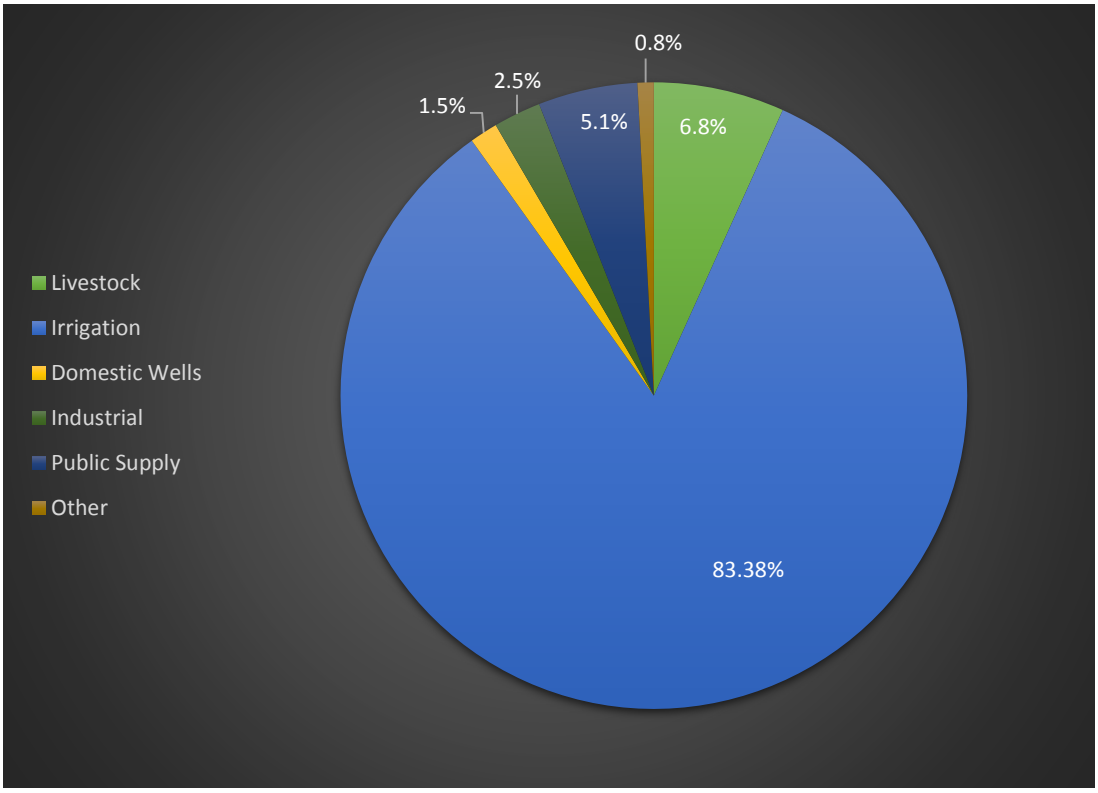
Figure 6: Surface Water Appropriations



As shown in Figure 7, irrigation and agricultural uses account for the overwhelming majority of water use within the planning area. These uses, especially for irrigation, are seasonal in nature, with peak demands occurring (depending upon the year) during the timeframe of late June through mid-September. Even though this time period encompasses a small amount of the annual calendar the in-season impacts of the spike in demand has caused localized groundwater shortages to occur.

The LENRD had 13,904 registered wells (all uses) as of October 2016 (Figure 8). The registration of newly constructed domestic wells was not required until 1993; therefore, the actual number of wells within the district is likely much higher, as many of the older constructed wells have never been registered but are still in service. Figure 9 illustrates the percentages in number of wells by type (or use) of the total percentage. The majority of wells are used for irrigation (47%), domestic use (20%), and monitoring (19%). Wells indicated as “other” include wells that support uses like injection, recovery, lake supply, geothermal, aquaculture, etc.

Figure 7: Water Use in LENRD



Source: USGS, 2010 Water Use by County

Figure 8: Registered Wells in LENRD

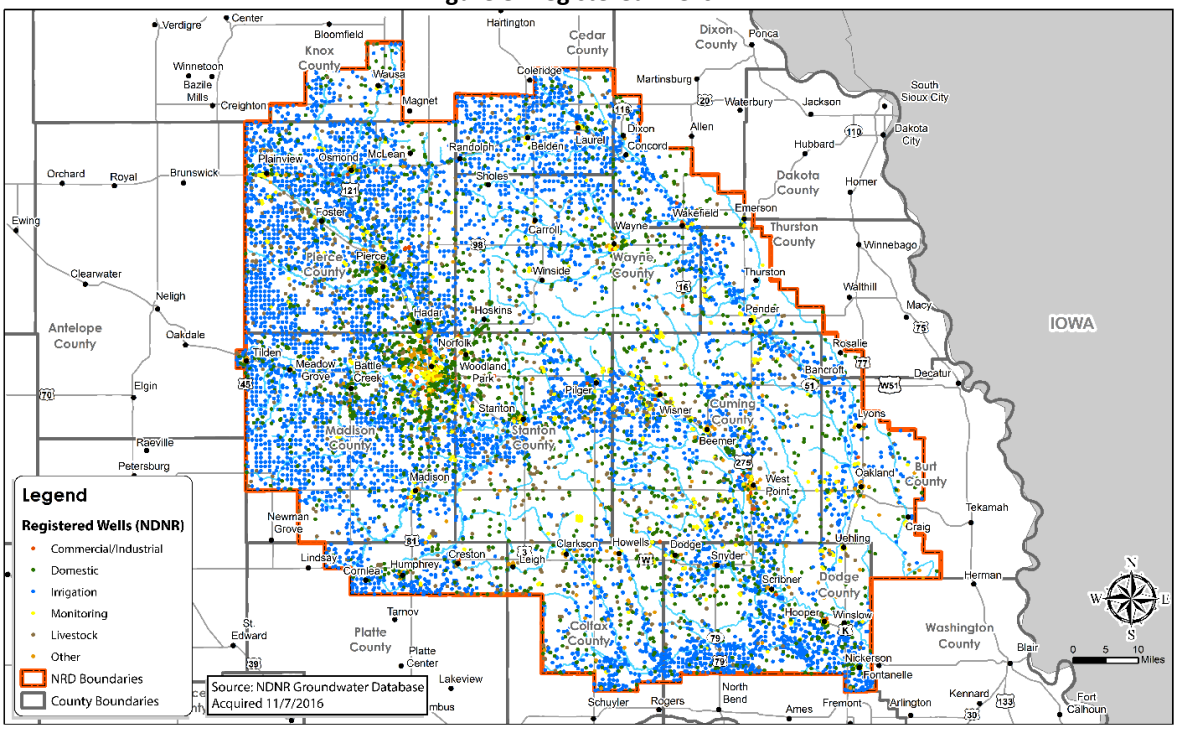
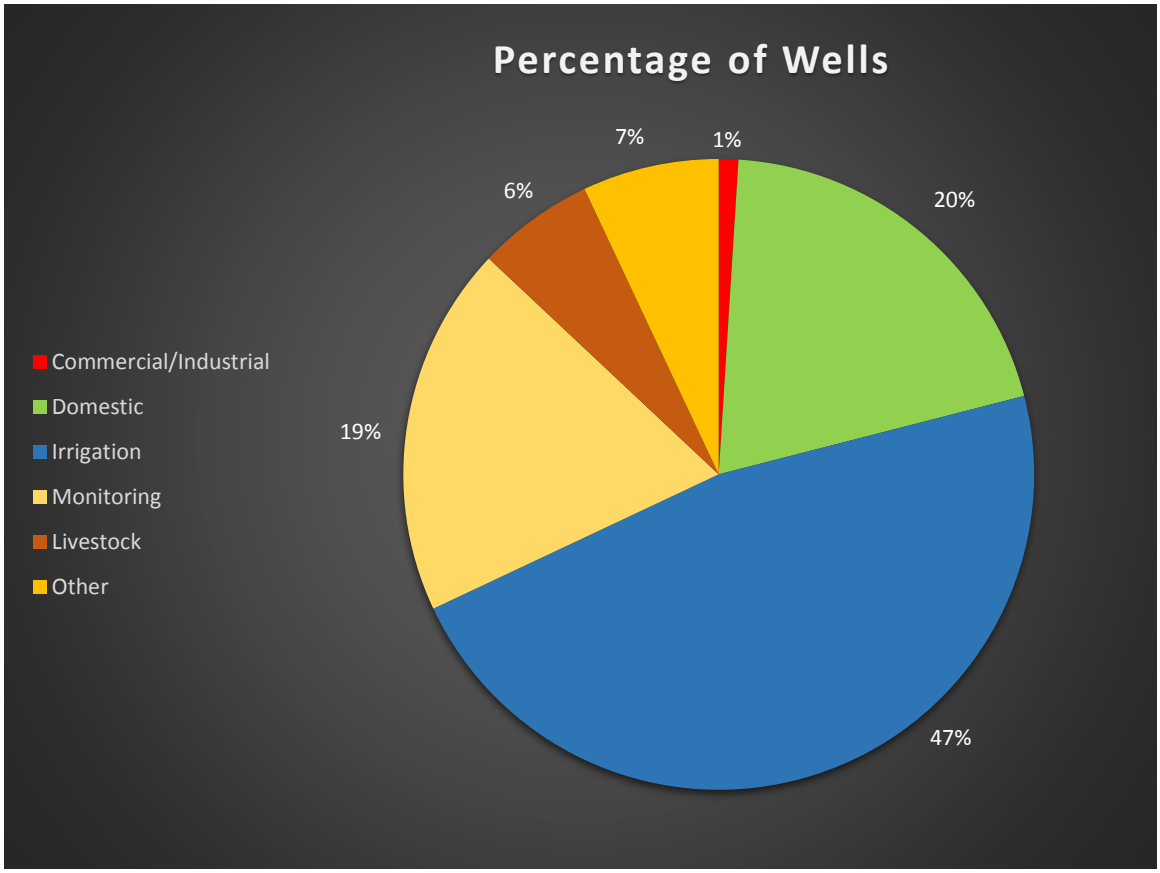


Figure 9: Percentage of Wells by Use



Source: Lower Elkhorn River Basin Water Quality Management Plan, 2015

Section Three: Current Planning Efforts

The planning process identified current planning efforts within the LENRD that either directly or indirectly relate to drought, and integrate hazard mitigation principles. As the LENRD is tasked with managing the groundwater resources in the area, there are a number of current relevant planning efforts. The identified planning mechanisms are described below.

Lower Elkhorn NRD Multi-Jurisdictional Hazard Mitigation Plan 2015

Current Plan Integration - The Hazard Mitigation Plan specifically addresses hazards such as drought, and subsequently proposes mitigation actions to reduce the risk from drought at the regional and local level. The following participants identified drought as a high priority hazard during the hazard mitigation planning process:

- Beemer
- Belden
- Cuming County
- Emerson
- Leigh
- Madison County
- Madison
- Meadow Grove
- Oakland
- Pierce
- Pilger
- Plainview
- Randolph
- Tilden
- Stanton County
- Stanton
- Wakefield
- Wayne
- Wayne County
- Wisner

Future Plan Integration – The Drought Management Plan will be adopted as an appendix to the hazard mitigation plan.

Lower Elkhorn NRD Master Plan 2010

Current Plan Integration - Includes the overall goals and objectives for the NRD. One goal identified in the plan is to conserve groundwater quantity and quality. The plan includes a number of objectives to achieve that goal. Stormwater and drainage improvement projects identified within the Master Plan will be consistent with the projects identified within the Drought Management Plan.

Future Plan Integration – Every ten years, the LENRD updates their Master Plan. As a part of that process, both the Drought Management Plan and Hazard Mitigation Plan will be examined, with specific attention given to best management practices to help chart the next decade of development and growth for the LENRD. Projects identified in this Drought Management Plan will be evaluated for inclusion into future Master Plan updates. The next Master Plan update is scheduled for 2020.

Groundwater Management Plan 2015

Current Plan Integration - Serves as a foundation for decision-making while managing groundwater resources within the district. Also, this outlines the regulatory actions that the district will take when groundwater quantity or quality problems arise.

Future Plan Integration – The Groundwater Management Plan is reviewed annually. The Drought Management Plan will be incorporated into future updates of the Groundwater Management Plan as it will be utilized to identify data sources and allocation levels for future water consumption. The Drought Management Plan and the local definition of drought provided in this document will be a foundation of data to inform updates to the Groundwater Management Plan.

Integrated Management Plan (Currently in Draft Form)

Current Plan Integration – The Integrated Management Plan (IMP) provides a framework for how the LENRD and Nebraska Department of Natural Resources (NDNR) will work collaboratively to manage groundwater and surface water across areas where the two are hydrologically connected. The Integrated Management Plan recommends the development of the Drought Management Plan.

Water Inventory Report (Portion of IMP)

Documents groundwater and surface water supplies and uses within the district boundary. The report also identifies potential conjunctive management project sites, including surface water storage or groundwater recharge.

Water Balance Study (Portion of IMP)

Applies recorded inflows and outflows into the water balance equation to determine change in storage. The study is a tool for developing and supporting water management decisions.

Future Plan Integration – Projects identified in this Drought Management Plan will be evaluated for inclusion within future updates to the Integrated Management Plan.

Bazile Groundwater Management Area Plan, 2016

This plan was developed jointly by the Nebraska Department of Environmental Quality, Lewis & Clark NRD, Lower Elkhorn NRD, Lower Niobrara NRD, and Upper Elkhorn NRD to address water quality concerns within Antelope, Knox, and Pierce counties. Groundwater area management plans provide coverage for projects to restore or protect groundwater resources, groundwater recharge areas or wellhead protection areas. The Bazile plan was recently accepted by the EPA, meaning the plan addressed the nine elements for an Alternative Management Plan, as identified in the EPA's "Handbook for Developing Watershed Plans to Restore and Protect Our Waters". https://www.epa.gov/nps/handbook-developing-watershed-plans-restore-and-protect-our-waters

Current Plan Integration – The plan identifies strategies to protect groundwater supplies and manage the level of contaminants present in the plan area. If water supplies decline during periods of drought, water quality could be negatively impacted.

Future Plan Integration – The Drought Management Plan will not likely impact any future updates to the Bazile Groundwater Management Area Plan. Any impacts to this plan will be more closely linked with updates to the Groundwater Management Plan and the Lower Elkhorn NRD Rules and Regulations for Management of Groundwater that address the annual process for determination of annual groundwater allocations within the District.

Emergency Response Plans for Community Water Systems within the NRD

An Emergency Response Plan is a documented strategy describing actions that a community water system would take in response to various major events, including drought. Emergency Response Plans from the following community water systems were reviewed:

- Battle Creek
- Belden
- Clarkson
- Country Village Mobile Home Park
- Cuming County RWD #1
- Dodge
- Green Acres Mobile Home Court North
- Green Acres Mobile Home Court South
- Hooper
- Hoskins
- Howells
- Lyons
- Madison
- McLean
- Meadow Grove
- Norfolk Regional Center
- Norfolk
- North Bend
- Oakland
- Osmond
- Park Mobile Home Park
- Pender
- Pierce
- Pilger
- Plainview
- Randolph
- Scribner
- Snyder
- Stanton
- Tilden
- Uehling
- Wayne
- West Point
- Winside
- Winslow
- Wisner

Information gathered during the Drought Workshop and within Emergency Response Plans indicated that for water users across the district, there is an inconsistent and largely undocumented drought response. Most community water systems within the LENRD do not have a local drought definition or response triggers and for the community water systems that do list drought response triggers, the triggers are often vague and subjective. The Emergency Response Plans also fail to define the end of drought.

These subjective triggers do allow the community flexibility in determining the appropriate time to enforce water restrictions. However, the lack of specific triggers may make the decisions to declare drought and enforce water restrictions more difficult for the community. Drought declarations are typically politically difficult decisions as the declaration may impact some in the community economically. Pre-established triggers can help ease the political pressure and enable decision makers to formulate an informed decision regarding a drought declaration.

Current Plan Integration – Will provide a technical basis for declaration of drought conditions and identifies the actions that a community water system would take in the event of a drought.

Future Plan Integration – Strategies identified within this Drought Management Plan will have to be represented in local documents. Allocations will impact local water supplies during prolonged periods of drought. Any future updates to these emergency response plans should account for any groundwater management implemented by the LENRD.

Wellhead Protection Plans

Current Plan Integration – Wellhead protection plans attempt to proactively protect and manage the source of community drinking water from potential contaminants. Wellhead protection plans often recommend specific actions that can be taken to protect water quality. Many actions (i.e. zoning overlay district) are consistent with the recommendations included to this plan.

Future Plan Integration – Future updates to (and newly developed) wellhead protection plans should incorporate the local definitions for data included in this plan as well as consider the mitigation alternatives identified and prioritized in this plan.

The following table shows communities within the LENRD that have an established wellhead protection plan as of 2016.

Table 3: Wellhead Protection Plans in LENRD

Community	Date Approved	Community	Date Approved
Village of Belden	2/22/07	City of Norfolk	12/12/08
City of Clarkson	5/30/03	Village of Pender	8/29/03
Village of Dodge	4/15/02	City of Stanton	7/27/11
Village of Emerson	8/25/03	City of Wakefield	2/3/03
Village of Howells	12/16/04	City of Wayne	5/9/13
Logan East Rural Water System	9/18/00	City of Osmond	12/8/16

Section Four: Drought Risk Assessment

This section describes the unique characteristics of the planning area that affect its risk and vulnerability to future drought events. The risk assessment provides the factual basis for developing specific strategies to mitigate the impacts of drought. This section contains a description of historical drought occurrence and extent, previous drought impacts and damages, probability of future occurrences, and a vulnerability assessment.

Historical Drought Occurrence and Extent

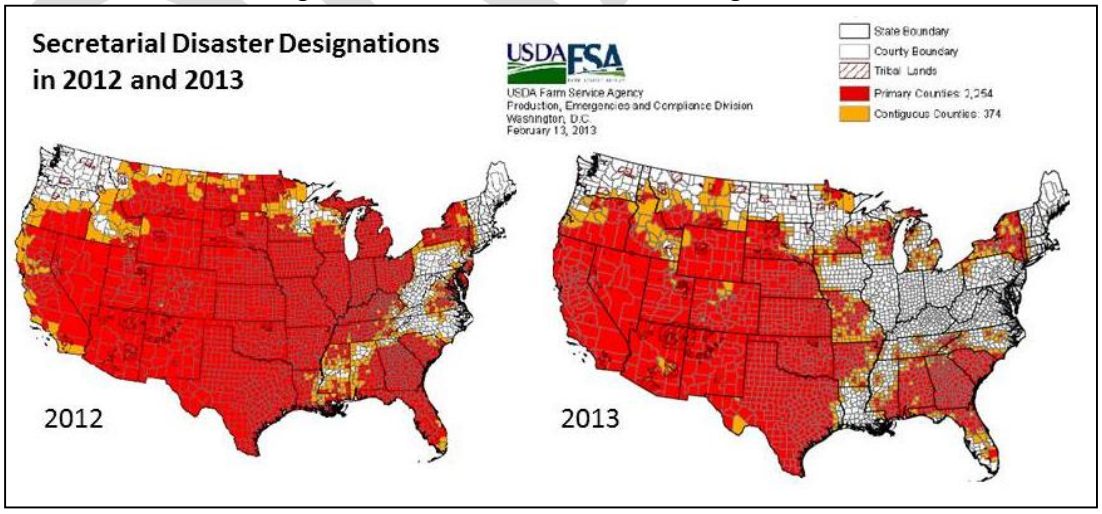
The Palmer Drought Severity Index (PDSI) was used to document historical occurrence and extent of drought within the planning area beginning in 1985. Among the various indices, the PDSI has been widely used by state and local governments in the United States. The PDSI is further discussed in *Section Five: Drought Monitoring*. The following table depicts the percentage of months the LENRD experienced drought and the extent associated with this index.

Table 4: Historical Drought Occurrence in LENRD

Drought Classification	PDSI Range	Total Occurrences in Months	Percent of Months
Drought	-1.0 or Less	364/1453	25.1%
Mild Drought	-1.0 to -1.99	135/1453	9.3%
Moderate Drought	-2.0 to -2.99	91/1453	6.3%
Severe Drought	-3.0 to -3.99	46/1453	3.2%
Extreme Drought	-4.0 or Less	92/1453	6.3%

Past drought events in the planning area have resulted in United States Department of Agriculture (USDA) Secretarial Disaster Designations, most recently in 2012 and 2013. Figure 10 shows that the entirety of the planning area was associated with a drought disaster designation within those two years.

Figure 10: USDA Secretarial Disaster Designations



Source: U.S. Department of Agriculture

Past Drought Impacts

Drought causes significant economic, environmental, and social impacts. Although agriculture is typically the major sector affected, impacts on rural and municipal water supplies, fish and wildlife, tourism, recreation, water quality, soil erosion, the incidence of wildfires, electricity demand, and other sectors are also significant. Drought can also indirectly impact personal and business incomes, tax revenues, unemployment, and other areas as well.

The NDMC's Drought Impact Reporter documents the impacts of drought throughout the United States. The following table summarizes, by category, the impacts within the LENRD from 2000-2016. Many of these reported impacts have been in the agricultural sector.

Table 5: Reported Drought Impacts (2000 - 2016)

Area	Agricultural	Business & Industry	Energy	Fire	Plant & Wildlife	Relief, Response, & Restrictions	Society & Public Health	Tourism & Recreation	Water Supply & Quality
LENRD	145	31	7	7	25	67	31	3	43

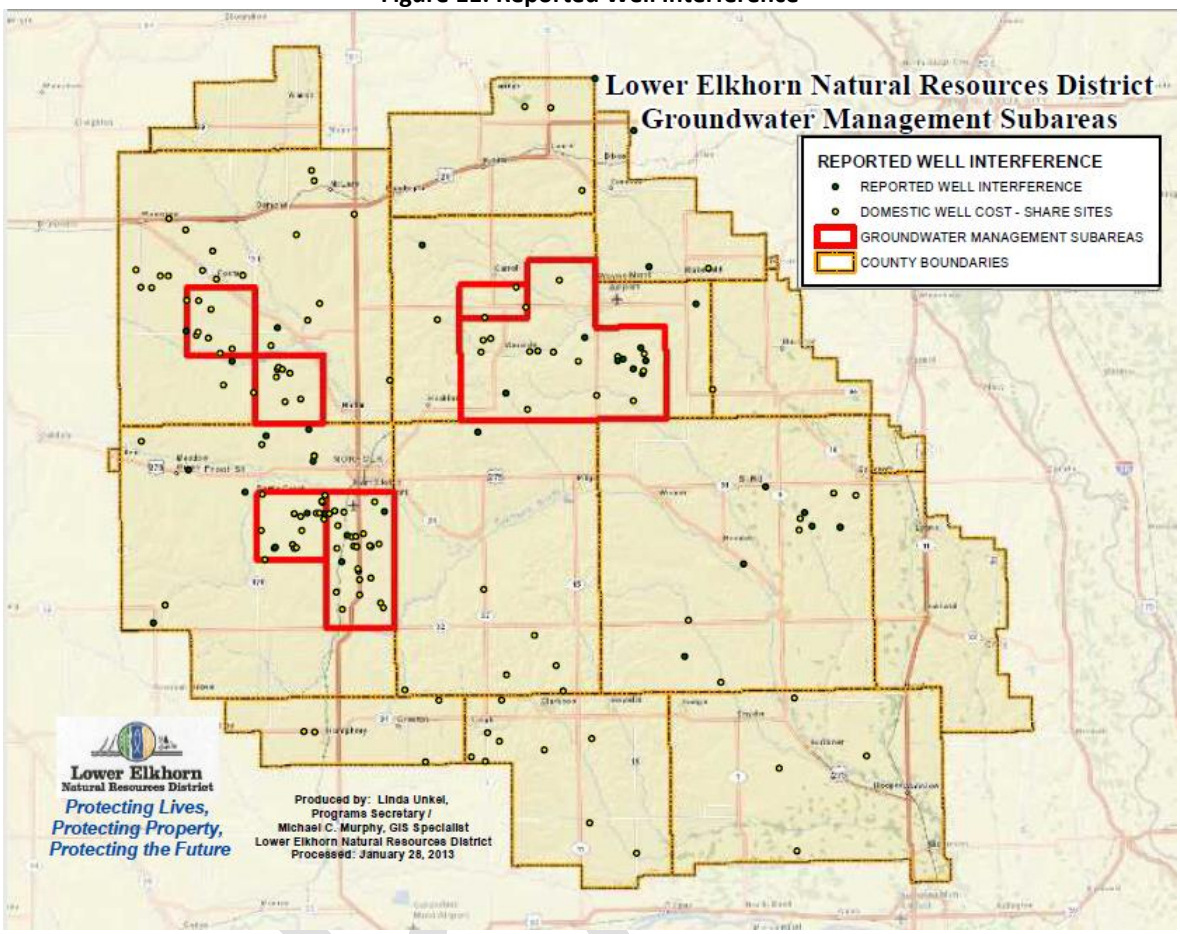
Source: NDMC – Drought Impact Reporter

According to the Drought Impact Reporter, there have been more than 40 impacts reported related to water supply and quality in the planning area. The LENRD received over 150 complaints regarding individual well water quantity problems during the summer months of 2012. Figure 11 shows the locations of reported well interference and groundwater management subareas. The LENRD implemented a cost share program to assist private well owners who experienced well interference due to in-season groundwater level declines during the 2012 drought. The cost share program was implemented to assist property owners who occurred extra out-of-pocket expenses in remediating impacts of water quantity issues. Those areas that reported well interference during the 2012 drought are more vulnerable to drought events.

Other notable drought impacts include:

- During the 2012 drought, more than a dozen communities implemented water restrictions. Some restrictions lasted for up to 13 weeks.
- Water use restrictions carried over into 2013 for two communities.
- In 2012, nearly 85% of the groundwater level observation wells in the LENRD reported a decline in ground water levels (Fall 2012 data); in 2013 more than 98% of observation wells reported declining groundwater levels (18% were reported as historic lows, Spring 2013 data); and in 2014, 57% of observation wells showed decline.
- In response to the drought, complaints regarding the continuous withdrawals of groundwater for irrigation pumping, and the in-season shortages that occurred in many areas of the District causing negative impacts to many types of wells in 2012, motivated the LENRD to become the first NRD in eastern Nebraska to impose water allocation measures on irrigators within groundwater management subareas.

Figure 11: Reported Well Interference



Drought is one of the costliest hazard events. According to NOAA National Centers for Environmental Information (NCEI), there have been 23 billion-dollar disasters in the US attributed to drought since 1980. Table 6 shows the damage that drought causes in the planning area each year. This table does not include losses from displacement, functional downtime, economic loss, injury, or loss of life.

Table 6: Average Annual Damages

Total Property Loss[1]	Average Annual Property Loss [1]	Total Crop Loss[2]	Average Annual Crop Loss [2]
$0	$0	$444,493,927	$31,749,566

1 Indicates the data is from NCDC (January 1996 to January 2014); 2 Indicates data is from USDA RMA (2000 to 2014)

Future Probability of Occurrence

The probability for future drought events was calculated by the previous number of months in drought divided by the total months on record. The planning area experienced drought in 364 out of 1,453 months on record; resulting in a 25.1% chance of drought occurring each month within the LENRD. However, according to the University of Nebraska-Lincoln report *Understanding and Assessing Climate Change: Implications for Nebraska*, the state of Nebraska can expect an increase in drought frequency and severity in the future.

Vulnerability Assessment

As drought is a normal, recurrent feature of climate, the entirety of the planning area is susceptible to its impacts. However, there are some areas that may experience greater impacts due to the vulnerabilities described below.

Water Quality Concerns

Water quality concerns are often exacerbated under drought conditions because contaminants can become more concentrated in light of a diminished water supply. Figure 12 shows the known nitrate levels within wells (tested for nitrate concentrations) throughout the district. The EPA has set the Maximum Contaminant Level of nitrate as nitrogen at 10 mg/L (or 10 parts per million) for the safety of drinking water. Only wells with nitrate levels over 10 mg/L are shown in Figure 12.

Figure 12: Known Nitrate Levels

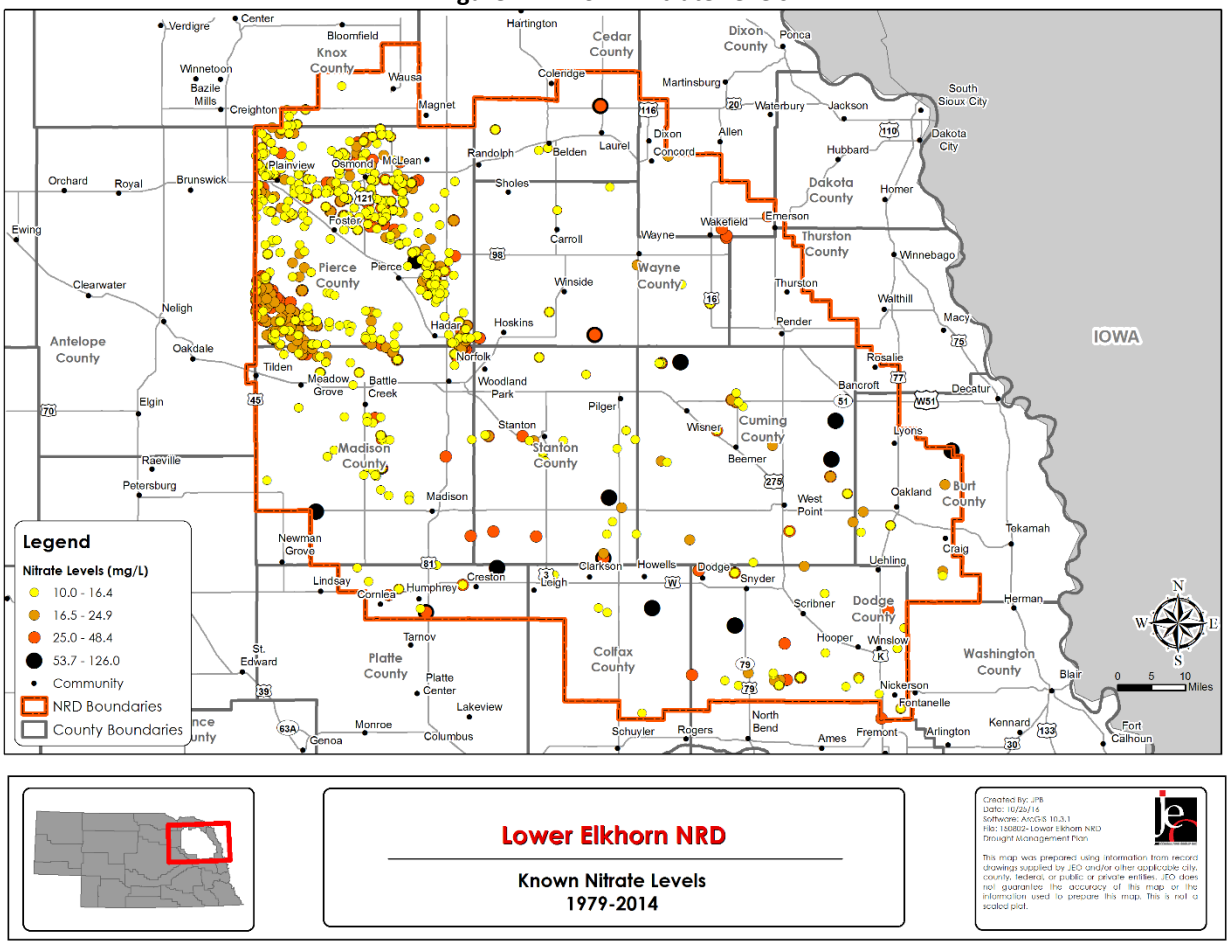


Figure 13: Current Phase 2 Groundwater Management Area

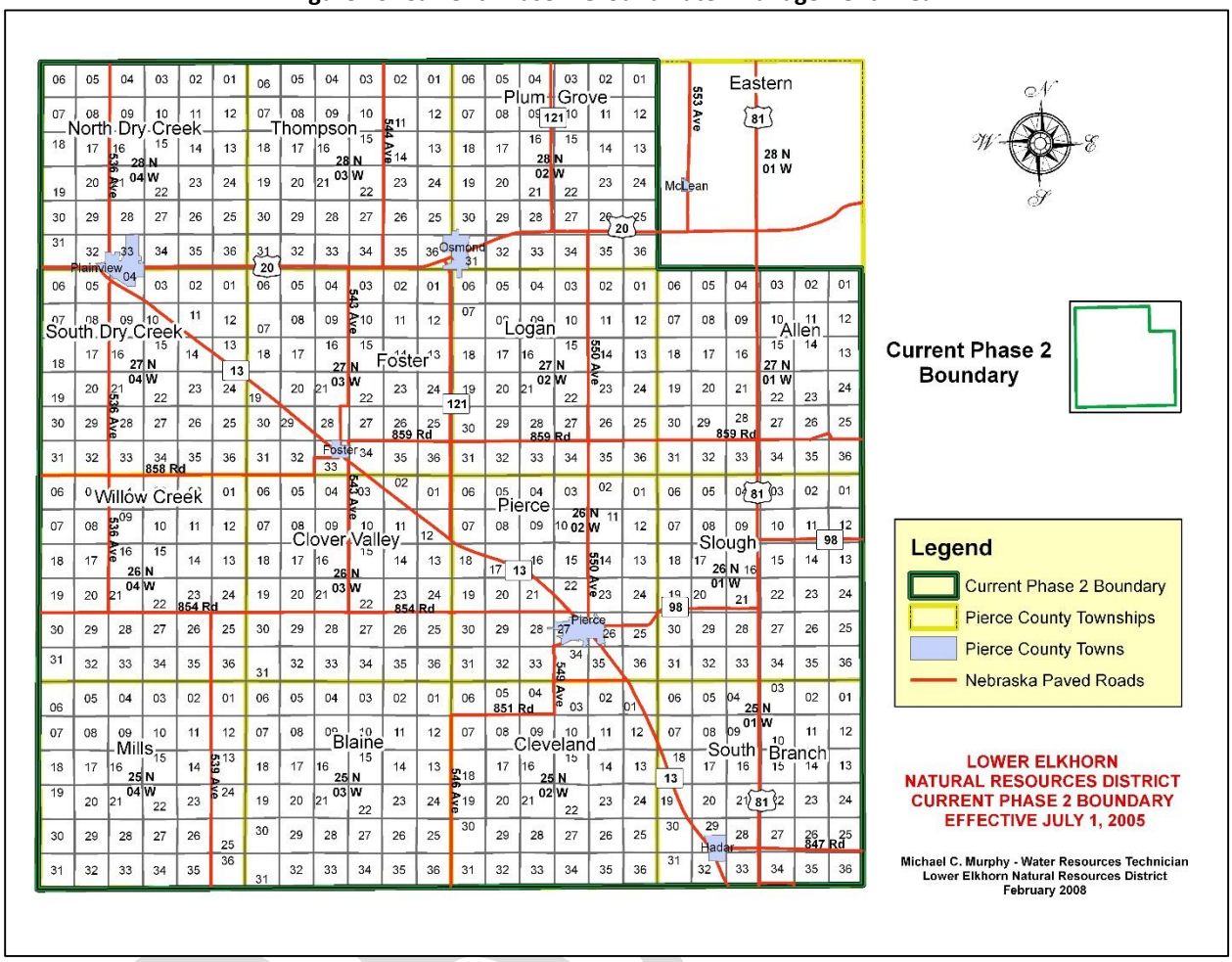
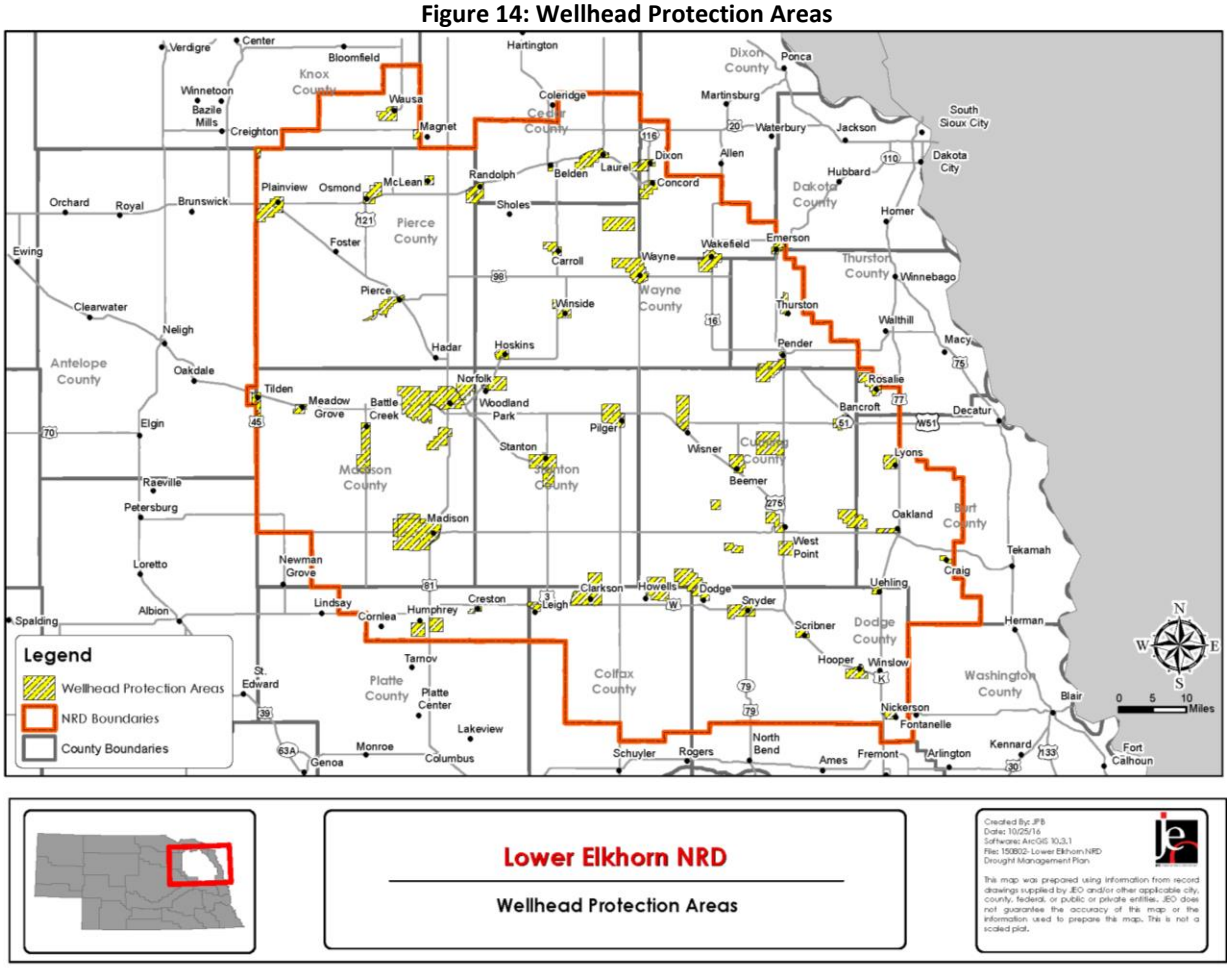


Figure 13 shows the groundwater management area, which currently includes all of Pierce County except for Eastern Township. This area has been identified as having high nitrate levels or having the potential for groundwater contamination.

Figure 14 shows the identified wellhead protection areas within the district. A wellhead protection area is defined by the geographic area (and flow direction) contributing water to the well or well field of a municipal water system. These maps also include information that estimates the time-of-travel of the groundwater as it flows towards the wellhead. Identifying the wellhead protection area allows a community to proactively protect and manage the source of community drinking water.

Figure 14: Wellhead Protection Areas



Economics

Agriculture is a major industry and economic driver of the economy within the LENRD. The following tables display the importance of the agricultural sector within the LENRD. Drought can cause significant economic impacts in agricultural based economies. According to the USDA Risk Management Agency (RMA), drought accounted for $444,493,927 of crop losses within the planning area from 2000 – 2013. Reduced income for farmers has a ripple effect into other sectors, as their ability to purchase goods and services is reduced.

Table 7: Farm Employment Structure by County, 2013

County	Jobs	% of Jobs	Location Quotient
Burt	553	15.5	10.8
Cedar	989	18	12.5
Colfax	627	9.5	6.6
Cuming	1,098	17.1	11.9
Dixon	570	18.2	12.6
Dodge	763	3.4	2.4
Knox	854	18.5	12.8
Madison	714	2.6	1.8
Pierce	692	19.5	13.5
Platte	973	4	2.8
Stanton	613	23	15.9
Thurston	387	10	6.9
Wayne	627	10.7	7.4
Total	9460	-	-

Source: Nebraska Regional Economic Analysis Project (NE-REAP) with data provided by the U.S. Department of Commerce, Bureau of Economic Analysis

Table 8: Agricultural Land and Sales by County

County	Number of Farms	Land in Farms, Acres	Market Value of Agricultural Sales
Burt	560	309,934	$226,941,000
Cedar	939	466,473	$388,734,000
Colfax	554	257,628	$337,904,000
Cuming	918	362,926	$1,081,302,000
Dixon	570	298,996	$169,128,000
Dodge	767	330,044	$326,088,000
Knox	1,080	627,735	$312,845,000
Madison	753	351,799	$303,657,000
Pierce	677	329,181	$261,208,000
Platte	942	426,329	$652,102,000
Stanton	619	254,418	$182,084,000
Thurston	367	247,605	$197,685,000
Wayne	518	279,951	$203,253,000

Source: USDA, 2012 Census of Agriculture

There are also a number of water intensive industries in the planning area that may be vulnerable during a drought event. These industries include the Husker Ag and Louis Dreyfus ethanol plants, and Nucor Steel.

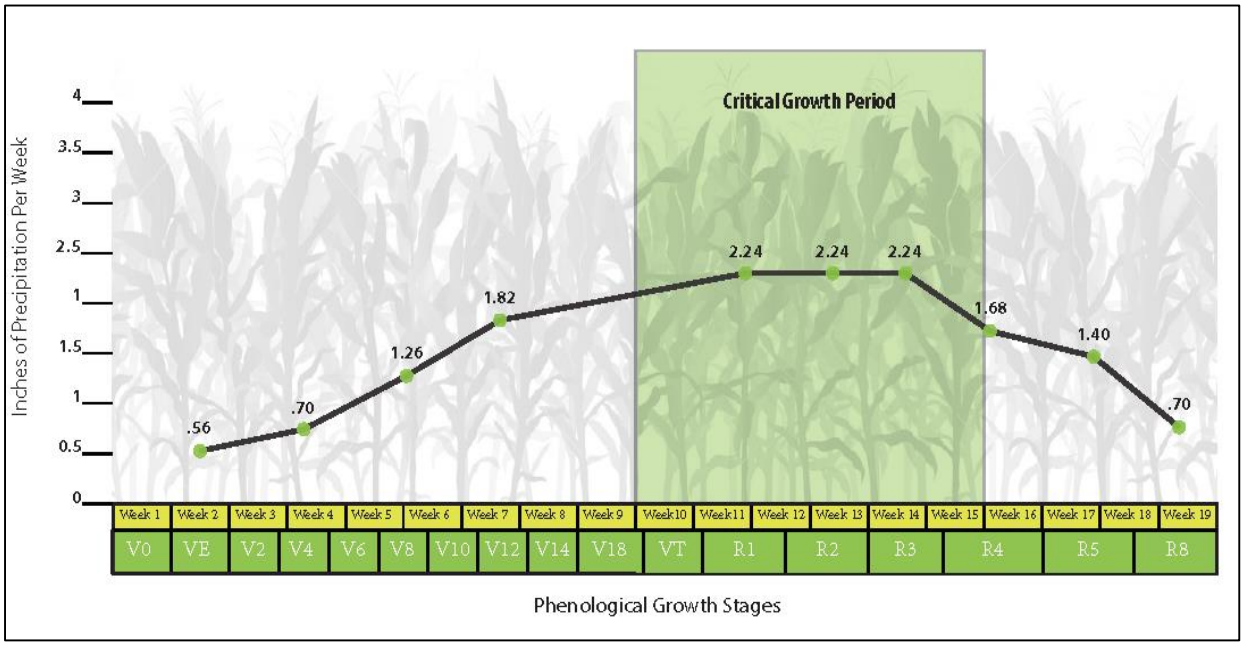
Seasonal Vulnerabilities

Seasonal vulnerabilities related to water availability and high water demand exist within the NRD and across the state. The planning area will be more vulnerable to drought during these periods. These seasonal vulnerabilities may impact when the LENRD schedules meetings, and when a drought stage is declared.

Agricultural irrigation is one key consideration directly related to monitoring and managing water use and water need for the LENRD. The phenology for crop development provides insight regarding times of high water demand. 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 15. The ideal time to sow crops in the region ranges from April 25th to May 10th. Clearly there is need for moisture throughout the growth cycle, but the most critical times for adequate soil moisture are during the pre-tasseling and tasseling phases. Critical moisture management times for 113-day maturing corn occur between weeks 10 and 15. If we assume a sowing date of May 1st, critical periods with adequate soil moisture for this particular crop would be during the months of July and August.

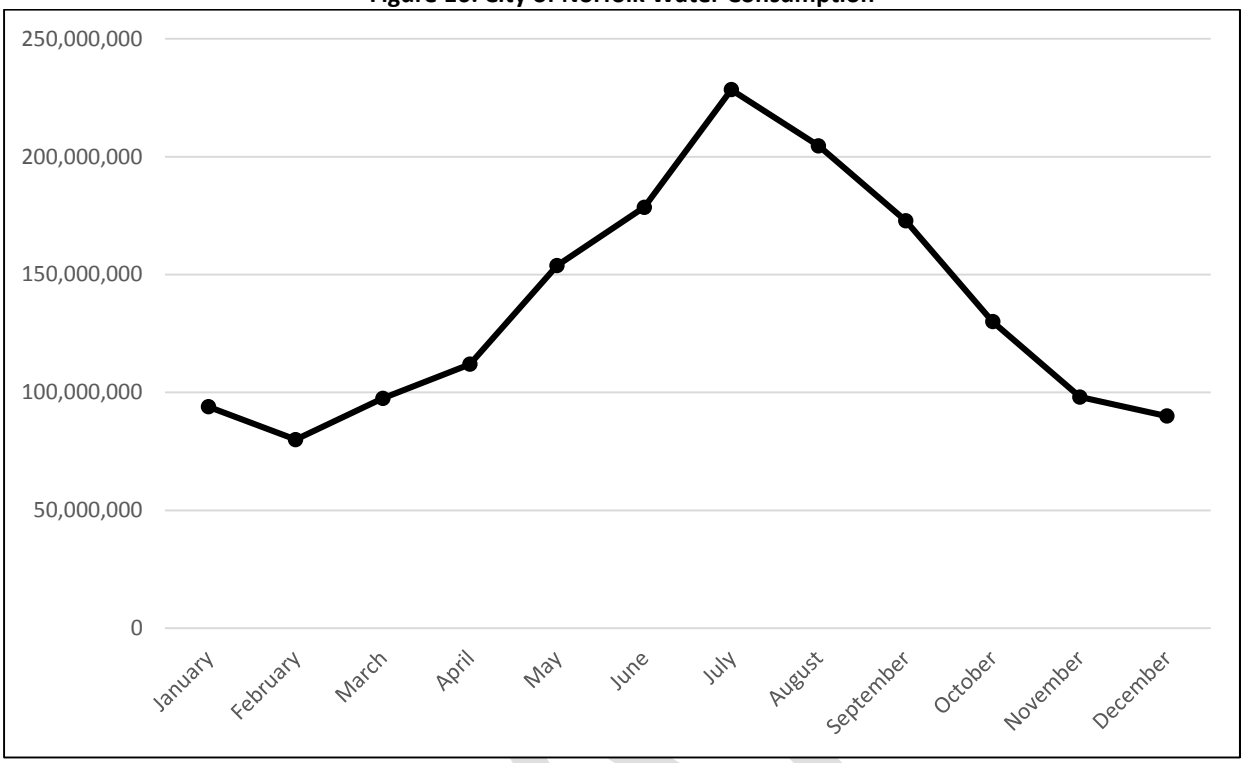
By reviewing the critical management periods for crops and comparing this data with water use data made available by the city of Norfolk (Figure 16), there is an overlap of increased demand during the summer months of July and August. While monitoring water supplies throughout the year is helpful, it is most important for agricultural, municipal, commercial, and industrial water users to manage and develop contingency plans in case of shortage, during the periods of peak demand.

Figure 15: Example of Crop Water Use by Growth Stage for 113-Day Maturity Corn



**Ideal sowing range: April 25 – May 10*

Figure 16: City of Norfolk Water Consumption



Indicates the average monthly water consumption for the city of Norfolk in gallons between 2010 – 2015

Section Five: Drought Monitoring

The goal of this section is two-fold. The first goal is to use historical drought information to define drought locally. The second goal works to identify the best available data specific to the LENRD to create a monitoring tool that detects the potential for drought occurrence as early as possible. This section includes the methodology used for selecting local drought indicators, a description of the drought monitoring tool, its limitations, and the recommended protocol for utilizing the drought monitoring tool.

Factors Contributing to the Drought Monitoring Tool

There were a number of factors that contributed to the selection of the components of the drought monitoring tool. These factors are described below.

Drought Plan Review

The planning process examined several drought planning mechanisms utilized to establish the best available data used in other geographic locations regarding drought management planning. The following table provides details and information from a wide range of plans collected throughout this process and identifies the type of data utilized to define drought locally within those documents.

Table 9: Indicators Used in Drought Plans

Plans	PDSI	SPI	Streamflow	Groundwater Level	Precipitation	Reservoir Level	Other
Drought Assessment and Response Plan – King George County, VA				x-Percentiles	x		
Drought Management Plan – Central Texas Groundwater Conservation District Management Plan							x-PHDI
Drought Management Plan – Jefferson River Watershed Council			x- cfs				
Drought Management Plan – Birmingham Water Works Board	x		x-Percentiles			x-Percentiles	
Drought Management Plan – Columbia Power & Water Systems						x-Percentiles	
Drought Management Plan – Loveland, CO							x-Projected water supply shortage
Klamath Basin Restoration Agreement Drought Plan						x-Acre ft	
Massachusetts Drought Management Plan		x-3,6,12	x-Months below normal	x-Months below normal		x-Below normal	x-Crop Moisture Index, Keetch-Byram Drought Index
Metropolitan Washington Water Supply and Drought Awareness Response Plan: Potomac River System						x -% of capacity	x-Projected water supply shortage
Northern Shenandoah Regional Water Supply Plan			x-Percentiles	x-Percentiles	x-% of normal	x-Elevation	
Susquehanna River Basin Drought Coordination Plan	x		x-Percentiles	x-Percentiles	x-% of normal		
Water Conservation and Drought Contingency Plan – Sabine River Authority of Texas			x- cfs			x-Acre ft & elevation	

Data Availability

A key factor that led to the selection of a monitoring tool is data availability. The following characteristics were identified as priorities when considering the available data:

- Frequently collected and/or available
- Significant historical record
- Locally specific
- Easy to collect and/or calculate

The data for this set of indicators/indices needed to be available and updated consistently to allow for timely detection of drought and subsequent coordination of responses. Indicators/indices with a long historical record were also desired, in order to test them against historical drought periods. The data needed to be available at the most local scale in order to be relevant to the planning area.
Lastly, the data for the selected indicators/indices needed to be easy to collect and interpret.

Redundancy

Having multiple sources of input into the drought monitoring tool allows the LENRD to examine different aspects of drought. One source of input may not reflect when local impacts are being experienced. Therefore, it is prudent to include multiple sources to provide some redundancy. Multiple sources of input may also be useful at representing both the early stages of drought and the end of a drought.

Guidance Documents

The following sources were also used to determine appropriate data and sources of input for the drought monitoring tool:

- World Meteorological Organization (WMO) and Global Water Partnership (GWP), 2016: Handbook of Drought Indicators and Indices (M. Svoboda and B.A. Fuchs). Integrated Drought Management Programme (IDMP), Integrated Drought Management Tools and Guidelines Series 2. Geneva.
- World Meteorological Organization, 2012: Standardized Precipitation Index User Guide (M. Svoboda, M. Hayes and D. Wood). (WMO-No. 1090), Geneva.
- Hayes, Svoboda, Wall, and Wildhalm. (April 2011). “The Lincoln Declaration on Drought Indices: Universal meteorological drought index recommended”. American Meteorological Society. DOI:10.1175/2010BAMS3103.1
- Drought-Ready Communities: A guide to community drought preparedness. 2011. National Drought Mitigation Center.
- Creating a Drought Early Warning System for the 21st Century: The national integrated drought information system. 2004. Western Governors’ Association.

Drought Monitoring Tool

Table 10 shows the drought monitoring tool that the LENRD can utilize to define drought locally. The following section defines and describes the individual components of the drought monitoring tool.

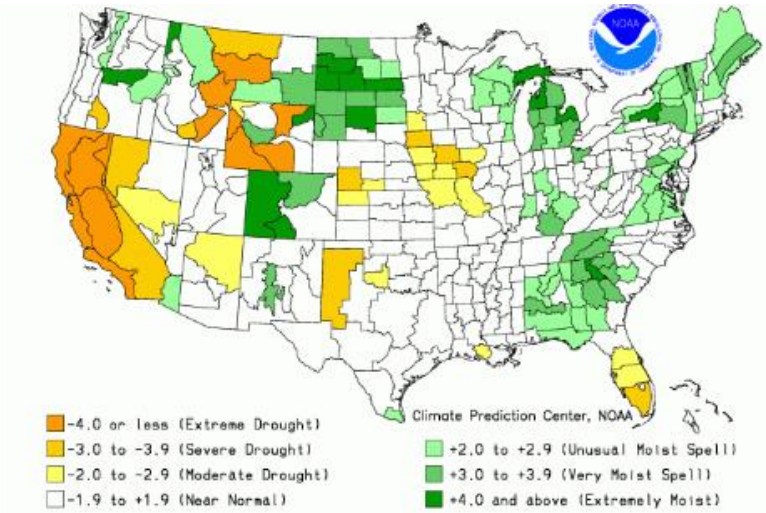
Table 10: Local Drought Monitoring Tool

Drought Level	PDSI	SPI, 1,3,6,12	Stream Flow	Groundwater
Drought Watch	-2.00 to -2.99	<-1.0 and >-1.5 for all timescales	Stream flows between the 25th and 10th percentile	Groundwater level between the 25th and 10th percentile
Drought Warning	-3.00 to -3.99	<-1.5 and >-2.0 for all timescales	Stream flows between the 10th and 5th percentile	Groundwater level between the 10th and 5th percentile
Drought Emergency	-4.00 and below	<-2.0 for all timescales	Stream flows below the 5th percentile	Groundwater level below the 5th percentile

Palmer Drought Severity Index (PDSI)

The PDSI is the most widely used mathematical drought index. The PDSI uses both meteorological and hydrologic data to measure soil moisture and water availability. It has been found to be particularly effective for monitoring agricultural droughts (Susquehanna River Basin Drought Coordination Plan, 2000). The PDSI is calculated weekly by the Climate Prediction Center of the National Weather Service by climate division. Data is standardized so that comparisons can be made across locations and time periods. Zero or near zero PDSI values indicate normal conditions, a negative PDSI value indicates drought and a positive value for a wet period. Historical PDSI data from 1895 to present day is available online from NOAA.

Figure 17: PDSI by Climate Division



Source: NOAA

Table 11: Palmer Classifications

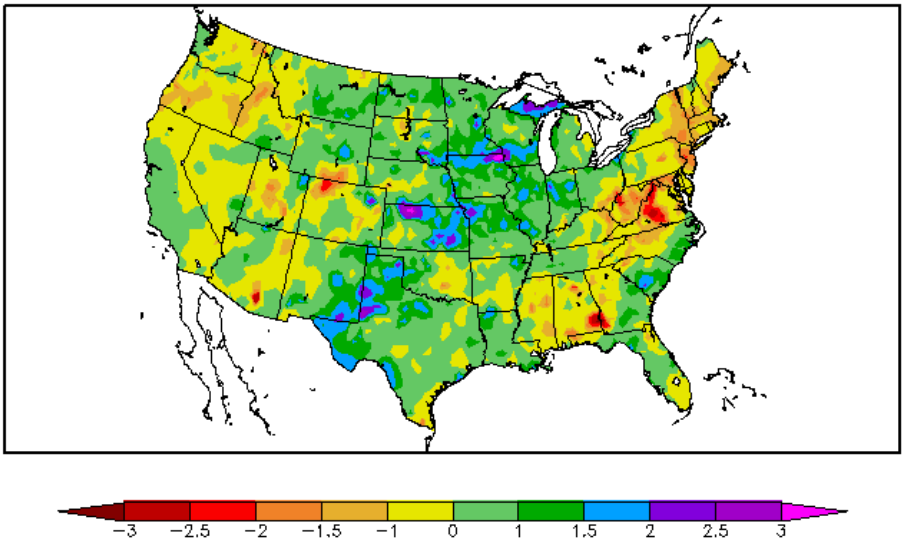
Numerical Value	Description	Numerical Value	Description
4.0 or more	Extremely wet	-0.5 to -0.99	Incipient dry spell
3.0 to 3.99	Very wet	-1.0 to -1.99	Mild drought
2.0 to 2.99	Moderately wet	-2.0 to -2.99	Moderate drought
1.0 to 1.99	Slightly wet	-3.0 to -3.99	Severe drought
0.5 to 0.99	Incipient wet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

Source: National Oceanic Atmospheric Administration National Weather Service, Climate Prediction Center

Standardized Precipitation Index (SPI)

The SPI uses only precipitation data to indicate relative dryness. Like the PDSI, a negative SPI indicates drought and a positive SPI indicates wet conditions. The SPI is calculated by the National Climatic Data Center (NCDC) for several time scales (i.e. 1, 3, 6, 12, and 24 month scales), to capture various scales of short-term and long-term drought. Historical SPI data from 1895 to present day is available from the NCDC. Current maps of the SPI at various time scales are updated daily by the High Plains Regional Climate Center.

Figure 18: SPI Map



Source: High Plains Regional Climate Center

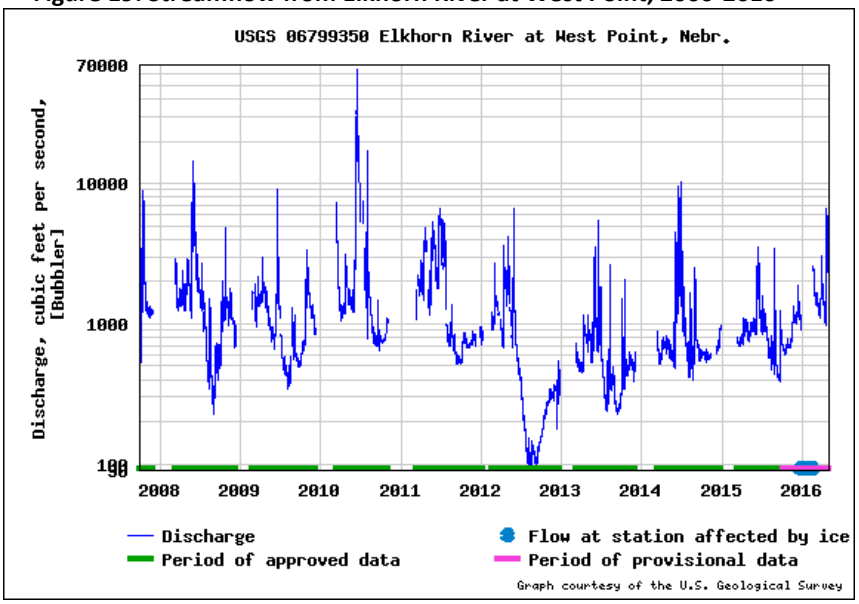
Table 12: SPI Classification

Numerical Value	Description	Numerical Value	Description
+2.0 and Above	Extremely Wet	-1.0 to -1.49	Moderately Dry
1.5 to 1.99	Very Wet	-1.50 to -1.99	Very Dry
1.0 to 1.49	Moderately Wet	-2.0 and Below	Extremely Dry
-0.99 to 0.99	Near Normal	-	-

Streamflow

Streamflow data is available online from the United States Geological Survey (USGS). At least 40 years of streamflow data is available for the following streams: Elkhorn River at West Point, Elkhorn River at Norfolk, Logan Creek near Uehling, and North Fork Elkhorn River near Pierce. Historical data from each of these streams was collected and measurements were then separated by month in order to establish drought indicators. Percentiles were then calculated by month in order to account for the rivers' natural fluctuation throughout the year and over the period of record. Microsoft Excel was used to organize data and calculate percentiles.

Figure 19: Streamflow from Elkhorn River at West Point, 2000-2016



Source: USGS

Groundwater

Groundwater data is from the LENRD observation wells. The LENRD monitors groundwater quantity by measuring the depth of the groundwater in approximately 240 privately owned irrigation wells each spring. This intermediate data, with collection events occurring only once per year, is collected too infrequently to be used as a part of the drought monitoring tool. However, transducers deployed in the LENRD monitoring well network will likely be able to transmit real time groundwater level measurements to the LENRD on a daily basis at some point in the future. At that time, acute in-season groundwater level changes could be integrated as additional triggering mechanisms within the drought monitoring tool.

In order to establish a local drought indicator, historical groundwater level data from the LENRD's transducers was collected and separated by month. Monthly percentiles were then calculated in order to account for the typical fluctuation in groundwater levels throughout the calendar year. Microsoft Excel was used to organize data and calculate percentiles.

The current Groundwater Management Plan contains information that establishes triggers for three action levels that have corresponding actions and control measures. According to LENRD staff, these triggers are antiquated and need refining. The existing triggers do not provide the sort of protections necessary to minimize the impacts of in-season groundwater level declines. They may hold some utility in protecting the resource from long-term mining, but fall short in providing protections between groundwater users during periods of high use and demand. As more time passes, and additional data is collected related to groundwater management in response to the impacts of drought, these action levels should be revised reflect scenarios of when specific actions should be taken.

Limitations

There are a few limitations to the drought monitoring tool. The first limitation is that PDSI calculations are done at the climate division level. Figure 20 shows that Climate Division 3 is slightly larger than the district boundary and does not include the southern portion of the LENRD. This means that the PDSI is not perfectly representative of the planning area.

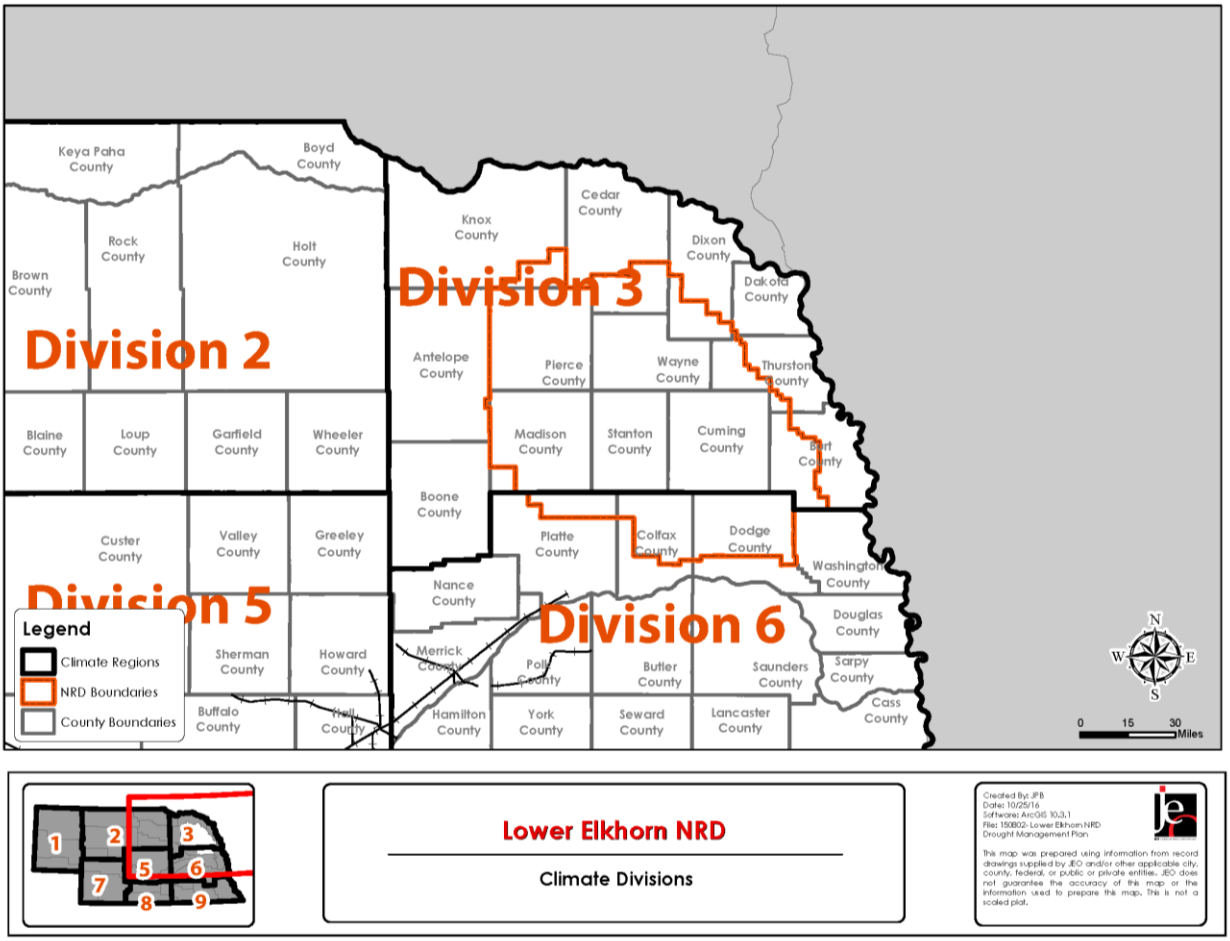
While it is preferable that changes to groundwater levels are incorporated into the definitions of drought (at the local level), it will require some time to expand the monitoring well network and some additional expenses would be occurred in equipping the existing wells with the telemetry equipment necessary to transmit the water level data. The other challenge that needs to be addressed, is the issue of in-season adjustment of groundwater allocation amounts, and the legal implications associated with that concept. The District would need to amend its policies in order to accomplish this goal.

The other variable to consider (when considering the use of groundwater levels as a triggering mechanisms) is the fact is often a lag time between the effects of drought – which causes an increase in water use not only by agriculture, but homeowners, livestock producers and municipalities and those pumping impacts may not be immediately apparent when examining groundwater changes. The drought could in fact be nearing an end from a climate standpoint, before the groundwater levels have reached their steepest point of declines. These variables are amplified depending upon the aquifer properties and conditions that exist within the District.

It is possible that areas of the district are affected by drought more or less than others due to factors such as topography or geology. The selected indicators do not account for those potential differences.

Lastly, having multiple indicators from multiple sources is an inherent limitation due to additional time and effort collecting the data.

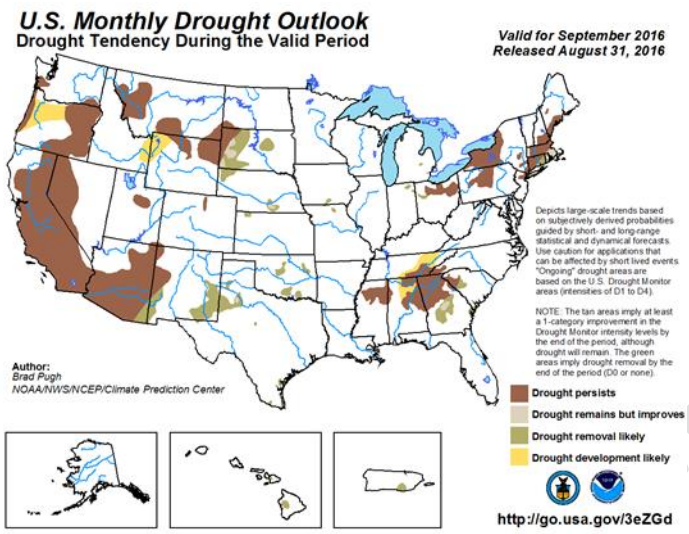
Figure 20: Climate Divisions



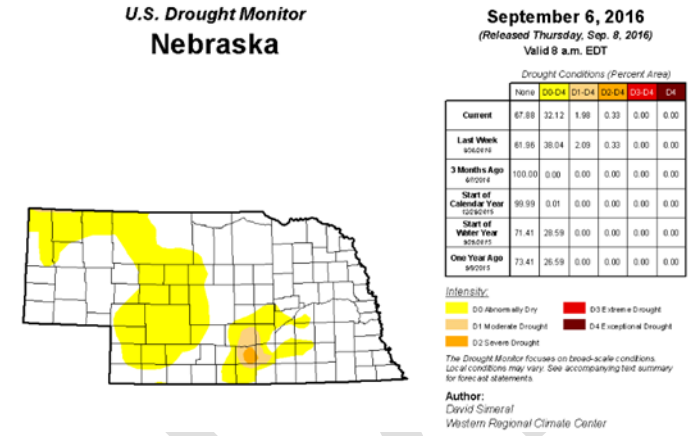
Recommended Drought Monitoring and Declaration Protocol

This plan has examined historic drought events and compiled climatic norms to define drought using the most local and best available data for the LENRD. The LENRD can use the established norms and drought monitoring data to develop a drought monitoring system. This system can be useful in identifying drought conditions as they develop as well as monitoring the intensity of drought events.

The following section describes the recommended method for the LENRD to use the drought definition as a proactive monitoring and management tool moving forward. The drought monitoring tool data inputs can be downloaded from their respective sources and combined into a spreadsheet. The LENRD can then compare the current data against the established drought indicators. The LENRD will utilize the data along with other resources (U.S. Drought Outlook, U.S. Drought Monitor, and local conditions) to determine whether to declare a drought stage.



The US Monthly Drought Outlook is an established nationwide monitoring tool developed by NIDIS. It provides a three-month prediction of potential drought occurrence. The Drought Outlook should be used as a tool to inform decision makers within the LENRD.



The U.S. Drought Monitor is a weekly map of drought conditions that is produced jointly by NOAA, USDA, and NDMC. The USDA utilizes the U.S. Drought Monitor for secretarial disaster declarations. The U.S. Drought Monitor should be used to inform decision makers within the LENRD, as well as continually calibrate the drought monitoring tool.

Drought Early Warning

This portion of the proposed drought monitoring protocol focuses on the data that would be required for early drought indication. The best available data to define early drought onset within the LENRD includes monitoring of the PDSI and SPI 1 & 3 month indicators. It is necessary to collect this data at least monthly and would ideally be collected weekly.

In examining the PDSI and the SPI 1 & 3 month indicators, it appears that drought onset can be identified prior to significant impacts occurring. When examining the PDSI and SPI 1 & 3 month indicators as they relate to the 2012 drought, onset was identified in June. It should be noted that onset was identified, for the LENRD, one month before it was indicated by the U.S. Drought Monitor.

Drought Intensity Monitoring

Drought intensity can be monitored weekly using the indices of the drought monitoring tool. A drought stage should be declared if the following conditions exist:

- At least two separate indicators are within a given drought stage, and the drought outlook indicates that drought will likely develop or persist, or the drought monitor indicates the presence of a drought, or local conditions/impacts indicate the presence of a drought.
- Or: if one of the indicators (other than groundwater) is triggering at an emergency level, and no other indicator is triggering, a drought watch should be declared.
- If groundwater is triggering at an emergency level, and no other indicator is triggering, a drought warning should be declared. [1]

Once the LENRD is determined to be in a drought, the LENRD should consider taking these steps:

1. Alert the appropriate municipal and county departments
2. Provide updates to the appropriate state and federal agencies
3. Update the LENRD webpage with a drought status report
4. Hold a press conference or send out a press release to get the message out to the general public
5. Continue to monitor drought conditions weekly

Drought Culmination

When entities engage in planning for drought, there is automatically a focus on defining drought onset, but it can be equally important to establish a protocol that can be used to signal the drought has subsided and that climatic patterns have returned to the established norms; signaling the end of the drought event and the easing or lifting of drought related management efforts.

Based on the historical record, monitoring the PDSI, SPI 12 month, streamflow, and groundwater levels are the best available data to correlate with the conclusion of drought events when local statistics return to normal levels.

Calibrating the Drought Monitoring Tool

In developing the proposed drought monitoring protocol, data was collected and utilized to establish regional norms. The collected data was analyzed for effectiveness. Part of the analysis was examining the PDSI, SPI (1, 3, 6, & 12 month indices), stream flow, and groundwater measurements to historic drought events. The comparative analysis was utilized to develop the proposed drought monitoring protocol previously discussed. The following discussion will provide insight related to the output of the comparative analysis and the calibration of the drought monitoring protocol.

Tables 13 and 14 show the percentage of months that individual indicators were triggered. See Appendix A for the full historical test.

[1] Although the depletion of groundwater could be caused by something other than drought (e.g. increased development, over-pumping), impacts may be monitored and managed in a similar fashion as a drought scenario.

Table 13: Historical Drought Test 1

Indicator	PDSI	SPI 1	SPI 3	SPI 6	SPI 12
Occurrences in Drought Watch (% of Months)	6.3%	8.7%	10.2%	8.7%	7.6%
Occurrences in Drought Warning (% of Months)	3.2%	4.9%	4.3%	4.3%	5.0%
Occurrences in Emergency (% of Months)	6.3%	1.6%	1.9%	2.2%	2.5%

Period of record used for these indices is 1985 - 2015

Table 14: Historical Drought Test 2

Indicator	Streamflow at North Fork of Elkhorn near Pierce[1]	Streamflow at Elkhorn near West Point[2]	Streamflow at Elkhorn near Norfolk[3]	Streamflow at Logan Creek near Uehling[4]	Groundwater Well 18S[5]
Occurrences in Drought Watch (% of Months)	11.9%	13.8%	12.4%	12.0%	3.5%
Occurrences in Drought Warning (% of Months)	4.4%	3.2%	3.9%	4.4%	1.2%
Occurrences in Drought Emergency (% of Months)	2.8%	3.2%	2.3%	2.3%	4.2%

**Only one of the groundwater wells is shown in this table*
[1]Period of Record Used: 1961 – 2015
[2]Period of Record Used: 1972 – 2015
[3]Period of Record Used: 1946 – 2015
[4]Period of Record Used: 1941 – 2013
[5]Period of Record Used: 2001 – 2015; Only one of the groundwater wells is shown

Section Six: Drought Management Recommendations

Ground Water Allocation

The LENRD is authorized by the State to manage and govern groundwater within the district. This authority provides the District with the means to restrict the use of groundwater, if conditions warrant. As drought conditions develop, the LENRD will increase its monitoring of wells in order to ensure that ground water is not being over pumped, thereby causing potential long term harm to the aquifer.

The LENRD should take into account the climactic information from the previous year, current year, and any future forecasted drought conditions when determining any changes to the groundwater allocation (as applicable) for the upcoming year.

Surface Water Administration

The NDNR governs the use of surface water in the State of Nebraska. This means that NDNR has the authority 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 develop a senior water rights holder can place a call to the local NDNR field office and can request a hold to be placed on junior rights holders because the senior water right holders are not receiving their full allocation. The field office will then analyze the situation and determine how they can adjust water consumption to ensure that the senior rights holder will be able to get the water they need. If the senior appropriator is in fact not receiving the allocated amount, other surface water users whose priority date is junior will be required to cut back, or cease usage, in order to satisfy the senior appropriator.

Drought Educational Outreach

One way to mitigate the impacts of drought is through outreach and education. Outreach can focus on identifying and sharing resources for agricultural producers, homeowners, renters, and other organizations. There are many groups that offer information on how to cope with drought conditions. Table 16 shows agencies that provide various types of educational resources useful in educating and informing the public on water conservation, especially during periods of drought.

Table 15: 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	

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

Resources

The LENRD can create a drought information page on their existing website (www.lenrd.org) and include the following links.

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

The LENRD currently provides a number of educational opportunities. The following are some of the opportunities currently available from the LENRD:

- Flow meter installation training
- Soil and Water Stewardship Week
- Classroom demonstrations of groundwater flow modeling
- Children's coloring books, such as "Every Drop Counts"
- School programs for conservation poster contest
- Elkhorn H2O Daze
- Irrigation water management field days
- Nitrogen certification courses
- Other online resources, related to crop production and irrigation management

Mitigation Alternatives

The following actions are mitigation actions identified for NRDs across the state within the *Nebraska's Climate Assessment Response Committee Drought Mitigation and Response Plan* from 2000. The actions listed in this plan are actions that have been determined to be relevant to the LENRD.

Current Actions

Action	**Reduce Economic Loss and Soil Erosion on Dry Cropland**
Description	1. Use public information programs to emphasize installation of soil and water conservation systems (i.e. terraces, crop residue use, and contour planting) 2. Assist landowners with the planning, design, and cost of installing soil and wate conservation practices on their property (i.e. terrace systems, improved irrigatio systems) 3. Utilize cost-share programs for soil and water conservation
Estimated Cost	Staff time, $5,000+ for cost-share program
Potential Funding	LENRD Annual Budget
Timeline	Ongoing
Priority	High
Status	This action is done on an ongoing basis
Lead Agency	LENRD Water Conservation Specialist, Information & Education Specialist

Action	**Maintain Groundwater Metering Efforts**
Description	1. Require all wells that pump over 50 gallons per minute to have a meter.
Estimated Cost	$0
Potential Funding	LENRD Annual Budget
Timeline	Ongoing
Priority	High
Status	This action is done on an ongoing basis. All irrigation wells that pump over 50 gallons per minute are required to have a meter.
Lead Agency	LENRD Board

Action	**Mitigate Quality and Quantity Problems in Private Wells**
Description	1. Monitor groundwater wells for quantity and quality 2. Work with private well owners to either drill the current well deeper or find a new well without quality or quantity issues
Estimated Cost	Staff time; Varies depending on funds available
Potential Funding	LENRD Annual Budget
Timeline	Ongoing
Priority	Medium
Status	LENRD continually monitors groundwater for quantity and quality issues. LENRD established a temporary cost share program in 2012 to assist private well owners in remediating impacts of water quantity issues.
Lead Agency	LENRD Water Resources Manager

Action	**Promote Water Conservation**
Description	1. Encourage indoor and outdoor conservation of water 2. Provide educational materials and information to landowners about beneficial conservation measures and effective irrigation management techniques
Estimated Cost	$1,000+ for educational materials
Potential Funding	LENRD Annual Budget
Timeline	Ongoing
Priority	High
Status	This action is done on an ongoing basis
Lead Agency	LENRD Water Conservation Specialist, Information & Education Specialist

The following actions are new actions identified during the drought management planning process.

Action	Promote Green Infrastructure and Best Management Practices
Description	1. Encourage the use of green infrastructure throughout the district 2. Encourage the use of rainfall enhancement projects such as rain barrels
Estimated Cost	$1,000+ for educational materials, $10,000+ for cost share
Potential Funding	LENRD Annual Budget
Timeline	2-5 Years
Priority	Medium
Status	Not yet started
Lead Agency	LENRD

Action	Develop Quantitative Recommendations for Allocations
Description	1. Develop quantitative recommendations to provide a technical basis for decision making regarding any changes to groundwater allocations
Estimated Cost	$20,000; Staff Time
Potential Funding	LENRD Annual Budget
Timeline	2-5 Years
Priority	Medium
Status	Not yet started
Lead Agency	LENRD Water Resources Manager, LENRD Board

Action	Acquire Transducer Transmission Technology
Description	1. Acquire technology to remotely transmit groundwater well transducer readings in real time
Estimated Cost	$50,000
Potential Funding	LENRD Annual Budget, Water Sustainability Fund, Nebraska Environmental Trust
Timeline	2-5 Years
Priority	High
Status	Not yet started
Lead Agency	LENRD General Manager, LENRD Water Resources Manager

Action	Develop Drought Dashboard
Description	1. Develop online drought dashboard to summarize local drought conditions in real time
Estimated Cost	$40,000
Potential Funding	LENRD Annual Budget, HMGP, Water Sustainability Fund
Timeline	2-5 Years
Priority	High
Status	Not yet started
Lead Agency	LENRD General Manager, LENRD Information & Education Specialist

Action	Groundwater Recharge
Description	1. Evaluate the feasibility of groundwater recharge projects 2. Implement groundwater recharge projects if they are found to be cost effective
Estimated Cost	Unknown
Potential Funding	LENRD Annual Budget, HMGP, Water Sustainability Fund
Timeline	5+ Years
Priority	Medium
Status	Not yet started
Lead Agency	LENRD General Manager, LENRD Water Resources Manager

Action	Surface Water Retention/Detention
Description	1. Evaluate the feasibility of surface water retention/detention projects

	2. Implement surface water retention/detention projects if found to be cost effective
Estimated Cost	Varies by location and size of project
Potential Funding	LENRD Annual Budget, HMGP, Water Sustainability Fund
Timeline	2-5 Years
Priority	Medium
Status	Identified potential surface water storage locations in Water Inventory Report. Preliminarily evaluated ten potential reservoir sites.
Lead Agency	LENRD General Manager, LENRD Water Resources Manager

Action	**Groundwater Management Plan**
Description	1. Update the groundwater management plan to include the drought definition specific to the LENRD identified within this plan
Estimated Cost	$0; Staff Time
Potential Funding	LENRD Annual Budget
Timeline	2-5 Years
Priority	Low
Status	Not yet started
Lead Agency	LENRD General Manager, LENRD Water Resources Manager

Action	**Planning Workshop**
Description	1. Facilitate planning workshop to assist community water systems in developing effective emergency response plans with a specific focus on drought
Estimated Cost	$10,000; Staff Time
Potential Funding	LENRD Annual Budget
Timeline	2-5 Years
Priority	Low
Status	Not yet started
Lead Agency	LENRD General Manager
Support Agencies	County Emergency Management, Municipalities

The following mitigation alternatives are suggested for counties and communities within the LENRD. While the LENRD does not have the authority to require jurisdictions to implement these actions, the LENRD can support these jurisdictions in mitigation efforts as an enhancer of regional capabilities, planning, and preparedness as it relates to drought.

Action	**Emergency Response Plans**
Description	1. Reevaluate current emergency response plans 2. Establish local triggers and response criteria for drought response
Estimated Cost	$5,000+; Staff Time
Potential Funding	Annual Municipal Budget
Timeline	2-5 Years
Priority	Low
Status	Not yet started
Lead Agency	Municipalities/Community Water Systems
Support Agencies	County Emergency Management, LENRD

Action	**Wellhead Protection Plans**
Description	1. Collaborate with local water providers to develop wellhead protection plans
Estimated Cost	$20,000
Potential Funding	Municipal Annual Budget
Timeline	2-5 Years
Priority	Low
Status	12 jurisdictions have developed wellhead protection plans within the planning area

Lead Agency	Municipalities
Support Agencies	County Planning/Zoning, LENRD

Action	**Collaborate with Large Water Users**
Description	1. Enhance communication with municipalities and large, independent water users to implement water conservation and drought-preparedness guidelines
Estimated Cost	Staff Time
Potential Funding	Municipal Annual Budget
Timeline	2-5 Years
Priority	Low
Status	Not yet started
Lead Agency	Municipalities
Support Agencies	LENRD, County Emergency Management

Action	**Promote Green Infrastructure and Best Management Practices**
Description	1. Encourage the use of green infrastructure throughout the district 2. Encourage the use of rainfall enhancement projects such as rain barrels
Estimated Cost	$1,000+ for educational materials, $10,000+ for cost share
Potential Funding	LENRD Annual Budget
Timeline	2-5 Years
Priority	Medium
Status	Not yet started
Lead Agencies	County Planning/Zoning, Municipalities
Support Agency	LENRD

Section Seven: Plan Maintenance and Updates

The LENRD will be responsible for monitoring (annually), evaluating, and updating the plan. Support and suggestions from stakeholders and the public will influence and enhance this process. Review and update of this plan will occur at least every five years in coordination with the Hazard Mitigation Plan update. The plan may be updated more frequently at the discretion of the LENRD Board, especially in the event of a major drought.

If new, innovative mitigation strategies arise that could impact the planning area or elements of this plan, a plan amendment may be proposed and considered separate from the annual review. The LENRD should compile a list of proposed amendments annually, and recommend action on the proposed amendments.

Continued Public Involvement

To ensure plan support and input from the public as well as other stakeholders, public involvement should remain a top priority for the LENRD. Notices for public meetings involving the discussion of or action on plan updates should be published and posted at least two weeks in advance.

Resources

World Meteorological Organization (WMO) and Global Water Partnership (GWP), 2016: *Handbook of Drought Indicators and Indices* (M. Svoboda and B.A. Fuchs). Integrated Drought Management Programme (IDMP), Integrated Drought Management Tools and Guidelines Series 2. Geneva.

World Meteorological Organization, 2012: *Standardized Precipitation Index User Guide* (M. Svoboda, M. Hayes and D. Wood). (WMO-No. 1090), Geneva.

Hayes, Svoboda, Wall, and Widhalm. 2011. *The Lincoln Declaration on Drought Indices: Universal meteorological drought index recommended.* American Meteorological Society. DOI:10.1175/2010BAMS3103.1

Drought-Ready Communities: A guide to community drought preparedness. 2011. NDMC.

Creating a Drought Early Warning System for the 21st Century: The national integrated drought information system. 2004. Western Governors' Association.

https://www.nrdnet.org/nrds/lower-elkhorn-nrd

NOAA National Centers for Environmental Information (NCEI) U.S. Billion-Dollar Weather and Climate Disasters (2016). https://www.ncdc.noaa.gov/billions/

Appendix A: Full Historical Trigger Test

Year	Month	PDSI	SP01	SP03	SP06	SP12	Streamflow (Elkhorn River at Norfolk)	Streamflow (Elkhorn River at West Point)	Streamflow (North Fork Elkhorn at Pierce)	Streamflow (Logan Creek near Uehling)	18s Groundwater
1895	1	0.09	-0.99	-99.99	-99.99	-99.99					
1895	2	0.26	-0.54	-99.99	-99.99	-99.99					
1895	3	0.31	-0.27	-1.13	-99.99	-99.99					
1895	4	0.59	0.63	0.06	-99.99	-99.99					
1895	5	0.22	-0.66	-0.27	-99.99	-99.99					
1895	6	0.82	0.67	0.23	-0.21	-99.99					
1895	7	0.52	-1.13	-0.63	-0.53	-99.99					
1895	8	0.99	0.43	0.04	-0.24	-99.99					
1895	9	1.18	0.42	-0.2	0.02	-99.99					
1895	10	-0.5	-1.88	-0.25	-0.66	-99.99					
1895	11	-0.38	0.13	-0.6	-0.46	-99.99					
1895	12	-0.77	-2.17	-1.68	-1.05	-0.8					
1896	1	-0.96	-0.79	-1.05	-0.71	-0.8					
1896	2	-1.31	-1.69	-2.71	-1.31	-0.88					
1896	3	-1.56	-0.33	-1.59	-2.7	-0.92					
1896	4	1.51	1.97	1.19	0.58	-0.3					
1896	5	1.58	0.4	1.27	0.67	0.09					
1896	6	1.98	0.6	1.77	1.1	0.06					
1896	7	3.34	1.45	1.39	1.77	0.93					
1896	8	2.83	-1.32	0.68	1.34	0.45					
1896	9	2.91	-0.01	0.27	1.36	0.31					
1896	10	3.52	0.84	-0.33	0.77	0.87					
1896	11	4.34	1.34	0.92	1.08	1.13					
1896	12	3.97	-1.08	0.98	0.74	1.18					
1897	1	4.39	1.44	1.21	0.24	1.38					
1897	2	4.17	-0.34	-0.03	0.77	1.49					
1897	3	4.33	0.64	0.8	1.15	1.73					
1897	4	5.07	1.24	1.06	1.39	1.4					
1897	5	-0.83	-1.89	-0.07	-0.11	0.72					
1897	6	-0.61	0.09	-0.29	0	0.52					
1897	7	-0.6	-0.17	-1.19	-0.34	-0.11					
1897	8	-0.66	-0.69	-0.52	-0.47	0.01					
1897	9	-1.56	-1.21	-1.22	-1.02	-0.27					
1897	10	0.41	0.83	-0.66	-1.34	-0.24					
1897	11	0.07	-0.61	-0.58	-0.87	-0.69					
1897	12	0.95	1.9	0.94	-0.44	-0.29					
1898	1	0.76	-0.16	0.58	-0.37	-0.47					
1898	2	0.68	0.05	1.2	-0.04	-0.45					
1898	3	0.34	-0.31	-0.6	0.5	-0.67					
1898	4	0.03	-0.65	-0.85	-0.38	-1.37					
1898	5	0.69	0.73	-0.11	0.28	-0.48					
1898	6	1.11	0.58	0.33	0.03	-0.29					
1898	7	1.04	-0.49	0.39	-0.19	-0.36					
1898	8	1.06	-0.25	-0.12	-0.23	-0.26					
1898	9	-0.46	-0.91	-1.04	-0.44	-0.19					
1898	10	-0.19	0.06	-0.81	-0.23	-0.4					
1898	11	-0.28	-0.29	-0.91	-0.77	-0.37					
1898	12	-0.54	-0.91	-0.55	-1.28	-0.78					
1899	1	-0.71	-0.63	-1.13	-1.26	-0.81					
1899	2	-0.67	0.17	-0.91	-1.16	-0.81					
1899	3	-0.95	-0.5	-0.83	-1	-0.87					
1899	4	-1.44	-1.3	-1.34	-1.81	-1.04					
1899	5	0.78	1.12	-0.11	-0.4	-0.86					
1899	6	1.32	0.75	0.49	0.11	-0.78					
1899	7	1.29	-0.43	0.79	-0.06	-0.75					
1899	8	1.64	0.36	0.34	0.09	-0.55					
1899	9	-0.67	-1.72	-0.93	-0.25	-0.67					
1899	10	-0.86	-0.31	-0.94	0	-0.76					
1899	11	-1.14	-0.11	-1.41	-0.68	-0.73					
1899	12	-0.85	0.72	-0.22	-1.01	-0.57					
1900	1	-1.11	-1.22	-0.23	-1.01	-0.59					
1900	2	0.08	0.58	0.24	-1.18	-0.56					
1900	3	-0.17	0.05	-0.25	-0.39	-0.48					
1900	4	0.95	1.39	1.13	0.8	0.38					
1900	5	-0.29	-0.42	0.49	0.5	-0.19					
1900	6	-0.8	-1.02	-0.08	-0.23	-0.84					
1900	7	1.15	1.43	0.02	0.62	-0.07					
1900	8	1.67	0.8	0.73	0.8	0.04					
1900	9	2.83	1.41	1.94	1.38	0.93					
1900	10	3.4	1.04	1.72	1.21	1.31					
1900	11	3	-1.04	1.22	1.34	1.21					
1900	12	2.72	-0.72	0.15	1.74	1.07					
1901	1	2.44	-0.99	-1.73	1.09	1.08					
1901	2	2.43	0	-1.07	0.77	1.01					
1901	3	2.59	0.48	-0.1	0.01	1.15					

1901	4	2.2	-0.49	-0.3	-1.06	0.51
1901	5	1.72	-0.62	-0.6	-0.93	0.45
1901	6	2.61	1.37	0.17	0.05	1.3
1901	7	1.55	-1.85	-0.29	-0.46	0.34
1901	8	0.64	-1.21	-0.43	-0.79	-0.25
1901	9	2.86	2.38	0.46	0.43	0.28
1901	10	2.96	0.37	1.34	0.7	0.09
1901	11	2.92	0.26	2.06	1.08	0.24
1901	12	3.01	0.49	0.33	0.49	0.36
1902	1	3.18	0.87	0.51	1.37	0.5
1902	2	3.04	-0.49	0.26	1.89	0.43
1902	3	2.73	-0.18	-0.27	0.09	0.32
1902	4	2.36	-0.54	-0.87	-0.44	0.32
1902	5	1.56	-0.89	-1.06	-0.94	0.25
1902	6	1.91	0.39	-0.69	-0.77	-0.18
1902	7	3.71	1.92	0.97	0.27	1.05
1902	8	4.54	0.92	1.8	0.69	1.62
1902	9	5.24	0.85	2	1.05	0.84
1902	10	4.82	-0.34	0.76	1.14	0.7
1902	11	4.38	-0.56	0.01	1.53	0.55
1902	12	4.98	1.46	-0.06	1.7	0.71
1903	1	4.45	-2.5	-0.05	0.61	0.54
1903	2	4.63	0.82	0.9	0.32	0.67
1903	3	4.46	0.25	-0.02	-0.12	0.78
1903	4	4.16	-0.01	0.16	0.06	0.95
1903	5	5.89	2.47	1.55	1.69	2.16
1903	6	5.2	-0.66	1.2	1.02	1.86
1903	7	6.04	1.32	2.03	1.66	1.53
1903	8	7.66	2.2	1.57	2.23	2.04
1903	9	7.15	-0.29	1.73	1.99	1.61
1903	10	7.03	0.51	1.29	2.22	1.76
1903	11	6.73	0.14	-0.11	1.23	1.87
1903	12	6.14	-0.94	0.03	1.48	1.63
1904	1	5.73	-0.25	-0.62	0.93	1.69
1904	2	5.23	-0.93	-1.49	-0.58	1.57
1904	3	4.52	-1	-1.65	-0.8	1.43
1904	4	4.29	-0.25	-1.05	-1.26	1.38
1904	5	4.24	0.33	-0.33	-0.76	0.46
1904	6	4.44	0.56	0.24	-0.31	0.87
1904	7	4.89	0.69	0.77	0.03	0.6
1904	8	5.1	0.26	0.77	0.26	-0.13
1904	9	4.53	-0.54	0.14	0.25	-0.19
1904	10	5.37	1.45	0.63	0.92	0.21
1904	11	4.6	-1.17	0.17	0.64	0.01
1904	12	4.11	-0.91	0.51	0.32	0.01
1905	1	4.44	1.49	-0.48	0.32	0.2
1905	2	4.39	0.22	0.37	0.25	0.27
1905	3	4.01	0.31	0.74	0.75	0.5
1905	4	4.36	0.67	0.53	0.19	0.81
1905	5	6.04	2.28	1.76	1.73	1.6
1905	6	5.71	0.23	1.91	1.98	1.49
1905	7	5.33	-0.28	1.39	1.34	1.16
1905	8	4.95	-0.08	-0.17	1.16	1.06
1905	9	5.83	1.58	0.72	1.73	1.75
1905	10	5.52	-0.09	0.88	1.51	1.26
1905	11	6.08	1.53	1.67	0.96	1.73
1905	12	5.37	-2.27	0.41	0.76	1.71
1906	1	5.11	0.11	0.78	1.07	1.56
1906	2	5.14	0.63	-0.54	1.31	1.65
1906	3	4.97	0.25	0.27	0.42	1.68
1906	4	5.38	1.15	1.02	1.15	1.89
1906	5	4.76	-0.24	0.49	0.27	0.86
1906	6	4.31	-0.3	0.21	0.22	0.68
1906	7	3.96	-0.46	-0.74	-0.04	0.64
1906	8	4.58	1.2	0.15	0.38	1.01
1906	9	5.67	1.64	1.31	1.07	1.01
1906	10	6.47	1.3	2.22	1.12	1.43
1906	11	6.03	-0.41	1.74	1.26	1.02
1906	12	6.11	0.79	0.94	1.6	1.24
1907	1	5.82	0.2	-0.03	2.03	1.25
1907	2	5.67	0.36	0.55	1.7	1.23
1907	3	4.68	-1.66	-0.91	0.39	1.04
1907	4	4.02	-1.37	-1.65	-1.38	0.32
1907	5	3.62	-0.74	-1.63	-1.34	0.17
1907	6	3.5	0.07	-1.11	-1.33	0.29
1907	7	4.83	1.61	0.58	-0.34	1.07
1907	8	4.63	-0.38	0.85	-0.47	0.58
1907	9	4.55	0.13	0.84	-0.17	-0.04
1907	10	3.75	-1.19	-0.81	-0.09	-0.69

1907	11	3.05	-1.2	-1.06	-0.04	-0.78
1907	12	2.99	0.47	-1.28	0.07	-0.83
1908	1	2.56	-0.89	-0.98	-1.21	-0.91
1908	2	2.82	1.11	0.52	-0.75	-0.81
1908	3	2.28	-0.6	-0.3	-1.32	-0.75
1908	4	1.84	-0.4	-0.37	-0.84	-0.55
1908	5	2.35	0.71	-0.08	0.05	0
1908	6	3.6	1.62	1.17	0.89	0.64
1908	7	4.25	0.87	1.85	1.24	0.31
1908	8	4.76	0.62	1.68	1.18	0.56
1908	9	3.83	-1.05	0.26	0.97	0.26
1908	10	4.05	0.63	0.04	1.32	0.69
1908	11	3.78	0.11	-0.42	1.15	0.81
1908	12	3.38	-0.53	0.19	0.24	0.72
1909	1	3.28	0.46	-0.23	-0.14	0.81
1909	2	3.8	1.51	0.78	-0.1	0.87
1909	3	3.3	-1.15	0.18	0.2	0.85
1909	4	3.04	-0.62	-0.48	-0.56	0.81
1909	5	3.18	0.29	-0.56	-0.29	0.66
1909	6	3.33	0.5	0.01	0.01	0.17
1909	7	3.95	0.82	0.8	0.31	0.17
1909	8	3.86	-0.03	0.68	0.04	-0.07
1909	9	4.39	0.93	0.87	0.62	0.52
1909	10	4.4	0.29	0.57	0.9	0.45
1909	11	5.11	1.51	1.32	1.37	0.78
1909	12	5.91	1.81	1.49	1.59	1.11
1910	1	5.72	0.46	2.07	1.46	1.11
1910	2	0.03	-1.29	0.9	1.45	0.8
1910	3	-1.02	-3.09	-2.11	0.61	0.75
1910	4	-1.74	-1.59	-2.7	-0.27	0.57
1910	5	-1.91	-0.97	-2	-1.51	0.17
1910	6	-2.67	-1.68	-2.19	-2.5	-0.54
1910	7	-2.73	-0.02	-1.62	-2.33	-0.86
1910	8	-1.34	1.48	-0.12	-1.45	-0.32
1910	9	-1	0.18	0.74	-1.03	-0.59
1910	10	-1.17	-0.2	0.74	-0.68	-0.71
1910	11	-1.53	-1.09	-0.58	-0.57	-1.27
1910	12	-1.46	0.28	-0.69	0.22	-1.55
1911	1	-1.66	-0.59	-0.99	0.27	-1.64
1911	2	-1.32	1.02	0.4	-0.39	-1.36
1911	3	-1.99	-0.8	-0.41	-0.89	-1.31
1911	4	-1.67	0.25	0.02	-0.48	-0.88
1911	5	-2.3	-1.01	-0.84	-0.69	-0.89
1911	6	-2.79	-0.47	-0.87	-0.97	-0.52
1911	7	-3.1	-0.34	-1.21	-0.98	-0.61
1911	8	-2.79	0.02	-0.61	-1.07	-1.1
1911	9	-3.05	-0.49	-0.61	-1.07	-1.27
1911	10	1.17	1.43	0.5	-0.56	-0.72
1911	11	0.87	-0.49	0.31	-0.35	-0.66
1911	12	1.41	1.39	1.24	0.23	-0.48
1912	1	1.4	0.44	0.43	0.57	-0.4
1912	2	1.33	-0.02	0.94	0.59	-0.56
1912	3	2.05	1.3	1.16	1.53	-0.09
1912	4	1.98	0.01	0.62	0.67	-0.17
1912	5	-0.61	-1.13	-0.16	0.13	-0.18
1912	6	-1.11	-1.4	-1.52	-0.91	-0.47
1912	7	-1.05	0.08	-1.52	-0.86	-0.31
1912	8	0.48	0.57	-0.54	-0.55	-0.16
1912	9	1.02	0.64	0.55	-0.7	0.2
1912	10	0.01	-0.07	0.52	-0.77	-0.27
1912	11	-0.17	-0.02	0.13	-0.42	-0.22
1912	12	-0.39	-0.56	-0.44	0.15	-0.49
1913	1	-0.61	-0.63	-0.74	0.13	-0.57
1913	2	-0.59	0.22	-0.7	-0.14	-0.57
1913	3	0.15	0.64	0.24	-0.29	-0.8
1913	4	1.11	1.26	1.19	0.68	-0.33
1913	5	1.86	0.9	1.34	1.06	0.4
1913	6	-0.49	-0.87	0.69	0.64	0.53
1913	7	-0.83	-0.73	-0.44	0.31	0.32
1913	8	-1.2	-0.49	-1.42	0.12	-0.02
1913	9	-1.38	-0.28	-0.98	-0.13	-0.31
1913	10	-1.62	-0.85	-1.05	-1	-0.44
1913	11	-1.91	-0.06	-0.91	-1.64	-0.47
1913	12	-1.18	1.57	-0.06	-0.94	-0.17
1914	1	-1.36	-0.44	0.54	-0.71	-0.16
1914	2	-1.55	-0.49	0.58	-0.6	-0.26
1914	3	-1.75	-0.01	-0.7	-0.47	-0.41
1914	4	-1.66	-0.04	-0.39	-0.06	-0.94
1914	5	0.19	0.46	0.09	0.23	-1.13

1914	6	0.57	0.74	0.54	0.19	-0.5
1914	7	-0.47	-0.83	0.19	-0.13	-0.51
1914	8	-0.5	-0.15	-0.1	-0.08	-0.42
1914	9	0.55	0.78	-0.15	0.27	-0.06
1914	10	-0.17	-0.13	0.2	0.23	0.12
1914	11	-0.91	-1.65	-0.14	-0.28	-0.06
1914	12	0.02	0.56	-0.63	-0.57	-0.24
1915	1	0.37	1.45	0.01	0.11	-0.04
1915	2	1.54	2.54	2.5	0.97	0.41
1915	3	1.65	0.44	2.04	0.78	0.53
1915	4	1.19	-0.24	0.86	0.67	0.49
1915	5	2.36	1.32	0.72	1.54	0.84
1915	6	2.71	0.39	0.79	1.62	0.69
1915	7	4.61	1.94	2.24	2.27	1.67
1915	8	4.59	-0.38	1.28	1.39	1.65
1915	9	6.18	1.85	2.11	2.04	2.05
1915	10	5.69	-0.23	0.92	2.12	1.95
1915	11	5.3	-0.06	1.13	1.78	2.12
1915	12	5.02	-0.2	-0.48	1.62	2.08
1916	1	5.3	1.37	0.24	0.87	2.07
1916	2	4.89	-0.73	0.1	1.01	1.66
1916	3	4.14	-1.13	-0.57	-0.8	1.47
1916	4	3.65	-0.57	-1.32	-0.94	1.41
1916	5	3.56	0.14	-0.64	-0.61	0.94
1916	6	3.4	-0.2	-0.5	-0.69	0.73
1916	7	2.95	-0.39	-0.43	-1.02	-0.23
1916	8	2.85	0.14	-0.39	-0.79	-0.1
1916	9	2.75	0.17	-0.21	-0.51	-0.8
1916	10	2.33	-0.34	-0.16	-0.45	-0.83
1916	11	1.99	-0.02	-0.36	-0.64	-0.82
1916	12	1.92	0.54	-0.28	-0.43	-0.74
1917	1	1.9	0.8	0.31	-0.08	-0.82
1917	2	1.54	-0.54	0.23	-0.27	-0.82
1917	3	1.55	0.54	0.31	-0.11	-0.57
1917	4	2.47	1.07	0.83	0.78	-0.01
1917	5	2.94	0.45	0.92	0.9	0.12
1917	6	3.14	0.38	0.96	0.92	0.32
1917	7	2.62	-0.85	-0.07	0.35	0.23
1917	8	2.85	0.32	-0.12	0.53	0.24
1917	9	-0.12	-0.35	-0.61	0.28	0.09
1917	10	-0.47	-1.55	-0.78	-0.56	-0.05
1917	11	-0.76	-0.18	-1.23	-0.96	-0.1
1917	12	-0.74	0.13	-1.17	-1.22	-0.16
1918	1	-0.45	0.99	0.09	-0.72	-0.13
1918	2	-0.41	0.11	0.4	-0.96	-0.1
1918	3	-1.27	-1.15	-0.47	-1.34	-0.37
1918	4	-1.33	-0.52	-1.03	-0.82	-0.94
1918	5	-0.57	1.21	0.13	0.21	-0.6
1918	6	-0.99	-0.64	0	-0.22	-0.97
1918	7	-1.17	-0.47	0.02	-0.55	-0.86
1918	8	-1.26	-0.23	-0.94	-0.58	-0.99
1918	9	-1.58	-0.96	-1.04	-0.68	-1.12
1918	10	0.65	1.09	-0.09	-0.09	-0.47
1918	11	1.16	1.13	0.49	-0.44	-0.19
1918	12	1.43	0.85	1.43	0.07	-0.09
1919	1	1.13	-0.93	0.94	0.29	-0.25
1919	2	2.17	2.22	1.63	1.05	0.07
1919	3	1.92	-0.46	0.64	1.44	0.15
1919	4	2.54	0.81	1.06	1.26	0.6
1919	5	2.22	-0.47	-0.09	0.47	-0.03
1919	6	2.53	0.7	0.46	0.6	0.44
1919	7	2.46	-0.04	-0.03	0.54	0.58
1919	8	2.18	-0.5	0.08	-0.09	0.47
1919	9	1.93	0.08	-0.4	0.06	0.72
1919	10	2.35	0.64	-0.03	-0.08	0.6
1919	11	3.5	1.8	1.15	0.75	0.79
1919	12	3.28	-0.41	1.27	0.42	0.66
1920	1	2.91	-1.6	1.12	0.44	0.64
1920	2	2.74	-0.56	-1.43	0.62	0.2
1920	3	3	0.75	-0.09	1	0.48
1920	4	4.91	2	1.77	1.89	1.05
1920	5	5	0.59	1.72	1.31	1.38
1920	6	4.92	0.47	1.83	1.57	1.3
1920	7	5.05	0.46	0.73	1.65	1.43
1920	8	5.19	0.27	0.58	1.62	1.66
1920	9	4.47	-0.54	-0.01	1.22	1.44
1920	10	4.61	0.9	0.22	0.62	1.5
1920	11	4.72	0.77	0.33	0.59	1.21
1920	12	4.67	0.58	1.01	0.53	1.32

1921	1	4.42	0.11	0.69	0.43	1.4
1921	2	4.21	-0.13	0.09	0.3	1.47
1921	3	-0.31	-0.47	-0.71	0.53	1.25
1921	4	-0.42	-0.38	-0.77	-0.26	0.33
1921	5	0.53	0.66	-0.08	-0.08	0.38
1921	6	-0.97	-1.56	-0.75	-0.95	-0.28
1921	7	0.91	1.34	0.35	-0.18	0.13
1921	8	0.9	-0.17	-0.07	-0.18	-0.04
1921	9	0.87	0.17	0.73	0	0.17
1921	10	-0.23	-0.22	-0.28	0.04	-0.12
1921	11	-0.48	-0.59	-0.49	-0.48	-0.39
1921	12	-0.68	-0.43	-0.79	0.17	-0.52
1922	1	-0.24	1.41	-0.13	-0.39	-0.36
1922	2	-0.46	-0.64	0.06	-0.44	-0.43
1922	3	-0.74	0	0.14	-0.63	-0.36
1922	4	-0.79	-0.1	-0.46	-0.49	-0.29
1922	5	-1.39	-0.95	-0.79	-0.76	-0.86
1922	6	-1.35	0.2	-0.64	-0.58	-0.29
1922	7	1.09	1.4	0.38	-0.02	-0.23
1922	8	-0.38	-0.84	0.58	-0.19	-0.43
1922	9	-1.24	-1.38	-0.15	-0.57	-0.79
1922	10	-1.7	-0.68	-1.87	-0.77	-0.9
1922	11	0.74	1.58	-0.42	0.1	-0.37
1922	12	-0.42	-1.48	0.21	-0.1	-0.44
1923	1	-0.36	0.54	1.06	-1	-0.56
1923	2	-0.81	-1.99	-1.56	-0.89	-0.65
1923	3	-0.76	0.46	-0.21	0.01	-0.57
1923	4	0.34	0.46	0.08	0.58	-0.39
1923	5	0.76	0.37	0.48	0.04	0.09
1923	6	1.23	0.61	0.67	0.46	0.24
1923	7	1.25	-0.13	0.36	0.24	-0.36
1923	8	3.6	2.68	1.69	1.56	0.83
1923	9	5.3	1.86	2.4	2.19	1.84
1923	10	4.82	-0.79	2.37	1.94	1.77
1923	11	4.34	-0.59	0.79	1.95	1.34
1923	12	4.24	0.07	-1.02	1.71	1.47
1924	1	3.91	-0.84	-0.92	1.93	1.37
1924	2	4.14	0.82	0.05	0.69	1.63
1924	3	4.3	0.63	0.49	-0.55	1.71
1924	4	3.57	-0.79	-0.11	-0.57	1.39
1924	5	2.83	-1.46	-1.13	-1.09	0.81
1924	6	4.32	1.93	0.1	0.22	1.37
1924	7	4.73	0.59	0.8	0.49	1.56
1924	8	4.97	0.38	1.63	0.49	0.73
1924	9	4.98	0.19	0.48	0.4	0.03
1924	10	4.22	-0.59	-0.1	0.48	0.1
1924	11	3.47	-1.2	-0.78	0.88	0.02
1924	12	4.12	1.76	-0.19	0.22	0.29
1925	1	3.92	0.25	0.38	0.01	0.36
1925	2	3.71	-0.17	1.12	-0.25	0.21
1925	3	-0.39	-1.18	-1.07	-0.78	-0.07
1925	4	-0.46	0.11	-0.59	-0.31	0.18
1925	5	-0.95	-1.31	-1.17	-0.69	0.24
1925	6	-0.54	0.46	-0.54	-0.86	-0.45
1925	7	-0.97	-1.24	-1.15	-1.25	-1
1925	8	-1.09	-0.38	-0.6	-1.28	-1.18
1925	9	-0.95	0.41	-0.7	-0.87	-1.08
1925	10	-0.5	0.07	-0.09	-0.94	-0.95
1925	11	-0.77	-0.66	-0.16	-0.66	-0.88
1925	12	-0.42	0.88	-0.11	-0.75	-1.06
1926	1	-0.01	1.26	0.38	0.02	-0.94
1926	2	-0.31	-1.29	0.54	0.02	-1.03
1926	3	-0.78	-1.18	-0.87	-0.6	-1.07
1926	4	-1.61	-2.35	-2.78	-1.81	-1.64
1926	5	-1.95	-0.13	-1.44	-1.18	-1.26
1926	6	-2.34	-0.87	-1.52	-1.67	-1.73
1926	7	-2.68	-0.2	-0.86	-1.79	-1.47
1926	8	0.34	0.78	-0.3	-1.24	-1.01
1926	9	1.74	1.65	1.21	-0.15	-0.45
1926	10	1.29	-0.76	1.15	0.17	-0.62
1926	11	1.55	0.72	1.05	0.4	-0.37
1926	12	1.63	0.55	-0.06	0.95	-0.43
1927	1	1.22	-1.69	0.32	1.11	-0.65
1927	2	1.37	0.69	0.13	0.95	-0.49
1927	3	1.97	1.32	1.09	0.52	0.03
1927	4	3.57	1.9	2.22	1.94	1.28
1927	5	3.52	0.1	1.66	1.58	1.33
1927	6	2.93	-0.71	0.79	1.1	1.38
1927	7	2.51	-0.55	-0.81	0.82	1.26

1927	8	3.09	0.78	-0.4	0.95	1.27
1927	9	2.91	0.15	0.07	0.58	0.64
1927	10	-0.55	-1.03	-0.01	-0.64	0.63
1927	11	-0.82	-0.74	-0.89	-0.97	0.36
1927	12	-0.97	-0.38	-1.42	-0.71	0.26
1928	1	-1.32	-2.5	-1.55	-0.63	0.25
1928	2	-0.8	1.33	0.05	-0.8	0.32
1928	3	-1.07	0.03	0.13	-1.1	-0.02
1928	4	-1.7	-2.35	-0.97	-1.66	-1.33
1928	5	-1.71	0.03	-1	-0.97	-1.38
1928	6	-1.64	-0.46	-1.21	-1.08	-1.26
1928	7	-1.82	-0.32	-0.6	-1.01	-1.2
1928	8	-2.37	-1.15	-1.25	-1.57	-1.68
1928	9	-2.61	-0.75	-1.36	-1.86	-1.91
1928	10	0.82	1.24	-0.35	-0.7	-1.34
1928	11	1	0.67	0.46	-0.65	-1.03
1928	12	-0.39	-1.53	0.87	-0.59	-1.11
1929	1	-0.47	-0.02	-0.13	-0.45	-1.02
1929	2	-0.19	0.85	-0.3	0.28	-1.1
1929	3	-0.72	-0.62	-0.26	0.58	-1.25
1929	4	0.18	0.38	0.12	-0.02	-0.67
1929	5	0.08	-0.41	-0.37	-0.48	-0.82
1929	6	0.5	0.4	0.03	-0.12	-0.49
1929	7	0.98	0.54	0.15	0.1	-0.17
1929	8	0.64	-0.84	0.08	-0.28	-0.12
1929	9	0.99	0.37	-0.01	0.01	0.2
1929	10	1.78	1.09	0.31	0.27	0.18
1929	11	1.73	-0.04	0.68	0.41	0.01
1929	12	-0.2	-1.38	0.41	0.14	0.01
1930	1	0.23	0.56	-0.54	-0.01	0.06
1930	2	-0.3	-1.21	-1.24	0.22	-0.17
1930	3	-0.72	-1.15	-1.36	-0.29	-0.22
1930	4	0.3	0.57	-0.37	-0.63	-0.15
1930	5	1.31	1.16	0.64	0.26	0.46
1930	6	-0.21	-0.62	0.53	0.01	0.1
1930	7	-1.13	-2.37	-0.59	-0.72	-0.57
1930	8	-0.8	0.61	-1.12	-0.29	-0.16
1930	9	-1.04	-0.24	-0.84	-0.17	-0.34
1930	10	0.14	0.32	0.21	-0.33	-0.59
1930	11	0.64	1.19	0.36	-0.64	-0.3
1930	12	-0.33	-0.88	0.54	-0.45	-0.28
1931	1	-0.5	-0.25	0.5	0.34	-0.35
1931	2	-0.93	-1.21	-1.6	-0.17	-0.38
1931	3	-1.24	-0.23	-1.13	-0.08	-0.27
1931	4	-1.69	-0.78	-1.23	-0.71	-0.69
1931	5	-2.12	-1	-1.25	-1.7	-1.56
1931	6	-3.05	-1	-1.63	-1.83	-1.64
1931	7	-3.75	-0.56	-1.6	-1.84	-1.3
1931	8	-4.27	-1.11	-1.8	-2.04	-1.7
1931	9	-4.15	0.33	-0.81	-1.82	-1.49
1931	10	-4.14	-0.07	-0.6	-1.61	-1.72
1931	11	0.79	1.7	0.84	-0.68	-1.45
1931	12	1.29	1.49	1.31	0.14	-1.13
1932	1	1.95	2.05	2.6	0.92	-0.83
1932	2	1.88	0.2	2	1.49	-0.72
1932	3	1.59	-0.27	0.68	1.36	-0.75
1932	4	0.84	-1.12	-1.1	0.9	-0.85
1932	5	0.93	0.39	-0.51	0.27	-0.34
1932	6	1.02	0.33	-0.22	0.01	0.1
1932	7	0.65	-0.56	-0.02	-0.61	0.12
1932	8	1.16	0.81	0.26	-0.24	0.62
1932	9	-0.04	-0.17	-0.09	-0.22	0.45
1932	10	-0.06	-0.13	0.15	0.04	0.48
1932	11	-0.42	-0.86	-0.75	-0.38	-0.1
1932	12	-0.55	-0.1	-0.72	-0.55	-0.35
1933	1	-0.76	-0.41	-1.07	-0.33	-0.65
1933	2	-1.07	-0.87	-1.01	-1.05	-0.77
1933	3	0.72	1.57	1.06	0.04	-0.27
1933	4	-0.27	-0.67	0.3	-0.25	-0.17
1933	5	-0.85	-1.27	-0.36	-0.67	-0.72
1933	6	-2.42	-2.41	-2.29	-1.61	-1.55
1933	7	-2.03	1	-1.35	-0.93	-0.95
1933	8	-1.9	-0.1	-0.69	-0.78	-1.2
1933	9	-2	0.11	0.49	-1.33	-1.08
1933	10	-2.62	-1.78	-0.8	-1.55	-1.42
1933	11	-2.98	-0.7	-1.12	-1.31	-1.35
1933	12	-2.52	1.08	-0.99	-0.15	-1.18
1934	1	-2.62	-0.19	-0.11	-0.83	-1.17
1934	2	-2.82	-0.56	0.18	-0.95	-1.14

1934	3	-2.93	0.29	-0.34	-1.1	-1.61
1934	4	-3.69	-1.75	-1.34	-1.19	-1.9
1934	5	-5.35	-2.06	-2.02	-1.85	-2.22
1934	6	-5.22	0.43	-1.59	-1.57	-1.23
1934	7	-5.97	-0.27	-1.09	-1.52	-1.79
1934	8	-6.46	-1.24	-0.59	-1.8	-1.92
1934	9	-5.39	0.63	-0.5	-1.56	-1.71
1934	10	-5.4	-0.5	-0.64	-1.25	-1.63
1934	11	-4.98	0.69	0.23	-0.38	-1.3
1934	12	-4.83	-0.06	-0.15	-0.61	-1.47
1935	1	-4.77	-0.28	0.22	-0.54	-1.48
1935	2	-4.49	0.55	-0.06	0.15	-1.33
1935	3	-5.09	-0.72	-0.61	-0.52	-1.57
1935	4	-3.91	1.02	0.54	0.5	-0.82
1935	5	-2.93	0.44	0.52	0.44	-0.01
1935	6	-2.6	-0.29	0.52	0.2	-0.28
1935	7	-2.98	-0.95	-0.52	-0.17	-0.44
1935	8	-2.7	0.22	-0.68	-0.13	-0.07
1935	9	-3.04	-0.81	-0.94	-0.23	-0.48
1935	10	-3.1	-0.65	-0.81	-0.93	-0.49
1935	11	-2.8	0.32	-0.97	-1.21	-0.59
1935	12	-2.73	-0.02	-0.47	-1.16	-0.59
1936	1	-2	1.71	0.76	-0.4	-0.36
1936	2	-1.39	1.3	1.5	-0.21	-0.27
1936	3	-1.75	-0.6	0.85	0.08	-0.26
1936	4	-2.06	-1.25	-0.82	-0.24	-0.97
1936	5	-2.46	-0.44	-1.21	-0.55	-1.32
1936	6	-3.43	-1.82	-1.86	-1.34	-1.76
1936	7	-5.31	-3.09	-2.42	-2.25	-2.21
1936	8	-6.1	-1.05	-3.09	-2.87	-2.3
1936	9	-5.66	0.43	-1.56	-2.56	-1.91
1936	10	-5.83	-1.26	-0.98	-2.51	-2.22
1936	11	-5.94	-0.92	-0.78	-2.63	-2.29
1936	12	-5.56	0.54	-1.19	-2.04	-2.2
1937	1	-4.86	1.51	0.23	-0.82	-2.24
1937	2	-5.04	-1.14	0.51	-0.52	-2.39
1937	3	-4.82	0.58	0.57	-0.61	-2.31
1937	4	-4.55	-0.22	-0.29	-0.16	-2.15
1937	5	-4.64	-0.46	-0.33	-0.18	-2.26
1937	6	-4.69	-0.54	-0.87	-0.61	-1.77
1937	7	-4.95	-0.2	-0.88	-0.9	-1.22
1937	8	-4.86	0.17	-0.49	-0.63	-0.82
1937	9	-4.96	-0.49	-0.45	-0.96	-1.09
1937	10	-4.18	0.56	-0.04	-0.71	-0.68
1937	11	-4.26	-0.97	-0.52	-0.81	-0.69
1937	12	-4.39	-1.12	-0.38	-0.7	-0.86
1938	1	-4.23	0.2	-1.33	-0.6	-1.02
1938	2	-3.8	0.89	-0.05	-0.52	-0.82
1938	3	-4.17	-0.05	0.21	-0.26	-1
1938	4	-4.07	-0.1	-0.03	-0.66	-0.99
1938	5	-3.46	0.36	-0.02	-0.07	-0.68
1938	6	-3.7	-0.76	-0.44	-0.38	-0.74
1938	7	-2.8	1.17	0.38	0.2	-0.18
1938	8	-3.59	-1.68	-0.51	-0.42	-0.66
1938	9	-2.42	1.3	0.75	0.22	-0.01
1938	10	-3.06	-1.51	-0.54	-0.09	-0.4
1938	11	-2.77	0.37	0.36	-0.24	-0.22
1938	12	-3.03	-1.33	-1.2	0.02	-0.24
1939	1	-2.74	0.8	-0.06	-0.58	-0.17
1939	2	-2.27	1.1	0.39	0.42	-0.17
1939	3	-2.6	-0.41	0.35	-0.78	-0.23
1939	4	-2.85	-0.8	-0.58	-0.55	-0.42
1939	5	-3.45	-0.58	-1.06	-0.9	-0.75
1939	6	-3.66	-0.38	-1.1	-0.9	-0.62
1939	7	-4.29	-0.54	-1.03	-1.15	-1.3
1939	8	-4.21	-0.33	-0.87	-1.39	-0.9
1939	9	-5.05	-1.66	-1.42	-1.8	-1.76
1939	10	-5.26	-1	-1.77	-1.84	-1.83
1939	11	-5.63	-1.65	-2.14	-1.99	-2.01
1939	12	-5.46	0.02	-1.53	-2.07	-1.9
1940	1	-5.26	0.27	-1.02	-2.07	-1.96
1940	2	-5.2	-0.06	-0.18	-2	-2.02
1940	3	-4.8	0.87	0.61	-0.8	-1.85
1940	4	-3.92	0.7	0.81	0.24	-1.43
1940	5	-4.61	-1.98	-0.39	-0.46	-1.92
1940	6	-3.52	1.16	0.02	0.19	-1.19
1940	7	-3.84	-0.68	-0.72	-0.15	-1.23
1940	8	-3.77	-0.53	0.1	-0.28	-1.21
1940	9	-4.61	-1.92	-1.7	-1.05	-1.22

1940	10	-4.17	0.6	-1.01	-1.19	-0.85		
1940	11	-3.55	0.72	-0.46	-0.33	-0.51		
1940	12	-2.99	0.92	0.87	-0.82	-0.4		
1941	1	-2.29	1.51	1.34	-0.21	-0.24		
1941	2	-2.15	-0.02	1.15	0.03	-0.27		
1941	3	-2.45	-1.15	-0.19	0.61	-0.64		
1941	4	-1.38	1.28	0.55	1.08	-0.4		
1941	5	-2.01	-1.06	-0.18	0.19	-0.13		
1941	6	-1.55	0.34	0.26	0.1	-0.49		
1941	7	-1.74	-0.67	-0.88	-0.44	-0.47		
1941	8	-2.44	-1.48	-0.99	-0.84	-0.7		
1941	9	0.9	1.27	-0.29	-0.01	0.2		
1941	10	1.05	0.32	0.23	-0.53	0.16		
1941	11	0.7	-0.24	0.81	-0.24	-0.06		49.6
1941	12	0.6	0.23	-0.01	-0.35	-0.16		39.8
1942	1	0.26	-0.71	-0.54	-0.08	-0.38		45.2
1942	2	0.5	0.98	0.3	0.79	-0.28		41
1942	3	0.91	1.11	1.1	0.55	0.17		
1942	4	0.06	-1.42	0.01	-0.3	-0.67		
1942	5	0.17	-0.04	-0.27	-0.19	-0.31		79.1
1942	6	0.74	0.69	-0.33	0.1	-0.18		
1942	7	0.49	-0.62	-0.06	-0.13	-0.14		
1942	8	0.3	-0.47	-0.2	-0.4	0.07		59
1942	9	1.12	0.88	-0.14	-0.34	-0.09		
1942	10	-0.35	-1.04	-0.22	-0.22	-0.35		43.5
1942	11	-0.7	-0.76	-0.28	-0.45	-0.44		39.6
1942	12	-0.81	-0.2	-1.36	-0.88	-0.49		39
1943	1	-0.92	-0.19	-0.98	-0.66	-0.46		39
1943	2	-1	-0.13	-0.57	-0.48	-0.62		
1943	3	-1.35	-0.58	-0.91	-1.83	-1.04		57.4
1943	4	-1.77	-0.72	-1.08	-1.49	-0.92		45.9
1943	5	-2.07	-0.89	-1.27	-1.43	-1.23		39.9
1943	6	-1.59	0.65	-0.59	-0.87	-1.23		
1943	7	-1.65	0.06	-0.23	-0.77	-1.01		
1943	8	-2.13	-0.85	-0.06	-0.97	-1.06		46.2
1943	9	-2.7	-1.36	-1.22	-1.25	-1.69		31.6
1943	10	-2.37	0.32	-1.21	-0.92	-1.47		32.8
1943	11	-2.44	-0.28	-0.93	-0.74	-1.35		40.4
1943	12	-2.85	-2.27	-0.48	-1.38	-1.47		31.9
1944	1	0.34	1.67	-0.14	-1.2	-1.24		48.1
1944	2	0.28	0.6	0.49	-0.66	-1.14		
1944	3	0	0.15	0.88	0.09	-1.06		70.2
1944	4	1.19	1.31	1.11	0.82	-0.36		
1944	5	1.97	1.31	1.45	1.47	0.47		
1944	6	2.42	0.79	1.96	2.09	0.52		
1944	7	2.89	0.56	1.47	1.77	0.7		
1944	8	4.02	1.43	1.4	2.02	1.36		
1944	9	3.56	-0.64	0.67	1.73	1.45		
1944	10	3.03	-0.58	0.15	1.11	1.25		56.8
1944	11	2.98	0.38	-0.82	0.63	1.34		
1944	12	2.65	-0.56	-0.55	0.22	1.43		44
1945	1	2.51	0.13	-0.13	0	1.26		50
1945	2	2.65	0.64	-0.07	-0.79	1.28		
1945	3	2.23	0.04	0.11	-0.45	1.29		
1945	4	2.34	0.11	0.08	-0.05	0.86		
1945	5	3.15	0.93	0.48	0.4	0.71		
1945	6	3.63	0.57	0.8	0.7	0.61		
1945	7	3.81	0.32	0.93	0.7	0.53		
1945	8	3.55	-0.38	0.25	0.44	-0.08		
1945	9	0.01	-0.24	-0.29	0.36	0.03		
1945	10	-0.71	-1.9	-1.27	-0.06	-0.1		
1945	11	-0.96	-0.66	-1.4	-0.76	-0.29		52.5
1945	12	-0.42	1.15	-0.97	-0.85	-0.08		45.3
1946	1	-0.64	-1.04	-0.23	-1.29	-0.15		37.4
1946	2	-0.84	-0.81	-0.1	-1.31	-0.33		
1946	3	-0.81	1.05	0.28	-0.66	-0.06		
1946	4	-1.59	-1.23	-0.48	-0.56	-0.4	394.7	62.2
1946	5	-0.82	0.71	0.23	0.15	-0.48		
1946	6	-1.03	-0.43	-0.5	-0.4	-0.86		
1946	7	-1.71	-1.58	-0.63	-0.8	-1.41	176.7	72.1
1946	8	-1.73	-0.38	-1.43	-0.77	-1.31		54.5
1946	9	0.66	0.95	-0.41	-0.64	-0.86		52.1
1946	10	1.83	1.43	1.13	0.31	-0.03		
1946	11	2.81	1.56	2.09	0.49	0.43		
1946	12	2.57	-0.69	1.62	0.69	0.21		
1947	1	2.88	1.05	1.34	1.55	0.37		
1947	2	2.69	-0.84	-0.43	1.73	0.34		
1947	3	2.36	-0.91	-0.75	1.1	-0.04		
1947	4	2.72	0.43	-0.39	0.42	0.41		

1947	5	2.64	-0.22	-0.29	-0.45	0.09			
1947	6	3.93	1.66	1.07	0.66	0.91			
1947	7	-0.43	-1.53	0.25	-0.09	0.91			
1947	8	-1.53	-1.89	-0.34	-0.51	0.56		57.7	
1947	9	-1.73	-0.19	-1.99	-0.4	0.16		56.2	
1947	10	-1.58	0.61	-0.88	-0.38	-0.11	186	57.7	
1947	11	-0.96	1.05	0.48	-0.04	-0.3		53.8	
1947	12	-0.74	0.62	0.98	-0.94	-0.16		42.6	
1948	1	-0.98	-0.93	0.75	-0.46	-0.33		49.7	
1948	2	-0.62	1.02	0.54	0.58	-0.15			
1948	3	-0.98	-0.78	-0.48	0.59	-0.13			
1948	4	-1.53	-0.65	-0.64	-0.12	-0.46	340.8	70.9	
1948	5	-2.44	-1.69	-1.75	-1.45	-0.91	254.4	55.2	
1948	6	0.37	0.71	-0.89	-1.01	-1.37		85.4	
1948	7	0.57	0.66	-0.18	-0.54	-0.7			
1948	8	0.8	0.5	0.95	-0.45	-0.09			
1948	9	0.16	-0.6	0.21	-0.49	-0.19		49.3	
1948	10	0.1	0.07	-0.18	-0.29	-0.32		40.5	
1948	11	0.7	1.21	0.02	0.71	-0.29	210.7	38.2	
1948	12	1.07	1.08	0.9	0.64	-0.22		37.9	
1949	1	2.14	2.49	2.25	0.99	0.19		40.8	
1949	2	1.77	-1.64	1.53	0.61	-0.09		40	
1949	3	2.59	1.36	1.82	1.62	0.42			
1949	4	1.99	-0.86	-0.12	1.19	0.39			
1949	5	2.06	0.41	0.35	0.82	1.03			
1949	6	1.67	-0.31	-0.5	0.34	0.67			
1949	7	1.73	0.16	-0.02	-0.16	0.49			
1949	8	1.74	0.07	-0.18	0.05	0.33			
1949	9	2.3	0.74	0.4	-0.07	0.73			
1949	10	2.14	-0.02	0.34	0.17	0.74			
1949	11	-0.57	-1.26	-0.06	-0.29	0.3			
1949	12	-0.77	-0.56	-0.87	-0.18	0.1	217.1		
1950	1	-0.74	0.34	-1.17	-0.17	-0.22	169.4	36.6	
1950	2	-0.54	0.6	-0.01	-0.1	-0.07	237.5		
1950	3	-0.6	0.09	0.2	-0.65	-0.43			
1950	4	-0.83	-1.24	-0.81	-1.32	-0.52			
1950	5	0.33	0.2	-0.56	-0.57	-0.59			
1950	6	0.45	0.03	-0.56	-0.49	-0.47			
1950	7	2.13	1.6	1.06	0.37	0.19			
1950	8	2.92	0.61	1.26	0.51	0.32			
1950	9	2.44	-1.07	0.81	0.19	-0.19			
1950	10	2.39	0.16	-0.26	0.57	-0.11			
1950	11	2.28	-0.17	-0.88	0.45	-0.02		55.9	
1950	12	1.94	-1.16	-0.46	0.39	-0.06			
1951	1	1.69	-0.93	-1.19	-0.77	-0.14		49.2	
1951	2	2.08	0.99	-0.38	-0.96	-0.12			
1951	3	2.83	1.19	1.16	0.29	0.2			
1951	4	3.69	1.04	1.54	0.86	0.89			
1951	5	3.79	0.49	1.22	1.03	0.99			
1951	6	3.9	0.2	0.84	1.19	1.04			
1951	7	4.19	0.45	0.49	1.28	0.55			
1951	8	6.08	2.37	1.56	1.97	1.17			
1951	9	6.39	0.54	1.69	1.75	1.56			
1951	10	6.44	0.46	1.77	1.55	1.6			
1951	11	6.02	-0.46	0.23	1.43	1.58			
1951	12	5.96	0.49	0.1	1.49	1.74			
1952	1	5.9	0.84	0.04	1.62	1.86			
1952	2	5.77	0.42	0.7	0.43	1.85			
1952	3	5.59	0.36	0.54	0.32	1.65			
1952	4	5.01	-0.35	-0.15	-0.15	1.21			
1952	5	5.22	0.76	0.27	0.44	1.29			
1952	6	3.99	-0.93	-0.38	-0.19	0.95			
1952	7	3.8	0.36	0	-0.17	0.91			
1952	8	4.39	1.16	0.23	0.28	0.41			
1952	9	-0.7	-1.38	0.13	-0.19	-0.09			
1952	10	-1.29	-2	-0.75	-0.49	-0.5			
1952	11	-1.38	-0.17	-1.92	-1.05	-0.47			
1952	12	-1.27	0.33	-1.23	-0.58	-0.5			
1953	1	0.09	0.79	0.1	-0.69	-0.51			
1953	2	0.44	1.16	1.05	-1.22	-0.42			
1953	3	0.13	-0.01	0.63	-0.59	-0.51			
1953	4	1.24	1.13	1.05	0.87	0.01			
1953	5	1.38	0.04	0.54	0.81	-0.25			
1953	6	-0.14	-0.11	0.46	0.6	0.01			
1953	7	-0.22	-0.41	-0.44	0.22	-0.21			
1953	8	-0.39	-0.4	-0.64	-0.09	-0.72			
1953	9	-0.86	-0.72	-0.99	-0.3	-0.57			
1953	10	-1.55	-1.07	-1.36	-1.16	-0.45			
1953	11	0.09	0.76	-0.84	-1.11	-0.27			

1953	12	0.54	1.32	0.18	-0.8	-0.12			
1954	1	0.09	-1.93	0.78	-0.81	-0.28			
1954	2	0.39	1.46	1.24	-0.23	-0.26			
1954	3	0.47	0.51	0.65	0.44	-0.14			
1954	4	0.51	0.19	0.68	0.88	-0.51			
1954	5	0.75	-0.09	0.07	0.46	-0.54			
1954	6	1.27	0.81	0.38	0.53	-0.18			
1954	7	-0.48	-1.3	-0.26	0.11	-0.37			
1954	8	-0.32	0.02	-0.13	-0.12	-0.26			
1954	9	-0.52	-0.18	-0.87	-0.3	-0.12			
1954	10	0.59	0.79	0.19	-0.1	0.36			
1954	11	-0.55	-1.12	-0.19	-0.33	0.04			
1954	12	-0.96	-1.53	-0.24	-0.97	-0.26			
1955	1	-1.17	-0.51	-1.94	-0.52	-0.21	283.8		
1955	2	-1.1	0.41	-0.88	-0.49	-0.4	231.6		
1955	3	-1.52	-0.72	-0.79	-0.69	-0.64	514.5		
1955	4	-2.26	-0.89	-1.06	-1.93	-0.96	374.1		
1955	5	-3.14	-1.17	-1.55	-1.8	-1.35	245.5		
1955	6	-2.47	0.63	-0.8	-1.02	-1.4	349.5		104.8
1955	7	-3.02	-0.3	-0.56	-1.02	-1.14	203.7		
1955	8	-3.99	-1.6	-0.59	-1.52	-1.48	91.3		42.8
1955	9	-4.11	-0.33	-1.32	-1.48	-1.5	117.5		43.9
1955	10	-4.42	-0.99	-1.83	-1.5	-2.15	219.8		46.7
1955	11	-4.64	-1.32	-1.35	-1.37	-2.04	169.4		45
1955	12	-4.4	0.4	-1.24	-1.86	-1.86	156.4		37.7
1956	1	-4.32	0.16	-0.72	-1.98	-1.81	203.3		42.5
1956	2	-4.51	-0.81	-0.34	-1.37	-1.86	264.6		48.6
1956	3	-5.15	-1.96	-1.75	-2.27	-2.05	428.9		75.7
1956	4	-4.9	-0.3	-1.25	-1.5	-1.98	444.2		46.1
1956	5	-5.28	-0.89	-1.25	-1.33	-1.96	334.3		
1956	6	-5.62	-0.35	-1.03	-1.45	-2.31	293.2		
1956	7	-5.59	0.13	-0.82	-1.28	-2.25	182.7		
1956	8	-5.68	-0.61	-0.59	-1.32	-1.76	110.2		37.4
1956	9	-6.21	-1.77	-1.18	-1.58	-2.03	87.3		35.6
1956	10	-6.27	-0.33	-1.68	-1.63	-2.1	139.6		36
1956	11	-5.97	0.07	-1.36	-1.38	-1.79	202		
1956	12	-5.94	-0.75	-0.63	-1.43	-1.91	206.9		37.9
1957	1	-5.92	-0.79	-0.78	-1.89	-1.99	157.8		34.1
1957	2	-6.09	-1.33	-1.86	-1.87	-1.93	213.4		43.6
1957	3	-5.77	0.78	-0.15	-0.68	-1.65	320.4		58.5
1957	4	-5.57	-0.45	-0.33	-0.7	-1.75	420		42.8
1957	5	0.12	0.33	0.14	-0.36	-1.33			81.8
1957	6	0.55	0.71	0.25	0.1	-0.87			
1957	7	0.85	0.81	0.96	0.51	-0.58			
1957	8	0.45	-0.6	0.56	0.42	-0.58			
1957	9	1.26	0.99	0.67	0.63	0.17			
1957	10	1.83	0.71	0.59	1.02	0.5			
1957	11	2.17	0.82	1.22	1.2	0.62			
1957	12	1.88	-0.75	0.6	0.83	0.63			
1958	1	1.82	0.16	0.24	0.57	0.69			
1958	2	2.41	1.44	0.51	1.22	0.97			
1958	3	2.27	-0.34	0.36	0.62	0.76			
1958	4	2.93	0.93	0.87	0.78	1.24			
1958	5	1.95	-1.17	-0.34	-0.19	0.76			93
1958	6	1.08	-1.49	-1.01	-0.81	0.04	297		80.7
1958	7	3.1	2.26	0.21	0.6	0.78			
1958	8	0	-0.65	0.6	0.12	0.75			
1958	9	-0.69	-1.56	0.68	-0.22	0.04			
1958	10	-1.42	-1.92	-2.3	-1.08	-0.44			55.1
1958	11	-1.48	-0.03	-1.92	-0.74	-0.65			59.2
1958	12	-1.84	-1.77	-1.79	-0.25	-0.7			45.7
1959	1	-1.97	-0.44	-1.05	-2.52	-0.75			39.2
1959	2	-1.97	0.03	-1.23	-2.22	-0.96	243		41.4
1959	3	0.42	1.34	1	-0.64	-0.55			
1959	4	0.27	-0.25	0.5	-0.06	-1			96.8
1959	5	1.89	2.05	1.61	1.23	0.29			
1959	6	1.32	-0.56	0.79	1.07	0.54			
1959	7	0.87	-0.85	0.54	0.63	-0.76			
1959	8	1.24	0.8	-0.43	0.89	-0.32			
1959	9	0.89	-0.45	-0.36	0.31	-0.08			
1959	10	1.45	0.77	0.49	0.67	0.48			
1959	11	1.62	0.5	0.15	-0.33	0.55			
1959	12	1.74	0.55	0.77	0.09	0.73			
1960	1	2.29	1.67	1.09	0.87	0.95			
1960	2	2.32	0.13	1.1	0.53	0.96			
1960	3	2.64	0.65	1.08	1.12	0.77			
1960	4	2.86	0.5	0.56	0.95	1.03			
1960	5	3.87	1.44	1.24	1.46	0.75			
1960	6	4.05	0.5	1.33	1.6	1.1			

1960	7	3.62	-0.59	0.79	0.86	1.14				
1960	8	4.33	1.21	0.58	1.24	1.28				
1960	9	3.79	-0.37	0.05	0.94	1.26				
1960	10	3.06	-0.73	0.08	0.58	0.92				
1960	11	2.65	0.02	-0.89	-0.18	0.81				
1960	12	2.2	-0.5	-0.86	-0.5	0.7				
1961	1	1.76	-0.67	-0.7	-0.28	0.47				
1961	2	1.59	0.18	-0.72	-1.08	0.45				
1961	3	1.44	0.51	0.08	-0.72	0.44				
1961	4	1.06	-0.93	-0.5	-0.82	0.04				
1961	5	1.33	0.29	-0.21	-0.45	-0.43				
1961	6	0.94	-0.61	-0.77	-0.71	-0.85				
1961	7	1.12	0.16	-0.26	-0.54	-0.59				
1961	8	1.14	-0.07	-0.44	-0.52	-1.01				
1961	9	1.53	0.47	0.17	-0.44	-0.72				
1961	10	1.26	-0.24	-0.03	-0.25	-0.61				
1961	11	1.09	-0.04	-0.09	-0.5	-0.63				
1961	12	1.13	0.47	-0.25	-0.09	-0.53				
1962	1	0.78	-0.99	-0.31	-0.23	-0.54				
1962	2	1.55	1.89	1.13	0.34	-0.29				
1962	3	1.92	0.81	1.27	0.5	-0.21				
1962	4	1.46	-0.85	0.43	0.17	-0.19				
1962	5	1.92	1.04	0.45	0.76	0.13				
1962	6	2.52	0.86	0.65	1.07	0.65				
1962	7	3.67	1.29	1.83	1.65	1.08				
1962	8	3.58	-0.39	1.06	1.03	0.99				
1962	9	3.54	-0.04	0.5	0.78	0.8				
1962	10	-0.14	-0.5	-0.68	0.91	0.77				
1962	11	-0.54	-1.32	-0.94	0.23	0.62				
1962	12	-0.54	-0.31	-1.23	-0.23	0.54				
1963	1	-0.24	0.71	-0.84	-1.04	0.66				
1963	2	-0.38	-1.07	-0.58	-1.08	0.26				
1963	3	-0.58	0.12	-0.29	-1.26	0.11				
1963	4	-0.81	-0.44	-0.74	-1.11	0.22				91.2
1963	5	-1.42	-1.24	-1.09	-1.26	-0.58				90.7
1963	6	0.23	0.69	-0.61	-0.7	-0.66				
1963	7	0.8	0.88	0.16	-0.32	-0.84				
1963	8	1.27	0.56	1.1	0.06	-0.54				
1963	9	-0.09	-0.11	0.62	0.01	-0.54				
1963	10	-0.86	-0.93	-0.29	-0.1	-0.6				
1963	11	-1.36	-0.84	-1.07	0.19	-0.57				58.7
1963	12	-1.64	-0.78	-1.54	-0.23	-0.61	204.8		26.1	
1964	1	-1.86	-0.63	-1.5	-0.89	-0.73				
1964	2	-1.96	-0.08	-1.04	-1.36	-0.66				44.3
1964	3	-1.95	0.41	-0.14	-1.4	-0.62				89.5
1964	4	0.6	1	0.79	0.07	-0.13				92.8
1964	5	0.07	-0.51	0.3	-0.03	0.11				
1964	6	0.47	0.58	0.49	0.33	0.06				
1964	7	0.62	0.3	0.07	0.43	-0.15				
1964	8	1.42	0.83	0.84	0.74	-0.09				
1964	9	1.8	0.53	0.73	0.84	0.12				
1964	10	-0.54	-1.55	0.15	0.1	0.09				
1964	11	-0.91	-1.09	-0.81	0.09	0.04				
1964	12	-0.87	0.06	-1.66	-0.16	0.11	200.6			
1965	1	-0.98	-0.34	-1.07	-0.33	0.13	209.4			
1965	2	-0.64	0.86	0.21	-0.67	0.21				
1965	3	-0.82	-0.34	-0.19	-1.53	0.08				
1965	4	-1	-0.41	-0.39	-0.89	-0.41				
1965	5	1.01	1.54	0.55	0.55	0.41				
1965	6	1.19	0.21	0.76	0.56	0.26				
1965	7	1.71	0.46	1.21	0.69	0.34				
1965	8	1.95	0.05	0.32	0.54	0.06				
1965	9	4.63	2.44	1.82	1.8	0.96				
1965	10	3.99	-0.96	1.44	1.78	1.05				
1965	11	3.51	-0.88	1.31	1.06	1.05				
1965	12	3.39	-0.04	-1.29	1.04	1.05				
1966	1	3.23	-0.13	-0.93	0.98	1.06				
1966	2	3.51	0.79	0.18	1.2	1.05				
1966	3	3.18	0.01	0.09	-1.04	1.15				
1966	4	2.65	-1.13	-0.71	-1.12	1.01				
1966	5	1.69	-1.57	-1.65	-1.51	-0.07			50.8	89.7
1966	6	2.1	0.75	-0.98	-0.9	0.14				
1966	7	2.17	0.27	-0.35	-0.7	0.09	181.6			
1966	8	3.01	1.07	1.04	-0.32	0.38				
1966	9	3	0.07	0.6	-0.26	-0.69				
1966	10	-0.02	-0.21	0.41	-0.02	-0.54				
1966	11	-0.36	-1.32	-0.71	0.35	-0.58				
1966	12	-0.3	0.06	-0.85	0.02	-0.58	214.5			
1967	1	-0.32	-0.13	-1.08	-0.08	-0.58	203.9			

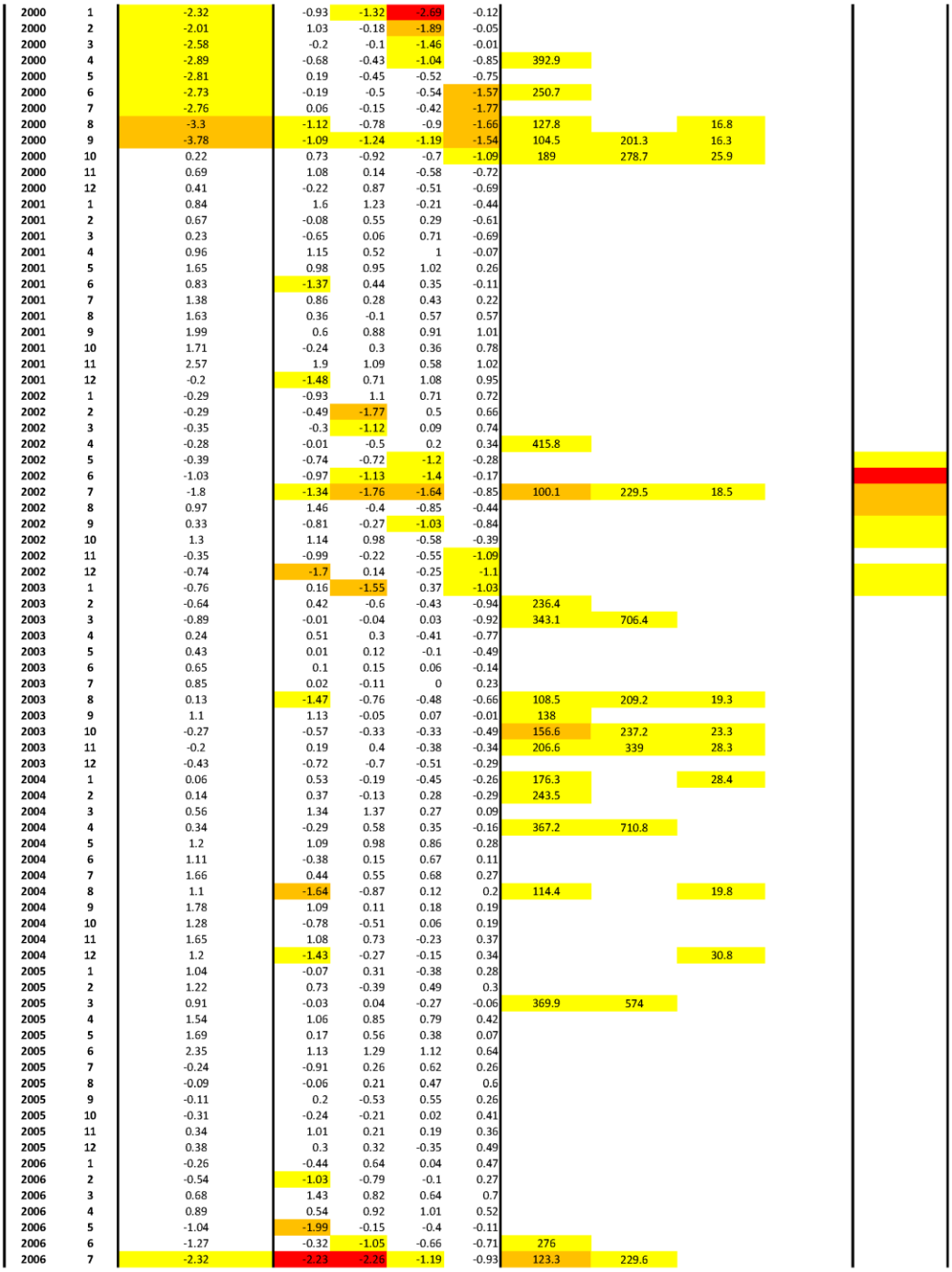
1967	2	-0.65	-1.92	-1.14	-1.05	-0.82					
1967	3	-1.5	-3.09	-2.82	-2.3	-1.08			43.5	87.7	
1967	4	-1.82	-0.59	-1.85	-2.27	-0.99	341.2		43.2	72.4	
1967	5	-1.79	-0.44	-1.18	-1.51	-0.63	320.1		41.6	90.3	
1967	6	2.63	2.96	1.62	0.76	0.51					
1967	7	-0.36	-1.45	1.3	0.17	0.09					
1967	8	-0.46	-0.73	1.23	0.11	-0.48					
1967	9	-0.85	-0.89	-1.78	0.11	-0.71					
1967	10	-0.77	-0.02	-1.15	0.28	-0.66					
1967	11	-1.23	-1.45	-1.23	0.22	-0.67					
1967	12	-1.25	0.09	-0.7	-1.96	-0.67					
1968	1	-1.43	-0.44	-1.23	-1.61	-0.7			26.5		
1968	2	-1.87	-1.92	-1.26	-1.57	-0.71			34.8		
1968	3	-2.78	-1.13	-2.25	-1.87	-0.66	351.5		39.3	75.8	
1968	4	-2.37	0.58	-0.44	-1.01	-0.3	401.7			72.4	
1968	5	-2.83	-1.42	-0.9	-1.27	-0.59	323.8		37.3		
1968	6	-2.97	-0.19	-0.71	-1.26	-2.23	227		27.4		
1968	7	-3.14	-0.16	-1.16	-1.18	-1.94	165.5			43.7	
1968	8	-3.07	-0.17	-0.43	-0.99	-1.6	124.6			46.4	
1968	9	0.04	0.18	-0.24	-0.7	-1.27	140.9			51.2	
1968	10	1.59	1.9	1.13	-0.05	-0.52					
1968	11	1.33	-0.32	1.19	0.4	-0.42					
1968	12	2.16	1.79	1.84	0.98	-0.14	219.4			46.6	
1969	1	2.48	1.19	1.08	1.43	0.02	200.5			46.1	
1969	2	3	1.28	2.25	1.89	0.29	223.6		30.9	54.7	
1969	3	2.74	-0.52	0.6	1.78	0.37					
1969	4	1.85	-1.5	-0.92	-0.1	-0.17					
1969	5	1.28	-0.63	-1.4	-0.34	0.09				54.8	
1969	6	1.77	0.53	-0.79	-0.53	0.34					
1969	7	2.15	0.52	0.1	-0.44	0.58					
1969	8	2.42	0.37	0.7	-0.46	0.71					
1969	9	1.93	-0.56	0.07	-0.53	0.49					
1969	10	2.84	1.13	0.44	0.32	0.19					
1969	11	2.37	-0.78	-0.05	0.43	0.1					
1969	12	2.53	0.66	0.65	0.36	-0.1					
1970	1	2.18	-1.22	-0.7	0.07	-0.3					
1970	2	1.81	-1.45	-0.84	-0.35	-0.61					
1970	3	1.82	0.25	-0.95	0.1	-0.49					
1970	4	2.11	0.43	-0.02	-0.39	0.01					
1970	5	-0.12	-0.14	0.07	-0.21	0.19					
1970	6	-0.64	-0.93	-0.54	-0.84	-0.33			38.4		
1970	7	-1.14	-0.99	-1.26	-1.04	-0.79	124.8		20.5	62.4	
1970	8	-1.76	-1.17	-2.07	-1.21	-1.18	111.2		20	49.7	
1970	9	0.92	1.24	-0.33	-0.62	-0.53	120.4				
1970	10	1.83	1.06	0.77	-0.4	-0.54					
1970	11	2.16	0.78	1.64	-0.2	-0.27	236.8				
1970	12	2.04	-0.14	0.97	0.25	-0.38	203				
1971	1	1.86	-0.31	0.27	0.74	-0.33	204.5				
1971	2	3.27	2.69	1.7	2.03	0.22					
1971	3	2.91	-0.63	1.06	1.27	0.08					
1971	4	2.33	-0.73	0.25	0.29	-0.25					
1971	5	2.23	-0.19	-0.84	-0.14	-0.25			47.5		
1971	6	2.75	1.11	0.11	0.47	0.48					
1971	7	3.25	0.53	0.74	0.64	0.92					
1971	8	2.33	-2.01	0.14	-0.55	0.73	135.5				
1971	9	1.63	-0.9	-1.2	-0.7	0.04					
1971	10	1.97	0.88	-1.14	-0.14	0.01					
1971	11	2.16	0.8	0.17	0.11	-0.01					
1971	12	2.07	0.23	0.93	-0.43	0.03					
1972	1	1.78	-0.44	0.42	-0.85	0.02	208.9		28.9		
1972	2	1.45	-0.78	-0.73	-0.11	-0.55					
1972	3	0.9	-0.57	-1.35	0.23	-0.56					
1972	4	1.08	0.29	-0.4	-0.15	-0.27	371.5		43.9	82.4	
1972	5	2.3	1.61	0.88	0.61	0.47					
1972	6	1.58	-0.96	0.53	0.01	-0.29					
1972	7	3.41	2.03	1.83	1.21	0.46					
1972	8	3.15	-0.67	0.59	0.98	0.7					
1972	9	3.12	0.07	1.04	1.08	0.93					
1972	10	3.07	0.05	-0.49	1.01	0.71					
1972	11	3.26	0.64	0.07	0.41	0.65					
1972	12	3.72	1.23	0.59	1.15	0.8					
1973	1	4.02	1.19	1.29	0.16	0.95					
1973	2	3.91	-0.11	1.14	0.47	1					
1973	3	5.26	2.22	2.47	1.79	1.88					
1973	4	4.76	-0.25	1.28	1.6	1.74					
1973	5	4.75	0.36	1.15	1.4	1.22					
1973	6	3.86	-0.75	-0.51	0.71	1.28					
1973	7	3.87	0.42	-0.14	0.6	0.55					
1973	8	2.56	-1.91	-1.26	0.05	0.25		226.4			

1973	9	4.04	1.86	0.64	0.09	0.97				
1973	10	3.74	0.08	0.49	0.18	1				
1973	11	4.03	1.01	1.72	0.28	1.07				
1973	12	3.88	0.25	0.49	0.74	0.94				
1974	1	3.56	-0.34	0.64	0.65	0.8				
1974	2	-0.09	-1.45	-0.94	1.26	0.69				
1974	3	-0.45	-0.86	-1.83	-0.36	-0.18				
1974	4	-0.69	-0.58	-1.4	-0.72	-0.27				
1974	5	-0.4	0.19	-0.57	-0.86	-0.31	305.3			
1974	6	-0.62	-0.73	-0.75	-1.22	-0.31				
1974	7	-1.41	-1.88	-1.22	-1.64	-0.89	102.8	180.4	22.7	64.4
1974	8	-0.74	0.63	-1.04	-1.15	-0.22	125	210.5		
1974	9	-1.24	-1.2	-1.18	-1.35	-1.28	128.8	201		
1974	10	-1.38	-0.1	-0.44	-1.23	-1.39	169	239.7		
1974	11	-1.84	-0.97	-1.34	-1.67	-1.74	206.3	309.1	31.6	
1974	12	-1.92	0.04	-0.67	-1.46	-1.77		288.7		
1975	1	-1.41	1.56	0	-0.47	-1.54		319		
1975	2	-1.67	-0.67	0.4	-1.05	-1.45	248.2	304.6	29.6	61.6
1975	3	-1.83	0.08	0.28	-0.44	-1.38		697.4	47.6	
1975	4	0.51	0.61	0.17	0.09	-1.04				
1975	5	-0.5	-0.66	-0.17	-0.07	-1.37	315.3	617.3		
1975	6	0.89	1.18	0.57	0.56	-0.57				
1975	7	-0.24	-0.63	-0.06	-0.04	-0.3				
1975	8	-0.34	-0.26	0.26	-0.02	-0.58	128.8	210.5	20.1	
1975	9	-0.77	-1.02	-1.18	-0.33	-0.53	107.9	167.7	25.4	62.5
1975	10	-1.49	-1.45	-1.57	-0.97	-0.76	154.7	196.8		58
1975	11	1.3	1.99	-0.17	-0.02	-0.06	194.5	271.6	30.2	58.6
1975	12	-0.2	-0.84	0.41	-0.79	-0.14		294.5		
1976	1	-0.25	-0.19	1.42	-0.55	-0.34		263.4		
1976	2	-0.29	-0.13	-0.91	-0.48	-0.32				
1976	3	0.31	0.88	0.47	0.52	-0.12		662.1		
1976	4	0	0.06	0.32	0.97	-0.31			52.9	96.5
1976	5	-0.02	-0.38	0.01	-0.28	-0.2		668	45.2	84
1976	6	-0.89	-1.77	-1.25	-0.98	-1.25	216.7	339.3	29	56.6
1976	7	-1.21	-0.49	-1.58	-1.08	-1.21	101.2	154.4	7.85	17.3
1976	8	-2.09	-1.81	-2.81	-1.56	-1.51	61.9	90	7.85	15
1976	9	-2.05	-0.01	-1.32	-1.86	-1.22	97	136.6	13.2	35.5
1976	10	-2.33	-1.23	-1.78	-2.29	-1.25	147.1	174	18.6	42.8
1976	11	-2.72	-1.57	-1.24	-2.52	-2.03	171.5	242.3	21.6	38.7
1976	12	-3.02	-0.94	-2.07	-2.19	-2.03	151.5	202.7	22.8	34.9
1977	1	-3.28	-0.89	-2.11	-2.46	-2.08	145.6	167.9	21.4	36.8
1977	2	-3.55	-0.67	-1.64	-1.69	-2.02		350.9		
1977	3	0.29	1.67	1.15	-0.65	-1.84		636.1	46.2	72.7
1977	4	0.45	0.85	1.39	0.5	-1.6			56	64.6
1977	5	0.77	1.05	1.7	1.25	-1.03				
1977	6	0.56	-0.07	0.93	1.26	-0.49				101.3
1977	7	0.77	0.45	0.7	1.34	-0.16				58.9
1977	8	1.34	0.63	0.43	1.5	0.43			16.5	
1977	9	1.27	0.05	0.45	0.93	0.44			18.5	56.3
1977	10	1.8	0.86	0.7	0.91	0.94			25.5	50
1977	11	2.07	0.7	0.6	0.65	1.21				
1977	12	2.02	0.09	0.81	0.78	1.3		329.4		
1978	1	1.74	-0.89	0.16	0.63	1.3	193.7	253.5	24.4	47.9
1978	2	1.99	0.76	0.01	0.5	1.47	128.7	225.9	24.2	41.6
1978	3	1.69	-0.76	-0.65	0.37	0.9				
1978	4	2.59	1.18	0.74	0.64	1.06				
1978	5	-0.07	-0.38	0.16	0.11	0.54				
1978	6	-0.91	-1.73	-0.52	-0.74	0.05			48.5	
1978	7	0.66	0.95	-0.66	-0.15	0.28			25.1	59.9
1978	8	1.03	0.38	-0.18	-0.08	0.16				44.3
1978	9	-0.46	-0.57	0.36	-0.12	-0.01	123.3	211.4	15.9	50.2
1978	10	-0.85	-0.86	-0.66	-0.94	-0.42	147.7	231.7	22.7	54.1
1978	11	-0.91	-0.09	-1.11	-0.93	-0.6	163.2	240.6	23.2	44.4
1978	12	-0.73	0.52	-0.62	-0.1	-0.55		298.7	26.6	42.3
1979	1	-0.49	0.89	0.29	-0.52	-0.41	169.4	216.9	23.5	43.8
1979	2	-0.75	-0.97	0.11	-0.97	-0.61	148.6	200.9	27.4	38.1
1979	3	1.19	1.87	1.76	0.59	0.1				
1979	4	1.34	-0.01	0.94	0.86	-0.35				
1979	5	1.8	0.45	1.05	0.99	-0.03				
1979	6	1.61	-0.19	-0.04	0.7	0.4				
1979	7	1.89	0.24	0.11	0.56	0.14				81.5
1979	8	2.26	0.44	0.14	0.79	0.13				
1979	9	1.83	-0.37	0.02	-0.02	0.18				
1979	10	2.83	1.38	0.75	0.54	0.84				
1979	11	3.55	1.27	1.09	0.75	1.11				
1979	12	3.33	-0.58	1.42	0.86	1.01				
1980	1	3.14	-0.48	0.6	0.86	0.9				
1980	2	3	-0.54	-1.18	0.62	0.92				
1980	3	2.9	-0.04	-0.76	0.9	0.36				

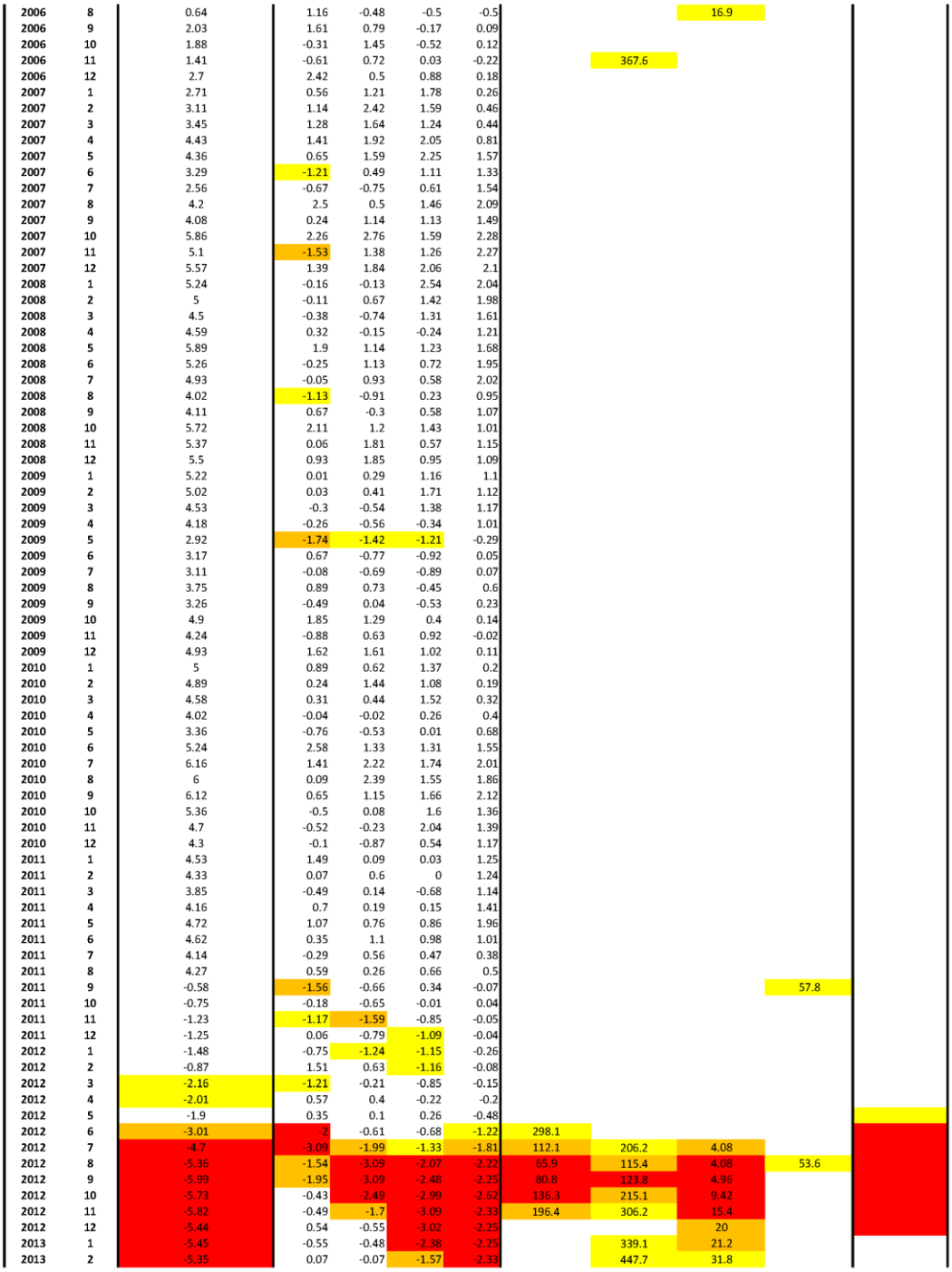
1980	4	-0.38	-0.89	-1.05	-0.51	0.14				
1980	5	-0.62	-0.64	-1.01	-1.36	-0.23				
1980	6	-1.37	-1.43	-1.68	-1.78	-0.61	246.5	512.4	49.3	
1980	7	-2.29	-1.59	-2.01	-2.06	-1.1	99.1	160.5	11.3	38.3
1980	8	-1.28	1.39	-0.78	-1.29	-0.71		124.7	11.3	59.5
1980	9	-1.9	-1.02	-0.48	-1.62	-0.85	99.5	138.8	13.9	51.5
1980	10	-1.68	0.16	0.29	-1.3	-1.35	124.7	191.7	19.1	52.4
1980	11	-2.25	-1.42	-1.17	-1.4	-1.82	203.8	274.5	20.8	50
1980	12	-2.61	-1.05	-0.86	-0.97	-1.85	181	217.4	29.3	
1981	1	-3.03	-3.09	-2.47	-0.54	-1.92		279	26.4	
1981	2	-3.27	-0.37	-1.82	-1.68	-1.83		357.7	28	
1981	3	-3.3	0.89	0.08	-0.72	-1.69	298.2	411.1	35.4	67.7
1981	4	-4.45	-2	-0.87	-1.91	-1.97	254.5	377.6	31.1	56.7
1981	5	-4.68	-0.72	-0.98	-1.48	-2.08	228.2	325.1	27.7	53
1981	6	-4.64	0.06	-1.27	-1.14	-1.49	300.4	493.8		
1981	7	-4.27	0.75	-0.08	-0.57	-0.77				64.7
1981	8	-3.57	0.56	0.66	-0.24	-1.04	90.8			52.4
1981	9	-3.87	-0.85	0.21	-0.77	-0.98	137.7	204.1		41.2
1981	10	-3.57	0.04	-0.27	-0.27	-1.04	190.5	246.6	25.5	45.4
1981	11	0.09	0.89	-0.32	0.23	-0.65	213.7	309.5	29.4	50.9
1981	12	0.27	0.96	0.63	0.46	-0.44				
1982	1	0.55	1.37	1.42	0.41	-0.19	197.9	251.9	28.7	39.5
1982	2	-0.41	-1.21	0.69	-0.05	-0.28				
1982	3	-0.46	0.42	0.32	0.63	-0.41		666.1		
1982	4	-0.75	-0.81	-0.84	0.19	-0.21				81.5
1982	5	1.8	2.36	1.23	1.33	1.04				
1982	6	1.33	-1.04	0.58	0.58	0.7				
1982	7	1.83	0.68	1.32	0.58	0.67				
1982	8	1.94	0.05	-0.25	0.68	0.49				
1982	9	1.82	-0.07	0.24	0.55	0.67				
1982	10	3.29	1.82	1.04	1.57	1.3				
1982	11	4.2	1.45	1.73	0.95	1.45				
1982	12	5.24	1.99	2.51	1.89	1.66				
1983	1	5.18	0.62	2.16	1.9	1.57				
1983	2	4.88	-0.32	1.42	2	1.68				
1983	3	6.03	1.97	1.93	2.89	2.25				
1983	4	5.71	-0.22	1.01	1.87	2.41				
1983	5	5.65	0.28	0.93	1.3	1.51				
1983	6	6.36	1.47	0.87	1.63	2.36				
1983	7	5.76	-0.26	0.85	1.2	1.99				
1983	8	4.21	-1.81	0.03	0.64	1.66				
1983	9	3.45	-0.23	-1.32	-0.19	1.56				
1983	10	3.12	0.24	-1.16	-0.07	0.99				
1983	11	4.19	2.09	0.96	0.57	1.19				
1983	12	3.74	-0.22	1.28	-0.24	0.87				
1984	1	3.19	-0.84	1.57	-0.16	0.77				
1984	2	3.48	1.37	0.35	0.93	0.97				
1984	3	3.55	0.62	0.8	1.39	0.51				
1984	4	6.01	2.68	2.72	2.84	1.81				
1984	5	6.03	0.52	2.17	2.12	1.83				
1984	6	6.52	1.41	3.06	3.09	1.82				
1984	7	6.15	-0.04	1.06	2.71	1.82				
1984	8	4.94	-1.49	0.21	1.74	1.94				
1984	9	3.83	-1.4	-1.63	1.19	1.63				
1984	10	4.95	1.78	-0.24	0.58	2.09				
1984	11	4.76	0.49	0.62	0.47	1.68				
1984	12	4.9	1.05	1.74	-0.06	1.86				
1985	1	4.43	-0.71	0.52	-0.05	1.86				
1985	2	3.88	-1.59	-0.36	0.4	1.63				
1985	3	3.58	0.49	-0.57	1.27	1.64				
1985	4	4.55	1.7	1.24	1.21	1.12				
1985	5	3.93	-0.18	1	0.82	0.87				
1985	6	3.58	-0.24	0.7	0.38	0.21				
1985	7	3	-0.82	-0.83	0.05	0.02				
1985	8	3.3	0.56	-0.37	0.43	0.52				
1985	9	3.91	1.01	0.38	0.73	1.17				
1985	10	3.51	-0.34	0.67	-0.17	0.5				
1985	11	3.25	0	0.32	-0.17	0.38				
1985	12	2.85	-0.43	-0.59	-0.07	0.2				
1986	1	2.33	-1.6	-0.85	0.24	0.17				
1986	2	2.21	0.24	-0.86	-0.02	0.28				
1986	3	2.41	1.17	0.73	-0.09	0.51				
1986	4	3.19	1.2	1.46	0.89	0.29				
1986	5	3.01	0.06	1.09	0.79	0.38				
1986	6	3.09	0.6	0.96	1.1	0.68				
1986	7	3.04	0.04	0.25	1.04	0.9				
1986	8	3.17	0.09	0.34	0.96	0.74				
1986	9	3.95	1.18	0.65	1.09	0.8				
1986	10	4.49	0.97	1.19	0.96	1.17				

1986	11	4.28	-0.12	1.18	0.98	1.14				
1986	12	3.91	-0.78	0.35	0.67	1.13				
1987	1	3.53	-1.22	-1.07	0.7	1.14				
1987	2	3.31	-0.25	-1.36	0.66	1.09				
1987	3	5.74	2.93	2.9	1.91	1.97				
1987	4	-0.74	-1.55	1.49	0.85	1.22				
1987	5	-0.61	0.38	1.35	0.95	1.31				
1987	6	-1.4	-1.36	-1.27	0.35	0.69				
1987	7	-1.3	0.32	-0.48	0.5	0.79				
1987	8	-0.87	0.29	-0.53	0.61	0.82				
1987	9	-0.76	0.06	0.2	-0.78	0.4				
1987	10	-1.05	-0.97	-0.37	-0.62	-0.05				
1987	11	-1.06	0.37	-0.53	-0.84	0.01				
1987	12	-0.99	0.3	-0.49	-0.18	0.11				
1988	1	-0.82	0.73	0.44	-0.2	0.24				
1988	2	-1.08	-0.9	-0.12	-0.55	0.16				
1988	3	-1.92	-2.72	-1.46	-1.26	-1.23				
1988	4	-1.76	0.17	-0.86	-0.48	-0.84				
1988	5	-2.07	-0.19	-0.56	-0.61	-1.06				
1988	6	-3.34	-1.9	-1.13	-1.48	-1.18		583	48.9	115.6
1988	7	-3.48	0.14	-1.17	-1.38	-1.26			21.4	
1988	8	-3.47	-0.05	-1.16	-1.21	-1.28		190.7	12.5	59.6
1988	9	-2.38	1.17	0.63	-0.35	-0.83			20	
1988	10	-2.68	-1.81	0.08	-0.84	-0.95			24	
1988	11	-2.55	0.41	0.19	-0.79	-0.93			27.2	
1988	12	-2.6	-0.16	-0.96	0	-0.99			30.8	
1989	1	-2.32	0.9	0.35	0.15	-0.97				
1989	2	-2.48	-0.51	-0.13	0.09	-0.94	239.2	386.1	34.7	
1989	3	-2.82	-0.43	-0.44	-1.14	-0.85				
1989	4	-3.51	-1.37	-1.59	-1.06	-1.28	358.3	600.4	42.3	
1989	5	-4.26	-1.51	-1.88	-1.85	-1.76	265.6	424.2	31.9	83.5
1989	6	-4.65	-1.07	-2.12	-2.05	-1.48	200.8	347.7	21.8	60.7
1989	7	-4.89	-0.02	-1.61	-1.99	-1.56	150.9	273.7	7.54	41
1989	8	-4.87	-0.41	-1.05	-2.02	-1.54	91.8	135.5		27.8
1989	9	-4.1	0.54	-0.06	-1.65	-1.78			12.2	
1989	10	-4.29	-0.93	-0.43	-1.52	-1.81	159.4	268.5	16.5	56
1989	11	-4.53	-1.26	-0.64	-1.26	-1.97	182.7	317.3	17.3	51.7
1989	12	-4.41	0.09	-1.34	-0.79	-1.94	190.6	269.4	20	45
1990	1	-4.35	0.03	-0.96	-0.85	-2.04			25	
1990	2	-4.58	-1.03	-0.73	-0.86	-1.98			28.5	
1990	3	-4.48	0.9	0.27	-0.94	-1.79	388.8	551.4	30.3	91.6
1990	4	-4.73	-0.97	-0.52	-0.96	-1.78	279.3	444.3	28.7	74.5
1990	5	-3.88	0.67	0.21	-0.04	-1.01	346.1	649.5	35	
1990	6	-3.2	0.74	0.28	0.29	-0.34			27.7	
1990	7	-2.52	0.6	1.04	0.49	-0.09			7.41	
1990	8	-2.4	-0.31	0.57	0.48	-0.09				
1990	9	-3.02	-1.25	-0.51	-0.14	-0.56			9.53	
1990	10	-2.72	0.16	-0.95	0.19	-0.3			15.4	
1990	11	-2.52	0.44	-0.69	-0.08	-0.09			19.7	
1990	12	-2.42	0.06	0.14	-0.44	-0.09	211.9		15.3	40.6
1991	1	-2.34	0.16	0.17	-0.82	-0.08	197.4	339.7	17.2	42.9
1991	2	-2.56	-0.81	-0.6	-0.86	-0.1				
1991	3	-2.49	0.72	0.17	0.14	-0.15	386.5	612.2	30.3	91.1
1991	4	-2.24	0.32	0.27	0.26	0.22	400.1	616	31.8	
1991	5	-1.81	0.56	0.62	0.39	0.19			38.5	
1991	6	-1.61	0.28	0.49	0.44	-0.01				
1991	7	-1.92	-0.91	-0.09	0	-0.46	188.5			
1991	8	-2.5	-1.37	-1.12	-0.3	-0.73	106.2	197.8		56.3
1991	9	-2.36	0.05	-1.31	-0.47	-0.39	88.8	186.9	10.1	
1991	10	0.02	0.13	-0.82	-0.6	-0.37	172.8	268.3	13.5	
1991	11	0.85	1.45	0.59	-0.48	-0.11	240.1	345.7	14.7	
1991	12	0.77	0.13	0.81	-0.6	-0.1			14.6	
1992	1	0.85	0.71	1.34	-0.07	-0.04			15.6	
1992	2	1.13	1.1	0.86	0.8	0.14				
1992	3	1.71	1.46	1.85	1.57	0.4				
1992	4	1.32	-0.93	0.56	1.09	0.07		695.1	57.3	
1992	5	1.07	-0.4	-0.09	0.17	-0.26				
1992	6	1.01	-0.29	-1	-0.09	-0.48				
1992	7	2.58	1.49	0.45	0.59	0.42				
1992	8	3.83	1.23	1.32	0.86	1.11				
1992	9	4.32	0.6	1.71	0.62	1.26				
1992	10	5.33	1.34	1.62	1.41	1.61				
1992	11	5.58	0.68	1.32	1.95	1.42				
1992	12	5.42	0.15	1.21	2.12	1.44				
1993	1	5.39	0.77	0.64	1.69	1.45				
1993	2	5.57	1.02	0.85	1.43	1.47				
1993	3	5.11	-0.27	0.37	1.14	1.05				
1993	4	5.58	0.96	0.77	0.89	1.64				
1993	5	5.5	0.39	0.55	0.75	1.83				

1993	6	5.72	0.75	1.09	1.06	2.2
1993	7	7.87	2.45	2.36	2.32	2.55
1993	8	8.22	0.92	2.36	2.19	2.63
1993	9	8.04	0.2	2.1	2.2	2.4
1993	10	7.51	-0.13	0.43	1.9	1.88
1993	11	7.3	0.34	-0.08	2.09	1.84
1993	12	6.79	-0.36	-0.23	1.72	1.83
1994	1	6.55	0.56	0.07	0.35	1.8
1994	2	6.24	0.13	-0.11	-0.15	1.75
1994	3	5.04	-3.09	-1.21	-0.89	1.61
1994	4	4.78	0.17	-0.69	-0.56	1.35
1994	5	3.3	-1.8	-1.57	-1.55	0.69
1994	6	3.14	0.45	-0.72	-1.06	0.56
1994	7	4.54	1.8	0.5	-0.02	0.2
1994	8	4.51	-0.07	1.32	-0.03	-0.15
1994	9	4.73	0.7	1.41	0.55	0.03
1994	10	4.44	0.13	0.31	0.52	0.14
1994	11	4.29	0.48	0.49	1.37	0.14
1994	12	4.28	0.59	0.31	1.33	0.25
1995	1	4	-0.13	0.38	0.37	0.19
1995	2	3.69	-0.62	-0.24	0.33	0.09
1995	3	4.28	1.3	0.83	0.64	0.7
1995	4	4.93	1	1.23	1.14	1.02
1995	5	6.03	1.59	1.9	1.71	2.07
1995	6	4.72	-1.51	0.72	0.92	1.53
1995	7	3.85	-0.67	-0.19	0.53	0.62
1995	8	4.2	1.26	-0.54	1.06	1.01
1995	9	4.7	1.05	0.85	1.07	1.12
1995	10	5.15	1.03	1.71	1.06	1.38
1995	11	4.77	-0.08	1.13	0.28	1.28
1995	12	4.17	-0.98	0.39	0.87	1.15
1996	1	4.16	0.92	-0.28	1.45	1.25
1996	2	3.54	-2.29	-1.09	0.67	1.18
1996	3	3.11	-0.44	-0.9	-0.14	0.79
1996	4	2.41	-1.31	-1.91	-1.76	0.13
1996	5	3.34	1.23	-0.02	-0.35	-0.01
1996	6	2.72	-0.58	-0.24	-0.56	0.24
1996	7	2.95	0.36	0.49	-0.5	0.56
1996	8	3.55	0.86	0.23	0.07	0.38
1996	9	3.98	0.72	0.89	0.47	0.25
1996	10	3.43	-0.62	0.54	0.66	-0.17
1996	11	4.52	1.79	0.95	0.73	0.3
1996	12	4.35	-0.1	0.65	1.06	0.37
1997	1	4.08	-0.41	1.34	1.03	0.25
1997	2	4.11	0.34	-0.28	0.73	0.39
1997	3	3.3	-1.53	-1.16	0.02	0.32
1997	4	3.51	0.2	-0.41	0.41	0.71
1997	5	3.52	-0.02	-0.38	-0.49	0.24
1997	6	-0.26	-0.53	-0.4	-0.76	0.24
1997	7	-0.41	-0.53	-0.78	-0.88	-0.02
1997	8	-0.62	-0.7	-1.18	-1.1	-0.5
1997	9	0.3	0.54	-0.46	-0.61	-0.56
1997	10	0.75	0.8	0.28	-0.41	-0.14
1997	11	-0.29	-0.82	0.38	-0.67	-0.78
1997	12	-0.52	-0.61	-0.01	-0.49	-0.83
1998	1	-0.67	-0.31	-1.28	-0.27	-0.82
1998	2	-1.03	-1.03	-1.39	-0.1	-0.96
1998	3	0.68	1.42	0.84	0.4	-0.4
1998	4	1.61	1.18	1.4	0.71	-0.02
1998	5	1.01	-0.59	0.88	0.48	-0.2
1998	6	1.98	1.18	0.99	1.17	0.45
1998	7	2.36	0.41	0.51	1.2	0.75
1998	8	3.09	0.95	1.31	1.53	1.2
1998	9	1.95	-1.85	-0.09	0.62	0.62
1998	10	3	1.54	0.66	0.76	0.93
1998	11	3.45	1.18	0.62	1.45	1.27
1998	12	3.09	-0.98	1.46	0.8	1.26
1999	1	2.98	0.06	0.54	0.76	1.28
1999	2	2.99	0.25	-0.57	0.34	1.41
1999	3	2.6	-0.38	-0.46	1.04	0.99
1999	4	3.78	1.59	1.09	1.1	1.2
1999	5	3.5	-0.07	0.72	0.49	1.34
1999	6	4.64	1.66	1.94	1.56	1.55
1999	7	4.71	0.44	1.17	1.52	1.52
1999	8	-0.14	-0.9	0.87	1.07	1.03
1999	9	-0.78	-1.6	-1.04	0.72	1.03
1999	10	-1.34	-1.43	-2.37	-0.35	0.3
1999	11	-1.87	-0.52	-2.01	-0.53	-0.08
1999	12	-2.09	-0.69	-1.65	-1.8	-0.06



2000	1	-2.32	-0.93	-1.32	-2.69	-0.12			
2000	2	-2.01	1.03	-0.18	-1.89	-0.05			
2000	3	-2.58	-0.2	-0.1	-1.46	-0.01			
2000	4	-2.89	-0.68	-0.43	-1.04	-0.85	392.9		
2000	5	-2.81	0.19	-0.45	-0.52	-0.75			
2000	6	-2.73	-0.19	-0.5	-0.54	-1.57	250.7		
2000	7	-2.76	0.06	-0.15	-0.42	-1.77			
2000	8	-3.3	-1.12	-0.78	-0.9	-1.66	127.8		16.8
2000	9	-3.78	-1.09	-1.24	-1.19	-1.54	104.5	201.3	16.3
2000	10	0.22	0.73	-0.92	-0.7	-1.09	189	278.7	25.9
2000	11	0.69	1.08	0.14	-0.58	-0.72			
2000	12	0.41	-0.22	0.87	-0.51	-0.69			
2001	1	0.84	1.6	1.23	-0.21	-0.44			
2001	2	0.67	-0.08	0.55	0.29	-0.61			
2001	3	0.23	-0.65	0.06	0.71	-0.69			
2001	4	0.96	1.15	0.52	1	-0.07			
2001	5	1.65	0.98	0.95	1.02	0.26			
2001	6	0.83	-1.37	0.44	0.35	-0.11			
2001	7	1.38	0.86	0.28	0.43	0.22			
2001	8	1.63	0.36	-0.1	0.57	0.57			
2001	9	1.99	0.6	0.88	0.91	1.01			
2001	10	1.71	-0.24	0.3	0.36	0.78			
2001	11	2.57	1.9	1.09	0.58	1.02			
2001	12	-0.2	-1.48	0.71	1.08	0.95			
2002	1	-0.29	-0.93	1.1	0.71	0.72			
2002	2	-0.29	-0.49	-1.77	0.5	0.66			
2002	3	-0.35	-0.3	-1.12	0.09	0.74			
2002	4	-0.28	-0.01	-0.5	0.2	0.34	415.8		
2002	5	-0.39	-0.74	-0.72	-1.2	-0.28			
2002	6	-1.03	-0.97	-1.13	-1.4	-0.17			
2002	7	-1.8	-1.34	-1.76	-1.64	-0.85	100.1	229.5	18.5
2002	8	0.97	1.46	-0.4	-0.85	-0.44			
2002	9	0.33	-0.81	-0.27	-1.03	-0.84			
2002	10	1.3	1.14	0.98	-0.58	-0.39			
2002	11	-0.35	-0.99	-0.22	-0.55	-1.09			
2002	12	-0.74	-1.7	0.14	-0.25	-1.1			
2003	1	-0.76	0.16	-1.55	0.37	-1.03			
2003	2	-0.64	0.42	-0.6	-0.43	-0.94	236.4		
2003	3	-0.89	-0.01	-0.04	0.03	-0.92	343.1	706.4	
2003	4	0.24	0.51	0.3	-0.41	-0.77			
2003	5	0.43	0.01	0.12	-0.1	-0.49			
2003	6	0.65	0.1	0.15	0.06	-0.14			
2003	7	0.85	0.02	-0.11	0	0.23			
2003	8	0.13	-1.47	-0.76	-0.48	-0.66	108.5	209.2	19.3
2003	9	1.1	1.13	-0.05	0.07	-0.01	138		
2003	10	-0.27	-0.57	-0.33	-0.33	-0.49	156.6	237.2	23.3
2003	11	-0.2	0.19	0.4	-0.38	-0.34	206.6	339	28.3
2003	12	-0.43	-0.72	-0.7	-0.51	-0.29			
2004	1	0.06	0.53	-0.19	-0.45	-0.26	176.3		28.4
2004	2	0.14	0.37	-0.13	0.28	-0.29	243.5		
2004	3	0.56	1.34	1.37	0.27	0.09			
2004	4	0.34	-0.29	0.58	0.35	-0.16	367.2	710.8	
2004	5	1.2	1.09	0.98	0.86	0.28			
2004	6	1.11	-0.38	0.15	0.67	0.11			
2004	7	1.66	0.44	0.55	0.68	0.27			
2004	8	1.1	-1.64	-0.87	0.12	0.2	114.4		19.8
2004	9	1.78	1.09	0.11	0.18	0.19			
2004	10	1.28	-0.78	-0.51	0.06	0.19			
2004	11	1.65	1.08	0.73	-0.23	0.37			
2004	12	1.2	-1.43	-0.27	-0.15	0.34			30.8
2005	1	1.04	-0.07	0.31	-0.38	0.28			
2005	2	1.22	0.73	-0.39	0.49	0.3			
2005	3	0.91	-0.03	0.04	-0.27	-0.06	369.9	574	
2005	4	1.54	1.06	0.85	0.79	0.42			
2005	5	1.69	0.17	0.56	0.38	0.07			
2005	6	2.35	1.13	1.29	1.12	0.64			
2005	7	-0.24	-0.91	0.26	0.62	0.26			
2005	8	-0.09	-0.06	0.21	0.47	0.6			
2005	9	-0.11	0.2	-0.53	0.55	0.26			
2005	10	-0.31	-0.24	-0.21	0.02	0.41			
2005	11	0.34	1.01	0.21	0.19	0.36			
2005	12	0.38	0.3	0.32	-0.35	0.49			
2006	1	-0.26	-0.44	0.64	0.04	0.47			
2006	2	-0.54	-1.03	-0.79	-0.1	0.27			
2006	3	0.68	1.43	0.82	0.64	0.7			
2006	4	0.89	0.54	0.92	1.01	0.52			
2006	5	-1.04	-1.99	-0.15	-0.4	-0.11			
2006	6	-1.27	-0.32	-1.05	-0.66	-0.71	276		
2006	7	-2.32	-2.23	-2.26	-1.19	-0.93	123.3	229.6	



2006	8	0.64	1.16	-0.48	-0.5	-0.5			16.9			
2006	9	2.03	1.61	0.79	-0.17	0.09						
2006	10	1.88	-0.31	1.45	-0.52	0.12						
2006	11	1.41	-0.61	0.72	0.03	-0.22		367.6				
2006	12	2.7	2.42	0.5	0.88	0.18						
2007	1	2.71	0.56	1.21	1.78	0.26						
2007	2	3.11	1.14	2.42	1.59	0.46						
2007	3	3.45	1.28	1.64	1.24	0.44						
2007	4	4.43	1.41	1.92	2.05	0.81						
2007	5	4.36	0.65	1.59	2.25	1.57						
2007	6	3.29	-1.21	0.49	1.11	1.33						
2007	7	2.56	-0.67	-0.75	0.61	1.54						
2007	8	4.2	2.5	0.5	1.46	2.09						
2007	9	4.08	0.24	1.14	1.13	1.49						
2007	10	5.86	2.26	2.76	1.59	2.28						
2007	11	5.1	-1.53	1.38	1.26	2.27						
2007	12	5.57	1.39	1.84	2.06	2.1						
2008	1	5.24	-0.16	-0.13	2.54	2.04						
2008	2	5	-0.11	0.67	1.42	1.98						
2008	3	4.5	-0.38	-0.74	1.31	1.61						
2008	4	4.59	0.32	-0.15	-0.24	1.21						
2008	5	5.89	1.9	1.14	1.23	1.68						
2008	6	5.26	-0.25	1.13	0.72	1.95						
2008	7	4.93	-0.05	0.93	0.58	2.02						
2008	8	4.02	-1.13	-0.91	0.23	0.95						
2008	9	4.11	0.67	-0.3	0.58	1.07						
2008	10	5.72	2.11	1.2	1.43	1.01						
2008	11	5.37	0.06	1.81	0.57	1.15						
2008	12	5.5	0.93	1.85	0.95	1.09						
2009	1	5.22	0.01	0.29	1.16	1.1						
2009	2	5.02	0.03	0.41	1.71	1.12						
2009	3	4.53	-0.3	-0.54	1.38	1.17						
2009	4	4.18	-0.26	-0.56	-0.34	1.01						
2009	5	2.92	-1.74	-1.42	-1.21	-0.29						
2009	6	3.17	0.67	-0.77	-0.92	0.05						
2009	7	3.11	-0.08	-0.69	-0.89	0.07						
2009	8	3.75	0.89	0.73	-0.45	0.6						
2009	9	3.26	-0.49	0.04	-0.53	0.23						
2009	10	4.9	1.85	1.29	0.4	0.14						
2009	11	4.24	-0.88	0.63	0.92	-0.02						
2009	12	4.93	1.62	1.61	1.02	0.11						
2010	1	5	0.89	0.62	1.37	0.2						
2010	2	4.89	0.24	1.44	1.08	0.19						
2010	3	4.58	0.31	0.44	1.52	0.32						
2010	4	4.02	-0.04	-0.02	0.26	0.4						
2010	5	3.36	-0.76	-0.53	0.01	0.68						
2010	6	5.24	2.58	1.33	1.31	1.55						
2010	7	6.16	1.41	2.22	1.74	2.01						
2010	8	6	0.09	2.39	1.55	1.86						
2010	9	6.12	0.65	1.15	1.66	2.12						
2010	10	5.36	-0.5	0.08	1.6	1.36						
2010	11	4.7	-0.52	-0.23	2.04	1.39						
2010	12	4.3	-0.1	-0.87	0.54	1.17						
2011	1	4.53	1.49	0.09	0.03	1.25						
2011	2	4.33	0.07	0.6	0	1.24						
2011	3	3.85	-0.49	0.14	-0.68	1.14						
2011	4	4.16	0.7	0.19	0.15	1.41						
2011	5	4.72	1.07	0.76	0.86	1.96						
2011	6	4.62	0.35	1.1	0.98	1.01						
2011	7	4.14	-0.29	0.56	0.47	0.38						
2011	8	4.27	0.59	0.26	0.66	0.5						
2011	9	-0.58	-1.56	-0.66	0.34	-0.07					57.8	
2011	10	-0.75	-0.18	-0.65	-0.01	0.04						
2011	11	-1.23	-1.17	-1.59	-0.85	-0.05						
2011	12	-1.25	0.06	-0.79	-1.09	-0.04						
2012	1	-1.48	-0.75	-1.24	-1.15	-0.26						
2012	2	-0.87	1.51	0.63	-1.16	-0.08						
2012	3	-2.16	-1.21	-0.21	-0.85	-0.15						
2012	4	-2.01	0.57	0.4	-0.22	-0.2						
2012	5	-1.9	0.35	0.1	0.26	-0.48						
2012	6	-3.01	-2	-0.61	-0.68	-1.22	298.1					
2012	7	-4.7	-3.09	-1.99	-1.33	-1.81	112.1	206.2	4.08			
2012	8	-5.36	-1.54	-3.09	-2.07	-2.22	65.9	115.4	4.08		53.6	
2012	9	-5.99	-1.95	-3.09	-2.48	-2.25	80.8	123.8	4.96			
2012	10	-5.73	-0.43	-2.49	-2.99	-2.62	136.3	215.1	9.42			
2012	11	-5.82	-0.49	-1.7	-3.09	-2.33	196.4	306.2	15.4			
2012	12	-5.44	0.54	-0.55	-3.02	-2.25			20			
2013	1	-5.45	-0.55	-0.48	-2.38	-2.25		339.1	21.2			
2013	2	-5.35	0.07	-0.07	-1.57	-2.33		447.7	31.8			

2013	3	-5.49	-0.06	-0.51	-0.82	-2.34	330.7	533.6	35.2		
2013	4	0.66	0.93	0.54	0.2	-2.29			44.9		
2013	5	1.37	1.07	1	0.89	-2.05					
2013	6	0.9	-0.72	0.65	0.35	-1.6					
2013	7	0.36	-1.09	-0.38	-0.06	-1.3	170.4		25.5		
2013	8	1.07	1.06	-0.45	0.38	-0.49					
2013	9	0.35	-0.75	-0.43	0.17	-0.27	120.3		9.15		
2013	10	1.74	1.66	1.14	0.49	0.46			22.9		
2013	11	1.61	-0.08	0.53	-0.08	0.49					
2013	12	-0.23	-1.33	0.96	0.17	0.33			27		
2014	1	-0.44	-1.69	-1.29	0.59	0.29	176.1	328.1	25.7		
2014	2	-0.5	-0.54	-1.96	-0.08	0.2	190.1	327.1	26.8		
2014	3	-0.86	-1.24	-2.06	0.07	0.08	341.6	624	41.7		
2014	4	-0.78	-0.04	-0.84	-1.41	-0.27	399	695.4	56.2		
2014	5	-1.31	-1.18	-1.2	-1.74	-1.1	338.9	616.8			
2014	6	2.33	2.74	1.28	0.56	0.48					
2014	7	2.54	0.02	1.31	0.56	0.77					
2014	8	3.94	1.7	2.49	1.27	0.98					
2014	9	3.88	-0.01	0.81	1.4	1.14					
2014	10	3.6	-0.14	0.81	1.41	0.57					
2014	11	3.21	-0.76	-0.61	1.93	0.46					
2014	12	3.59	1.1	-0.18	0.52	0.7					
2015	1	3.29	-0.79	-0.27	0.57	0.73					
2015	2	3.16	-0.3	0.14	-0.53	0.73					
2015	3	2.4	-1.34	-1.7	-1.04	0.76					
2015	4	2.06	-0.22	-0.95	-0.98	0.73					
2015	5	2.09	0.05	-0.55	-0.52	1.1					
2015	6	2.06	0.15	-0.18	-0.69	-0.11					
2015	7	2.79	0.83	0.45	-0.18	0.21					
2015	8	3.49	0.8	0.88	0.21	-0.15					
2015	9	4.24	1.2	1.43	0.92	0.3					
2015	10	3.82	-0.28	0.96	0.92	0.31					
2015	11	4.33	1.35	1.16	1.43	0.7					
2015	12	5.24	1.9	1.15	1.83	0.86					

Appendix B: Drought Workshop Summary Report

Summary Report:

Lower Elkhorn Natural Resources District Drought Workshop

June 27, 2016

JEO CONSULTING GROUP INC

Acknowledgements

The development of the Lower Elkhorn Natural Resources District Drought Workshop was a collaborative effort among various entities. The workshop would not have been possible without the contributions of the following individuals and organizations.

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Nicole Wall

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Jeff Henson
Phil Luebbert
Anne Johnson

Introduction

This report provides an overview of the Lower Elkhorn Natural Resources District (LENRD) Drought Workshop. This workshop was held on June 27, 2016. The goals of the workshop were to gain an understanding of how stakeholders across the NRD respond to drought conditions and to identify potential gaps in planning and response.

Leading up to this event, research was conducted to establish what responses/effects were felt during the drought of 2012. While each entity at the event had its own protocols for responding to drought, this was the first time the stakeholders were able to hear and compare their own protocols to other groups.

A key component of the drought workshop was stakeholder engagement. For this event a stakeholder list was compiled by the LENRD and JEO. The stakeholder list was intended to reach as broad of a group as possible. Stakeholder groups identified and invited to participate included: agricultural producers, industrial users, water suppliers, village and city officials, USDA and the Farm Service Agency, county emergency management, the National Drought Mitigation Center, Nebraska Department of Natural Resources, and staff from the LENRD. For the event, 34 stakeholders were in attendance (some served as observers while most participated directly in the event). Sign in sheets are included in the appendix to this report.

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. At this time, Iowa and Kansas are in the development and planning phase for state drought tournaments.

It is important to note that this workshop was modeled after a drought tournament, however, due to the competitive nature of the term, the event was referred to as a workshop.

Overview of the Workshop

Background

The LENRD Drought Workshop was developed as a component of the LENRD Drought Management Plan. Stakeholder lists for the event were developed collaboratively between the LENRD 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 LENRD.

Outreach efforts for this event included notification letters to invited participants approximately two weeks in advance, and follow-up phone calls the week prior to the workshop. These outreach efforts were a joint effort between the LENRD and JEO.

The drought scenario for this event was developed based on the historical data from the 2003 and 2012 droughts in the LENRD. Data (such as the NOAA Drought Outlook, National Drought Monitor, USGS stream flow, etc.) was adapted from the year of record for use in the scenario; the event scenario included in the appendix of this report outlines the information utilized for the workshop. 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.

Targeted Capabilities

The National Planning Scenarios and establishment of the National Preparedness Priorities have steered the focus of homeland security towards a capabilities-based planning approach. Capabilities-based planning focuses on planning under uncertainty because the next danger or disaster can never be forecast with complete accuracy. Capabilities-based planning can be used to identify a baseline assessment of existing capabilities. The Department of Homeland Security (DHS), Universal Task List (UTL), and Target Capabilities List (TCL) can be used as measures related to local preparedness.

The capabilities listed below were applicable for the workshop exercise and are consistent with the needs identified at the beginning of the exercise design process. These capabilities provide the foundation for the development of the exercise design objectives and scenario. The purpose of this exercise is to measure and validate performance of these capabilities and their associated critical tasks.

- Operational Coordination
- Planning
- Public Information and Warning
- Situational Assessment
- Threat and Hazard Identification

The primary intent of this workshop was to identify responses from a variety of stakeholders to varying degrees of drought. The workshop allowed stakeholders to compare and contrast responses from across sector lines and identify opportunities for future coordination.

Exercise Objectives
The exercise objectives are as follows:

- Increase awareness of responses from a variety of stakeholders
- Identify cross-sector collaboration opportunities
- Examine capabilities to respond to drought
- Investigate familiarity with existing drought plans

Workshop Day Overview

34 stakeholders were in attendance for the workshop: 31 stakeholders attended as participants, three participated as observers and recorders (two members of the National Drought Mitigation Center [NDMC] and one from Nebraska Department of Natural Resources [NDNR] acting as observers for the event), and one facilitator. The participant involvement is described below:

- Six groups of five to seven participants – Each team consisted of players representing different sectors including agriculture, municipal, natural resources, and recreation. The teams were responsible for providing input as to their agency's responsibilities and responses during the drought scenario.

- 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 two JEO staff members, two employees of the NDMC, and one employee of NDNR.

- Observers – Observers were asked to observe the workshop and provide feedback related to the overall workshop. The two observers were from the NDMC and one from NDNR, these individuals also served as recorders.

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

Following is a list of the participants:

David Kathol (Acreage Owner, LENRD Board Member)
Wade Leisner (City of Pierce)
Keith Wiehn (Petersen Ag Systems)
Dennis Watts (City of Norfolk)
Todd Boling (City of Norfolk)
Bill Hansen (City of Osmond)
Mark Arps (Colfax County Emergency Management)
Randy Woldt (City of Wisner)
Curt Becker (LENRD)
Rick Wozniak (LENRD)
Ted Krienke (Agricultural Producer)
Tom Goulette (City of West Point)

Danny Kluthe (LENRD Board Member)
Nathan Brabec (Louis Dreyfus Company)
Mark Wooldrik (The Agronomic Consulting Group)
Trenton Howard (Region 11 Emergency Management)
Kristie Olmer (LENRD)
Kelly Smith (National Drought Mitigation Center)
Dave Safty (USDA Farm Service Agency: Stanton County)
Michelle Evert (Colfax County Emergency Management)
Jennifer Schellpeper (Nebraska Department of Natural Resources)
Roy Srymanske (Nucor Steel)
Rollie Cederburg (City of Plainview)
Mike Sousek (LENRD)
Doug Olson (Grossenburg Implements)
Nicole Wall (National Drought Mitigation Center)
Jim Mackel (Mackel's Trailer Court)
Karen Mackel (Mackel's Trailer Court)
Nicolas Kemnitz (Wayne County Emergency Management)
Dennis Schultz (LENRD Board Member)
Ron Dierking (LENRD)
Joel Hansen (City of Wayne, LENRD Board Member)

Participants were presented with a drought scenario 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?

Facilitators supplemented these questions as the workshop progressed in order to foster a constructive conversation.

The workshop 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.

Summary of Workshop Discussion

The following table summarizes the points of discussion during the drought workshop. This table is not a list of agreed upon strategies. It is only a list of the topics or ideas brought up by one or more of the participants. It should be noted that not all of the topics discussed are realistic for implementation, and some topics were contentious among the stakeholders present.

Discussion Points	
Impacts	• Water shortages • Harm to crops and livestock • Harm to water quality • Damage to infrastructure • Increased fire risk • Limited use of recreational facilities

Monitoring	• Stakeholders have different ways of monitoring drought
	  ○ Weather Service Drought Forecast
	  ○ Streamflow
	  ○ Groundwater Levels
	  ○ Precipitation
	• As drought intensifies, NRD staff would increase the frequency of monitoring irrigation wells in areas with allocations to ensure flow meters are installed and operating correctly
	• As drought intensifies, NRD and Municipalities will monitor water levels more frequently. (Norfolk compares water use from past 3 to 4 years).

Response	• Hold public meetings to discuss response • Contact first responders to confirm they have enough water to fight fires • Utility company may cut power to irrigation pumps during the day to cut peak use • Municipalities will use water restrictions if concerned about supply • Contact NEMA and outside operators for emergency water supply
Current Mitigation	• New wells are drilled • Irrigation companies are constantly implementing efficiency programs • NRD and partner agencies have programs in place to help irrigators increase efficiency, such as cost share for irrigation management equipment – flow meters and soil moisture sensors • Crop Insurance • NRD sets water allocation each year

Potential Mitigation	• Increase use of stream flow monitoring, create target flows and trigger levels • Monitoring wells across the district that could transmit readings, for real-time monitoring • Investments into infrastructure projects such as holding ponds or reservoirs • Groundwater recharge when water levels are high • Continue and increase public awareness, education (watering of trees, instead of grass, planting better drought resistant varieties) and careful rationing actions • Continue coordinating lines of communication between stakeholders during drought – need increased visibility among stakeholders due to the political considerations • Account for more acreages going dry and increase pre-planning efforts • Change agricultural well height requirements • Lower the water allocation and charge for use above allocation • Continue to evaluate water reuse options before discharge • Increase public awareness including that a certain amount of water will always need to be in reserve for fires and human health • List of best management practices available for residents and agricultural producers • Bring in water data earlier to start allocation conversation at NRD for the next year • Break up NRD into sub areas (for allocations) based on soil characteristics • Create zoning overlay for areas ill-suited for domestic wells • Create a plan with triggers in place
Challenges	• It's difficult to tell agricultural producers to conserve water when private well levels are high • The messages of conservation and water restrictions are tough to sell • There are not many things agricultural producers can do or are willing to do once the crops are planted • Balancing media coverage/public education efforts. If you call for alarm too soon or too often, it starts becoming background noise • Water restrictions are difficult to enforce • There is a lot that we don't understand about the natural system • Although there is some room for growth, there is not going to be much growth in terms of wells. Won't change the characteristics (height) of existing wells • Disaster declaration or executive order from Governor needed for organizations such as emergency management agencies and USDA FSA to implement certain actions • NRD can't charge per gallon for water use (to incentivize conservation)

Conclusions

The workshop was an effective means to engage stakeholder and gain participation. Throughout the drought scenario, the stakeholders were able to describe the responses that their jurisdictions would have during an actual drought. The drought workshop led to discussions on how to improve the drought response.

There are refinements that can be made if the organizers want to conduct another workshop in the future. Some of the refinements suggested include: ensure more agricultural producers participate, increasing the intensity and duration of the drought scenario, establishing new and/or understanding existing trigger points for restrictions, and focus on the potential impacts of stakeholders' decisions within the LENRD.

Appendices

Appendix A – Improvement Matrix

Appendix B – Sign-in Sheets

Appendix C – Workshop Pictures

Appendix D – Core Capability Discussion

Appendix E – Drought Scenario

Appendix A: Improvement Matrix

Capability	Exercise Objective	Observation	Corrective Action(s)	Responsible Agency
Operational Coordination **Situational Assessment**	Objective #1: Increase awareness of responses from a variety of stakeholders	The objective was accomplished during the workshop. However, periodically, updates may be required to maintain awareness of response.	1.1) Continue to hold drought workshops to keep all parties updated and address response needs.	LENRD
			1.2) Increase efforts to ensure attendance from multiple agricultural producers to encourage a more comprehensive discussion.	LENRD, Consultant
Planning **Operational Coordination** **Situational Assessment**	Objective #2: Identify cross-sector collaboration opportunities	The objective was accomplished during the workshop. Stakeholders identified areas to combine resources for a more effective drought response.	2.1) Education and awareness efforts would be helpful for stakeholders unable to attend the workshop.	LENRD
			2.2) Foster strong relationships between stakeholders to encourage a preemptive drought response	Water operators, Agricultural Producers, Municipalities, LENRD

Capability	Exercise Objective	Observation	Corrective Action(s)	Responsible Agency
Situational Assessment **Threat and Hazard Identification** **Public Information and Warning**	Objective #3: Examine capabilities to respond to drought	This objective was accomplished, while opportunities for improvement still exist.	3.1) Encourage best practices/responses to drought to facilitate creative solutions	All Stakeholders
			3.2) Conduct inventory of capabilities	All Stakeholders
			3.3) Educate stakeholders regarding existing drought monitoring tools	NDMC, LENRD
Planning **Operational Coordination**	Objective #4: Examine stakeholder familiarity with existing drought plans	Many stakeholders struggled to articulate a sufficient familiarity with drought plans	4.1) Request stakeholders to review any existing drought plans before attending future workshops	LENRD, Consultant
			4.2) Write a formal drought plan if none exists	All Stakeholders
			4.3) Establish responses to pre-defined drought triggers, and assess their impacts to neighboring stakeholders	All Stakeholders
			4.4) Notify all stakeholders of existing plans available online	LENRD, NDNR, Water Operators

Appendix B: Sign-In Sheets

Lower Elkhorn NRD – Drought Management Plan
Drought Workshop
Norfolk, NE 6/27/2016
PLEASE PRINT CLEARLY- THANK YOU!

NAME	TITLE	JURISDICTION Represented	ADDRESS Street #, Street Name, City, Zip	PHONE	EMAIL
David Kathol	Semi Retired	acreages	55380 Warnerville Rd Norfolk	402 649 3156	—
Wade Leisman	Water/Sewer Superintendent	City of Pierce	106 S 1st St Pierce NE 68767	402-329-4535	bluejaywater@ptenet.net
Keith Wiehe	owner	NEN - Petersen Ag Systems	3001 S. 17th St.	402 379-9849	Keith@PetersenAgSystems.com
Dennis Watts	Wtr/Sewr Distr.	Norfolk	300 S 4th	402-[illegible]-2270	dwatts@ci.norfolk.ne.us
Todd Bolby	Wastewater Supt	Norfolk	620 E. Benjamin Ave	402-844-2220	tbolby@ci.norfolk.ne.us
Bill Hansen	Utilities Supr.	Osmond	PO 340 Osmond 68765	402-748-3961	osmond water @ gmail.com
Mark Arps	EMD	Colfax Co.	464 rd 10 Schyler	402 615 0602	marps@colfaxne.com
Randy Wolff	Utilities Supt.	Wisner	P.O. Box 367 Wisner Ne. 68791	402-841-9937	rwolff@cableone.net
Curt Becker	Water Resources Specialist	LENRD Staff	PO Box 1204 Norfolk, NE 68833	402-371-7313	cbecker@lenrd.org
Rick Wozniak	Water Cons. Specialist	LENRD Staff	P.O. Box 1204 Norfolk NE 68702	402 371 7313	rwozniak@lenrd.org
[illegible]	Foreman		54749 853 Rd	402 329-4705	
[illegible]	City Administrator	City of Battle Creek	P.O. Box 327 Battle Creek 68715	402-372-2466	tfgorlok@cableone.net
Danny Klutka	NRD	LENRD	2464 RD 17 Dodge NE 68633	402-720-3425	dannyk558@hotmail.com
[illegible]	Mechanic/Inc.	Norfolk	3002 North Victory Road, Norfolk NE 68701	402-936-0944	nathan.barker@ldeen.com
Mark [illegible]	The Agronomic Consulting Group		2150 Hwy 275 West Point		
Trenton Howard	Asst. Chief/Region 116 M.	Norfolk Fire	701 Koenigstein Ave, Norfolk	402 844-250	thoward@ci.norfolk.ne.us
Kristie Olmer	Certification Specialist-LENRD	LENRD		402-371-7313	kolmer@lenrd.org

Please Sign In!

Lower Elkhorn NRD – Drought Management Plan
Drought Workshop
Norfolk, NE 6/27/2016
PLEASE PRINT CLEARLY- THANK YOU!

NAME	TITLE	JURISDICTION Represented	ADDRESS Street #, Street Name, City, Zip	PHONE	EMAIL
Kelly Smith		Nat'l Drought Mitigation Center	820 Hardin Hall	402 472-3373	ksmith2@unl.edu
Dave Seffy	CED	Stanton County		439-21606	david.seffy@nemaska.gov
Michelle Evert	Deputy EM	Colfax County EMA	411 Rd 10 Schuyler	402-352-7958	mevert@colfaxne.com
Jennifer Schellpeper	Town Division Head	NDNR	301 Centennial Mall South	402-471-2995	jennifer.schellpeper@nebraska.gov
Roy Szymanske	Environmental Scientist	Stanton County	2911 E Nucor Rd.	402-644-0317	roy.szymanski@nucor.com
Bobbie Cedarburg	Superintendant	City of Plainview	209 E Locust	402-582-4928	plainview supervisor@gmail
Mike Sousek	GM	LENRD		402 371 7313	msousek@lenard.org
Doug Olson	Jsm	Goldenberg Farms	Wayne	402-375-3325	dougolson@goldenbergfarms.

Please Sign In!

Lower Elkhorn NRD – Drought Management Plan
Drought Workshop
Norfolk, NE 6/27/2016
PLEASE PRINT CLEARLY- THANK YOU!

NAME	TITLE	JURISDICTION Represented	ADDRESS Street #, Street Name, City, Zip	PHONE	EMAIL
Nicole Wall	Research Outreach Spec	UNL - NDMC	3310 Holdrege St.	402-472-6776	nwall2@unl.edu
Jim & Karen Mackel	Mackels Trailer Ct		55471 835 9th Rd #24	402-371-5531	
Nicholas Kemnitz	Emergency Manager	Wayne County	521 Lincoln St. Wayne, NE 68787	402-833-5190	wkemnitz@wayneclinichussker.com
DENNIS Schultz	LENRD		1389 5th Rd	402 529 6433	dschultz@SKFWN.NET
RON DIERKING	LENRD BOARD	OAKLAND	1643 COUNTY	402 654-3601	
Joel Hansen	City of Wayne Inspector	Wayne	306 Pearl	402-375-1733	jhansen@cityofwayne.org

Please Sign In!

Appendix C: Workshop Pictures


EXIT


EXIT
Year #2 Drought Outlook

Appendix D: Core Capability Discussion

Core Capability: Threat and Hazard Identification

Strengths:

- Stakeholders adequately identified impacts of drought throughout the NRD
- Stakeholders used past impacts to inform others of likely future implications of drought
- Stakeholders have predetermined methods of defining and monitoring drought

Improvements:

- Increased awareness of existing drought monitoring tools

Core Capability: Situational Awareness

Strengths:

- Stakeholders are able to identify life-sustaining actions that will mitigate the effects of drought

Improvements:

- Encourage best practices/responses to drought to facilitate creative solutions
- Conduct inventory of capabilities

Core Capability: Operational Coordination

Strengths:

- A number of stakeholders identified an established coordinated response during drought events
- LENRD is able to provide necessary assistance and event facilitation during drought events
- Jurisdictional emergency management is able to activate additional resources

Improvements:

- Invite a wider range of stakeholders to ensure coordination of efforts
- Create coordination structure throughout the NRD

Core Capability: Planning

Strengths:

- LENRD has developed a groundwater management plan
- LENRD has developed a multi-jurisdictional hazard mitigation plan that addresses drought
- Water operators have developed drought response plans; some of the plans have identified triggers

Improvement:

- Jurisdictions without a formal drought plan could develop one in coordination with the LENRD and other stakeholders
- Stakeholders should be aware of all plans available online
- Examine existing drought plans with stakeholders to ensure practicality and validity

Core Capability: Public Information and Warning

Strengths:

- Stakeholders were able to identify methods to notify the public and other stakeholders of drought hazard
- Public information protocols were successfully activated during the workshop

Improvements:

- Public awareness efforts could be more coordinated

Appendix E

Lower Elkhorn NRD Drought Workshop Scenario

June 27, 2016

Lower Elkhorn
Natural Resources District
protecting lives protecting property protecting the future

JEO CONSULTING GROUP INC

Goals

- Gain a better understanding of the range of responses during drought events
- Cross-sector education and relationship building
- Identify strengths and gaps in preparedness and response related to drought
- Identify opportunities to reduce drought impacts through mitigation and conservation programs
- Assist in developing a long term vision and approach for managing natural resources

Rules

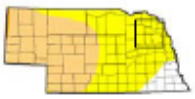
1. No fault environment
2. Provide an accurate depiction of drought responses for your agency or stakeholder group
3. Work with recorders to ensure accurate notes and information is collected throughout the event
4. Each round participating groups will discuss responses and adaptation options utilized within their group
5. Be respectful of other people's opinions and perspectives

Participants and Responsibilities

- Players
  - Engage and participate
  - Represent your agency/stakeholder group
  - Have fun
- Recorders
  - Assist each group in note taking
  - Track utilized strategies/responses
  - Make observations related to the overall event
  - Provide feedback to facilitator upon completion of the event

Year 0 (December)

The year saw average temperatures, while the year did record average amounts of precipitation there was a period of time late in the year with lower than normal precipitation. There were mild concerns related to stream flow and well measurements but there was no need to implement water restrictions at any point of the crop growing season throughout the NRD. There were no reported losses resulting from drought nor were any specific vulnerabilities identified by communities/stakeholder groups across the NRD. Drought Outlook calls for drought to persist across the NRD.



Year #1 Drought Outlook

Baseline Discussion

Work within your group to implement protocols for the current situation. Questions to consider include (but are not limited to):

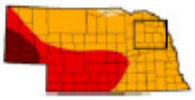
- What programs are utilized to encourage water conservation?
- What is being done to mitigate potential impacts resulting from drought?
- What method is used to monitor water supplies?
- What policies are enacted when drought is likely to occur in the near future?
- What agencies/groups do you coordinate with when drought is likely to occur?
- What additional supports are needed at this time?
- What information are you collecting in order to make decisions at this point?

Year #1: January 1 – June 30

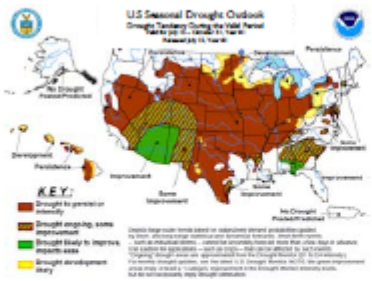
The first half of this year saw normal/slightly elevated temperatures. A couple of large storms helped April and May meet their monthly average. However, precipitation has been below average for most of the year. There has been less than an inch of precipitation in the last two months. The agricultural sector reports crops have been planted and are in good condition with slightly less soil moisture than average for this time of year.

Year #1: January 1 – June 30

- DM = D2
- Precipitation (YTD) = 10.85 in (3.11 in below normal)
- Streamflow = 250 cfs (monthly average for Elkhorn near Norfolk)
- Ave Daily Water Use (Mgd) = 7.1 (Norfolk)
- Soil Moisture – Slightly less than normal
- Ag Reports – Crops are in good condition



Year #1: July 1 – October 31 Drought Outlook



Year #1: January 1 – June 30

Work within your group to identify potential vulnerabilities, potential impacts, and any needed response/mitigation/adaption strategies given this situation. Questions to consider include (but are not limited to):

- 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 would that take place?
- What information are you collecting in order to make decisions at this point?

Year #1: July 1 – August 31

July and August saw only 1 inch of rain during this period (8.69 in below yearly average) with above average temperatures. This resulted in poor soil moisture, stress on crop and livestock, and lower than average stream flows. There were reports of damages to water distribution systems within the NRD. The NRD is within a D2 (severe drought) to D3 (extreme drought) classification from the US Drought Monitor. USDA Secretarial Drought Designation for counties within the NRD.

Year #1: July 1 – August 31

- DM = D2 – D3
- Precipitation = 11.84 in. (8.69 in. below normal)
- Streamflow = 100.1 cfs (Monthly average for Elkhorn near Norfolk)
- Ave Daily Water Use (Mgd) = 9.6 (Norfolk)
- Soil Moisture – Reported as lacking in most of the NRD
- Ag Reports – Crops are suffering in the field, Grazing Land impacted
- Local shallow-rooted trees are showing signs of stress from the drought, already dropping leaves
- Increased demand placed on local utilities

Year #1: July 1 – August 31

Work within your group to identify potential vulnerabilities, potential impacts, and any needed response/mitigation/adaption strategies given this situation. Questions to consider include (but are not limited to):

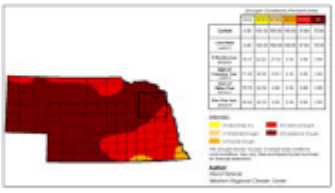
- What is the typical response from your agency/group/entity given these circumstances?
- What entities outside of yours will you need to coordinate with at this time?
- Are there any political considerations?
- How will you be communicating with your partners during this process?
- If you are communicating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

Year #1: September 1 – December 31

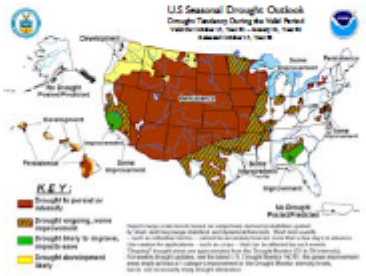
This time period saw less than 3 inches of precipitation and slightly above average temperatures. Crop yields were reported as being lower than expected due in large part to poor soil moisture throughout the growing season. Water main failures are occurring in communities across the NRD. Most of the NRD has received a D4 classification from the US Drought Monitor. The Governor declares a drought emergency for the entire state.

Year #1: September 1 – December 31

- DM = D3 – D4
- Precipitation (YTD) = 14.5 in. (12.9 in. below normal)
- Streamflow = 145 cfs (average for Elkhorn near Norfolk)
- Ave Daily Water Use (Mgd) = 7.0 (Norfolk)
- Soil Moisture – Reported as Poor
- Ag Report – Crop yields are lower than expected



Year #2 Drought Outlook



Year #1: September 1 – December 31

Work within your group to identify potential vulnerabilities, potential impacts, and any needed response/mitigation/adaption strategies given this situation. Questions to consider include (but are not limited to):

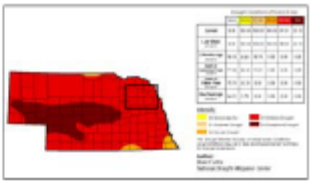
- What is the typical response from your agency/group/entity given these circumstances?
- What entities outside of yours will you need to coordinate with at this time?
- Are there any political considerations?
- How will you be communicating with your partners during this process?
- If you are communicating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

Year #2: January 1 – June 30

January, February, and March saw below average precipitation and seasonally appropriate temperatures. Lower Elkhorn NRD was able to complete well measurements and provide data to appropriate stakeholders. April, May, and June saw little precipitation with below normal temperatures. The Drought Monitor shows a D3 classification for the NRD. Crops have been planted and are doing well thanks to lower temperatures.

Year #2: January 1 – June 30

- DM = D3
- Precipitation (YTD) = 8.9 in (5.0 in. below normal)
- Streamflow = 226.8 cfs (average for Elkhorn near Norfolk)
- Ave Daily Water Use (Mgd) = 8.1 (Norfolk)
- Soil Moisture – Poor
- Ag Report – N/A



Year #2 January 1 – June 30

Year #2: January 1 – June 30

Work within your group to identify potential vulnerabilities, potential impacts, and any needed response/mitigation/adaption strategies given this situation. Questions to consider include (but are not limited to):

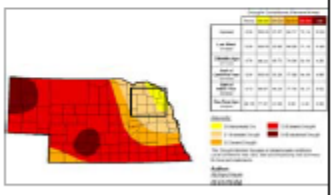
- What is the typical response from your agency/group/entity given these circumstances?
- What entities outside of yours will you need to coordinate with at this time?
- Are there any political considerations?
- How will you be communicating with your partners during this process?
- If you are communicating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

Year #2: July 1 – September 30

July, August, and September have had below average precipitation (4.0 in. below normal) with above normal temperatures. This resulted in poor soil moisture, and stress on crop and livestock. However, stream flows have improved some. NNRD is in a D1 drought according to the US Drought Monitor.

Year #2: July 1 – September 30

- DM = D0-D1
- Precipitation (YTD) = 19.26 in (4.0 in. below normal)
- Streamflow = 305 cfs (average for Elkhorn near Norfolk)
- Ave Daily Water Use (Mgd) = 8.4 (Norfolk)
- Soil Moisture – Poor
- Ag Report – Stress on crops and livestock



Year #2: July 1 – September 30

Work within your group to identify potential vulnerabilities, potential impacts, and any needed response/mitigation/adaption strategies given this situation. Questions to consider include (but are not limited to):

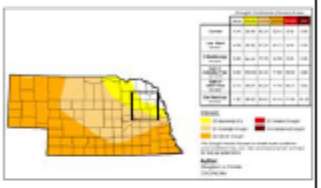
- What is the typical response from your agency/group/entity given these circumstances?
- What entities outside of your will you need to coordinate with at this time?
- Are there any political considerations?
- How will you be communicating with your partners during this process?
- If you are communicating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

Year #2: October 1 – December 31

October, November, and December had little precipitation (4.9 in. below normal) with seasonally appropriate temperatures. Crop losses are reported again due to Drought Conditions. The NRD was able to collect well heights. NNRD is in a D2 drought according to the US Drought Monitor.

Year #2: October 1 – December 31

- DM = D1
- Precipitation (YTD) =20.15 in. (4.9 in. below normal)
- Streamflow = 320 cfs (average for Elkhorn River near Norfolk
- Ave Daily Water Use (Mgd) = 4.2 (Norfolk)
- Soil Moisture – N/A
- Ag Report – N/A
- Drought Outlook calls for improvement

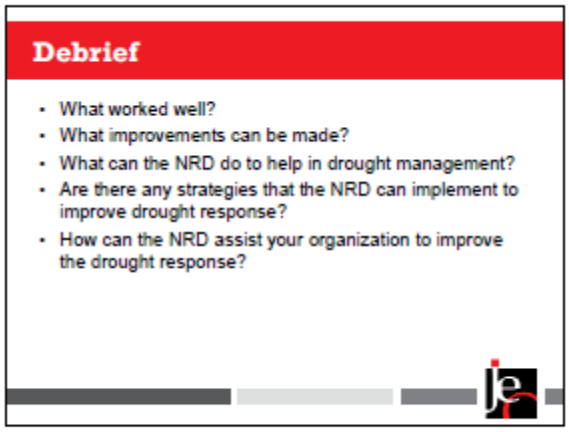


Year #3 Outlook

Year #2 October 1 – December 31

Work within your group to identify potential vulnerabilities, potential impacts, and any needed response/mitigation/adaption strategies given this situation. Questions to consider include (but are not limited to):

- What is the typical response from your agency/group/entity given these circumstances?
- What entities outside of your 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 would that take place?
- What information are you collecting in order to make decisions at this point?


Debrief
What worked well?
What improvements can be made?
What can the NRD do to help in drought management?
Are there any strategies that the NRD can implement to improve drought response?
How can the NRD assist your organization to improve the drought response?


Thank you!